ADVANCED NEONATAL CARE

CLINICAL & THERAPEUTIC GUIDELINE

MSF OCG (INTERNAL USE)

Updated version:

Version – Janvier 2015
Case management (CM) of sick neonates needs to approach not only ante-natal care and obstetrical emergencies, per natal resuscitation (Part II), mother to child transmitted diseases (Part III), and main neonatal diseases (Part IV) but also to be capable having a specific regard on Low Birth Weight, Very Low Birth Weight and Extremely Low Birth Weight babies (Parts V & VI).

Newborns in tropical countries and poor settings were neglected for too long time in the past decades, so now it is time to urgently act in order to decrease the 40% of under five years old children mortality due to neonatal deaths (Part I).

This protocol can apply in all MSF CH programs were there are newborns that means Mobile Clinics, OPD, IPD, Obstetrics etc… according to the skills of the health staff.

A large part of recommendations and treatments were agreed by the Pediatrics Working Group and it has largely participated to the writing.

This protocol is integrative part of the BibOp and will be regularly updated according to the capitalization of collected field experiences (your feedback), the scientific evolution (literature) and the WHO recommendations. Be vigilant and use uniquely the most recent version.

Some adaptations might be discussed according to the countries in order to follow a specific national protocol or in order to better cope with specific conditions. Nevertheless any change and/or adaptation should be communicated to the cell and validated by the medical department before use.

I would like to sincerely thank you the pediatricians from the different MSF Operational Centers (OC), whose have participated to the writing of this protocol.

A special attention is given to the MSF International Pediatrics Working Group Members, Isabel Zuniga, Isabel.zuniga@brussels.msf.org, Nicolas Peyraud, Nicolas.peyraud@geneva.msf.org, Harriet Roggeveen, Harriet.roggeveen@amsterdam.msf.org, Roberta Petrucci, Roberta.petrucci@geneva.msf.org, Anne Pittet, Anne.pittet@geneva.msf.org, Daniel Martinez, Daniel.martinez@barcelona.msf.org, Pascual Caballero, Pascual.caballero@msf.org, Maura PEDRINI, Maura.pedrini@msf.org, Elisabeth Canisius, Elisabeth.canisius@geneva.msf.org, Belen Caminoa, Belen.caminoa@msf.org, Marianne Sutton, mariannebsutton@gmail.com and to the Medical Director attached to this Working Group at the moment this guideline was written, Dr Eric Comte, Eric.comte@geneva.msf.org, for his implication in its realization. We renew all our best thanks to them.

We also would like to thanks for their contribution the pediatricians Dr Dina-Maria Jakob, dina.jakob@gmail.com, Teresa Gadsden Hevia, teregads@gmail.com, Marco Olla, Marco.olla@msf.org, Laurent HIFFLER, Laurent.hiffler@msf.org, Ante Liesbeth Wind, antewind@gmail.com as well as the Pediatrics Tropical Group of the French Society of Paediatrics.

I hope this tool will really help you. I am now looking forward to hear from you, remarks, comments, suggestions and questions. They will be welcomed and source of progress for everyone.

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CONTENT of TABLE

ADVANCED NEONATAL CARE.........................................................................................1
ACRONYMS..................................................................................................................6
PART I...........................................................................................................................9
EPIDEMIOLOGY & NEONATAL CONTEXT In the DEVELOPING WORLD...............9
PART II.......................................................................................................................15
NEONATAL VITAL EVALUATION & NEONATAL RESUSCITATION.........................16
1. PREPARATION for DELIVERY .................................................................................17
2. APGAR SCORE (VITAL EVALUATION) at 1, 5 and 10 minutes after birth (Total =
   10)................................................................................................................................19
3. RESUSCITATION AT BIRTH......................................................................................20
4. NEONATAL RESUSCITATION in PRACTICE.................................................................23
TRAINING MATERIALS AVAILABLE in MSF.................................................................32
5. DANGER SIGNS & NEONATAL TRANSFER.................................................................34
6. NEONATAL IMMEDIATE POST-PARTUM ROUTINE / ESSENTIAL CARE IN
   DELIVERY ROOM...........................................................................................................36
7. IDENTIFICATION OF NEONATES AT RISK FOR SEPSIS OR HYPOGLYCEMIA
8. POST PARTUM MATERNAL & NEONATAL CARE IN THE MATERNITY............44
PART III......................................................................................................................48
MATERNAL TO CHILD TRANSMITTED DISEASES.....................................................48
1. Infant Born from Mother with GONORRHEA or CHLAMYDIA.................................49
2. Infant Born from Mother with CYTOMEGALOVIRUS (CMV) INFECTION............51
3. Infant Born from Mother with ACTIVE HEPATITIS B...............................................52
4. Infant Born from Mother with HERPES SIMPLEX VIRUS (HSV).........................54
5. Infant Born from Mother with HIV*........................................................................57
6. CONGENITAL & NEONATAL MALARIA.................................................................69
7. CONGENITAL RUBELLA..........................................................................................75
8. CONGENITAL SYphilis.............................................................................................76
9. CONGENITAL TOXOPLASMOSIS.............................................................................80
10. Infant Born from Mother with ACTIVE TUBERCULOSIS.........................................83
11. Infant Born from Mother with Diabetes.................................................................88
12. SUMMARY TABLE of CASES MANAGEMENT...........................................................88
PART IV......................................................................................................................87
UNIT FOR SICK NEWBORNS MAIN NEONATAL DISEASES.................................90
1. PERINATAL ASPHYXIA & SEIZURES due to HYPOXIC / ISCHEMIC
   ENCEPHALOPATHY (HIE).........................................................................................91
2. NEONATAL SEIZURES due to OTHER CAUSES than HIE.......................................94
3. NEONATAL RESPIRATORY DISTRESS SYNDROME (RDS) – MANAGEMENT
   & MAIN ETIOLOGIES – NEONATAL APNOEAS.......................................................97
4. NEONATAL CYANOSIS............................................................................................102
5. TRANSIENT TACHYNOE A OF THE NEWBORN (TTN)............................................105
6. HYALINE MEMBRANE DISEASE (HMD).................................................................107
7. SEVERE DESHYDRATIONS HYPOVOLEMIC & HEMORRHAGIC SHOCKS /
   SEPTIC SHOCKS.........................................................................................................110
8. BLOOD TRANSFUSION IN NEONATOLOGY...............................................................118
9. OMPHALITIS.............................................................................................................125
10. NEONATAL INFECTION: RISK OF SEPSIS, SEPSIS AND BACTERIAL
   NEONATAL MENINGITIS...........................................................................................138
11. NECROTIZING ENTEROCOLITIS (NEC).................................................................144
12. NEONATAL SKIN CANDIDIASIS ("DIAPER RASH")................................................146
13. NEONATAL TETANUS..............................................................................................146
14. MANAGEMENT of NEWBORN with HIGH FEVER .......................................................... 151
15. MANAGEMENT of NEWBORN with HYPOTHERMIA ................................................... 152
16. MANAGEMENT of NEWBORN with HYPOGLYCEMIA OR RISK OF HYPOGLYCEMIA ........................................................................................................ 155
17. MANAGEMENT of HYPOCALCEMIA ............................................................................ 158
18. MANAGEMENT of NEWBORN with JAUNDICE ........................................................... 160
19. MANAGEMENT of a NEWBORN with GASTROINTESTINAL BLEEDING from the UPPER TRACT ........................................................................................................... 141
20. MANAGEMENT of a NEWBORN with GASTROINTESTINAL BLEEDING from the LOWER TRACT ........................................................................................................ 144
21. MANAGEMENT of NEONATAL PAIN .......................................................................... 147
22. MANAGEMENT of TALIPES CLUB-FOOTED NEWBORNS .......................................... 149
23. SURVEILLANCE & MONITORING FORM for SICK NEWBORN UNIT (NCU) ............ 150

PART V .................................................................................................................................. 152
KANGAROO CARE UNIT NOT SICK LBW – VLBW – ELBW & IUGR ................................. 152
1. EVALUATION OF GESTATIONAL AGE (GA) ............................................................... 153
2. LBW – VLBW – ELBW – IUGR: CAUSES & CONSEQUENCES .................................... 155
3. GENERAL PRINCIPLES MANAGING LBW, VLBW & ELBW ....................................... 157
4. KANGAROO MOTHER CARE (KMC) ............................................................................ 158
5. APNOEAS of the PREMATURITY .................................................................................. 162
6. PHYSIOLOGIC ANAEMIA in LBW, VLBW and ELBW BABIES DIAGNOSIS – PREVENTION & CORRECTION .............................................................. 165
7. SURVEILLANCE & MONITORING FORM for KMCU ................................................... 167

PART VI .................................................................................................................................. 169
FEEDING & INFUSIONS MANAGEMENT .......................................................................... 169
1. FEEDING/HYDRATION OF THE NEWBORN ................................................................. 169
2. BASIC PRINCIPLES TO UNDERSTAND THE CHOICE OF FEEDING THE NEWBORNS (ACCORDING TO WEIGHT AND HEALTH CONDITION) ............... 169
2.1 DAILY AMOUNTS REQUIRED FOR THE ENTERAL FEEDING ONLY .............................. 169
2.2 DAILY AMOUNTS REQUIRED FOR IV AND ENTERAL FEEDING ................................... 169
3. PLACING AN ORO / NASOGASTRIC TUBE ................................................................. 169
4. ENCOURAGEMENT TO EXCLUSIVE BREASTFEED ...................................................... 169
5. EXTRA CONSIDERATIONS ABOUT FEEDING IN CERTAIN SPECIFIC CONDITION ............ 169
6. MEDICAL SPECIALITED FORMULA for NEONATES .................................................. 170

PART VII .................................................................................................................................. 202
NEONATAL PROCEDURES & VITAL NORMS .................................................................... 202
1. OXYGEN THERAPY ......................................................................................................... 202
2. ORO / NASOGASTRIC TUBE (OGT / NGT) INSERTION .............................................. 206
3. INTRA OSSEOUS INFUSION (IO) .................................................................................... 209
4. LUMBAR PUNCTURE (LP) ............................................................................................ 212
5. TAKING CAPILLARY BLOOD SAMPLE (HEEL PRICK) – From WHO MANAGING NEWBORN PROBLEMS ................................................................. 214
6. Making an IM INJECTION in neonates and premature babies ...................................... 216
7. USING Nasal Continuous Positive Airways Pressure (NCPAP) in NEONATES ................ 219
8. ELECTRIC INFUSION PUMP in NEONATES ................................................................. 223
9. CLEANING OF INCUBATORS ....................................................................................... 224
10. LABORATORY REFERENCE VALUES ........................................................................... 225

PART VIII .................................................................................................................................. 227
CASE DEFINITIONS for the DATABASE ............................................................................... 227
CHECKLISTS CONCLUSION .................................................................................................. 244
REFERENCES ......................................................................................................................... 245
NEONATAL BIBOP 2015 .......................................................................................................... 244
## ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>Acute Gastro-Enteritis</td>
</tr>
<tr>
<td>ANC</td>
<td>Ante Natal Care</td>
</tr>
<tr>
<td>ARV</td>
<td>AntiRétroViral (treatment)</td>
</tr>
<tr>
<td>ART</td>
<td>AntiRétroViral Treatment</td>
</tr>
<tr>
<td>ASA</td>
<td>Acetylic Salicylic Acid</td>
</tr>
<tr>
<td>ATB</td>
<td>Antibiotic</td>
</tr>
<tr>
<td>BP</td>
<td>Blood Pressure</td>
</tr>
<tr>
<td>BPM / bpm</td>
<td>Beating Per Minute</td>
</tr>
<tr>
<td>BS</td>
<td>Blood Slide</td>
</tr>
<tr>
<td>CC</td>
<td>Chest Compression</td>
</tr>
<tr>
<td>CM</td>
<td>Case Management</td>
</tr>
<tr>
<td>CMV</td>
<td>Cyto Megalo Virus</td>
</tr>
<tr>
<td>CPAP</td>
<td>Continuous Positive Airways Pressure</td>
</tr>
<tr>
<td>CSN</td>
<td>Central Nervous System</td>
</tr>
<tr>
<td>CRT</td>
<td>Capillary Refill Time</td>
</tr>
<tr>
<td>CSF</td>
<td>Cerebral Spinal Fluid</td>
</tr>
<tr>
<td>D1, 2, 3…</td>
<td>Day 1, 2, 3…</td>
</tr>
<tr>
<td>D5%, 10%, 20%, 50%</td>
<td>Dextrose 5%, 10%, 20%, 50%</td>
</tr>
<tr>
<td>DBS</td>
<td>Dry Blood Spot</td>
</tr>
<tr>
<td>DC</td>
<td>Developing Country</td>
</tr>
<tr>
<td>DIVC</td>
<td>Disseminated Intra-Vascular Coagulation</td>
</tr>
<tr>
<td>ELBW</td>
<td>Extremely Low Birth Weight</td>
</tr>
<tr>
<td>ECMO</td>
<td>Extra Corporeal Membrane Oxygenation</td>
</tr>
<tr>
<td>EID</td>
<td>Early Infant Diagnosis</td>
</tr>
<tr>
<td>EPI</td>
<td>Enlarged Program of Immunization</td>
</tr>
<tr>
<td>FUO</td>
<td>Fever of Unexplicated Origin</td>
</tr>
<tr>
<td>GA</td>
<td>Gestational Age</td>
</tr>
<tr>
<td>GBS</td>
<td>Group B Streptococci</td>
</tr>
<tr>
<td>G6PD</td>
<td>Glucose6 Phosphate Deshydrogenase</td>
</tr>
<tr>
<td>Hb</td>
<td>Haemoglobin</td>
</tr>
<tr>
<td>HBP</td>
<td>High Blood Pressure</td>
</tr>
<tr>
<td>HIE</td>
<td>Hypoxic Ischemic Encephalopathy</td>
</tr>
<tr>
<td>HMD</td>
<td>Hyaline Membrane Disease</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>HSV</td>
<td>Herpes Simplex Virus</td>
</tr>
<tr>
<td>HIV / AIDS</td>
<td>Human Immunodeficiency Virus / Acquired Immune Deficiency Syndrome</td>
</tr>
<tr>
<td>HR / RR</td>
<td>Heart Rate / Respiratory Rate</td>
</tr>
<tr>
<td>IOI</td>
<td>Intra-Osseous Infusion</td>
</tr>
<tr>
<td>IDM</td>
<td>Infant born from a Diabetic Mother</td>
</tr>
<tr>
<td>Ig</td>
<td>Immunoglobulins</td>
</tr>
<tr>
<td>IM / IV / SIV</td>
<td>Intra-Muscular / Intra-Venous / Slow Intra-Venous</td>
</tr>
<tr>
<td>IUGR</td>
<td>Intra Uterine Growth Retardation</td>
</tr>
<tr>
<td>IVeH</td>
<td>Intra Ventricular (Cranial) Hemorrhage</td>
</tr>
<tr>
<td>KMCU</td>
<td>Kangaroo Mother Care Unit</td>
</tr>
<tr>
<td>LBW</td>
<td>Low Birth Weight</td>
</tr>
<tr>
<td>LGA</td>
<td>Large for Gestational Age / Macrosomic baby</td>
</tr>
<tr>
<td>LP</td>
<td>Lumbar Puncture</td>
</tr>
<tr>
<td>LRTI</td>
<td>Low Respiratory Tract Infection</td>
</tr>
<tr>
<td>MD</td>
<td>Medical Doctor</td>
</tr>
<tr>
<td>MSF</td>
<td>Médecins Sans Frontières,</td>
</tr>
<tr>
<td>MTCTD</td>
<td>Mother To Child Transmitted Disease</td>
</tr>
<tr>
<td>NCU</td>
<td>Neonatal Care Unit</td>
</tr>
<tr>
<td>NEC</td>
<td>Necrotizing Enterocolitis</td>
</tr>
<tr>
<td>NGT</td>
<td>Naso-Gastric Tube</td>
</tr>
<tr>
<td>NICU</td>
<td>Neonatal Intensive Care Unit</td>
</tr>
<tr>
<td>NS</td>
<td>Normal Saline</td>
</tr>
<tr>
<td>NTT</td>
<td>Neonatal Tetanus (TT – Tetanus; TTV – Tetanus Toxoid Vaccine)</td>
</tr>
<tr>
<td>OA</td>
<td>Orally Administered</td>
</tr>
<tr>
<td>OPV</td>
<td>Oral Polio Virus Vaccine</td>
</tr>
<tr>
<td>OGT</td>
<td>Oro-Gastric Tube</td>
</tr>
<tr>
<td>PDA</td>
<td>Patent Ductus Arteriosus</td>
</tr>
<tr>
<td>PF</td>
<td>Plasmodium Falciparum</td>
</tr>
<tr>
<td>PM</td>
<td>Placental Malaria</td>
</tr>
<tr>
<td>PMTCT HIV</td>
<td>Prevention of Mother to Child Transmission of HIV</td>
</tr>
<tr>
<td>PV</td>
<td>Plasmodium Vivax</td>
</tr>
<tr>
<td>RDS</td>
<td>Respiratory Distress Syndrome</td>
</tr>
<tr>
<td>RDT</td>
<td>Rapid Diagnosis Test</td>
</tr>
<tr>
<td>RL</td>
<td>Ringer Lactate</td>
</tr>
<tr>
<td>SAT (Pulse Oxymeter)/SpO2</td>
<td>Self-Administered Therapy: Setting up a pulse oxymeter for measuring the oxygen saturation of red blood cells in arterial blood via percutaneous</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>SC</td>
<td>Sub-Cutaneous</td>
</tr>
<tr>
<td>SEM</td>
<td>Skin, Eyes and Mouth</td>
</tr>
<tr>
<td>SSSS</td>
<td>Staphylococcal Scaled Skin Syndrome</td>
</tr>
<tr>
<td>TB</td>
<td>Tuberculosis (M+ Mothers – Infectious Mothers)</td>
</tr>
<tr>
<td>TRD</td>
<td>Transient Respiratory Distress</td>
</tr>
<tr>
<td>TTN</td>
<td>Transient Tachypnea of the Newborn</td>
</tr>
<tr>
<td>UAW</td>
<td>Upper Airway</td>
</tr>
<tr>
<td>UTI</td>
<td>Urine Tract Infection</td>
</tr>
<tr>
<td>USS</td>
<td>Ultra Sound Scanner or Echography</td>
</tr>
<tr>
<td>VL</td>
<td>Viral Load</td>
</tr>
<tr>
<td>VLBW</td>
<td>Very Low Birth Weight</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
</tbody>
</table>
PART I

EPIDEMIOLOGY & NEONATAL CONTEXT in the DEVELOPING WORLD

Maternal Mortality Ratio in 2011 (273 500 deaths)

IHME (Lancet 2011); Liu et al (2012)
Country variation in stillbirth rates
At least ~ 2.65 million stillbirths


Global burden of prematurity 2012

Figure 2: Global burden of preterm birth in 2010

11 countries with preterm birth rates over 15% by rank:
1. Malawi
2. Congo
3. Comoros
4. Zimbabwe
5. Equatorial Guinea
6. Mozambique
7. Gabon
8. Pakistan
9. Indonesia
10. Mauritania
11. Botswana

Born Too Soon – WHO 2012
New international context
(~ 6.6 millions under 5 deaths yearly)
Child Health Epidemiology Reference Group (CHERG) 2013

Causes of deaths among children under 5 years, 2011

Summary of global estimates
(CHERG 2013)

~ 6.6 millions deaths among children < 5 years old
64% (4.2 million) deaths due to infectious diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>%</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia</td>
<td>18%</td>
<td>1.20 million</td>
</tr>
<tr>
<td>Diarrhea</td>
<td>10%</td>
<td>0.66 million</td>
</tr>
<tr>
<td>Malaria</td>
<td>7%</td>
<td>0.46 million</td>
</tr>
</tbody>
</table>

43% (~ 3 million) of neonatal deaths

<table>
<thead>
<tr>
<th>Cause</th>
<th>%</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complications of prematurity</td>
<td>14%</td>
<td>0.93 million</td>
</tr>
<tr>
<td>Complications caused by pregnancy</td>
<td>11%</td>
<td>0.73 million</td>
</tr>
<tr>
<td>Infections &amp; Meningitis</td>
<td>5%</td>
<td>0.33 million</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>4%</td>
<td>0.27 million</td>
</tr>
</tbody>
</table>
Essential neonatal care

Essential neonatal care normally include care that should be done to all newborns in any circumstances including remote settings. They also should normally be integrated with the BemONC (Basic Emergency Obstétrical & Neonatal Care) package defined by the MSF Reproductive Health Working Group.

Midwives are the first line health care providers at this level of care and are in charge to ensure these essential neonatal care are properly done.

This package includes by chronological and priority order:

- Ante natal visits (at least 3 visits).
- Immediate recognition of newborns in needs for birth resuscitation (≤ 10%).
- Neonatal resuscitation at birth excluding chest compression and drugs (≤ 10%).
- Recognizing neonatal danger signs and preparing for transfer (≤ 10%).
- Immediate newborn routine care in delivery room (100%).
- Sick newborn care. See the chapter 10 in the MSF Guideline “Obstetrics in remote settings”.
- Managing non sick low birth weight from 1500 to 2500g in the maternity.
- Post partum care in the maternity including exclusive breastfeeding and attention to mother’s health.
- Neonatal health promotion by community health workers (CHW).
- Post partum visits for newborns (2 to 4 visits).
Advanced neonatal care

**Advanced neonatal cares** include that can be done at the level of care of a district or equivalent and so by evidence in a reference hospital. They also should normally be integrated with the CemONC (Comprehensive Emergency Obstétrical & Neonatal Care) package defined by the MSF Reproductive Health Working Group, but could also be already present in a BEmONC setting.

**Midwives are working there in collaboration** with nurses, medical assistants, medical doctors and sometimes paediatricians.

This package includes by priority order:

- Essential neonatal care.
- Creation and management of a Kangaroo Care Unit.
- Case management of sick neonates in a neonatal or paediatrics care unit (NCU).

**Benchmarks** for neonatal mortality in poor resource settings including MSF programs (based on field evidence and statistical data but to be discussed according to the characteristics of each setting)

- \( \leq 10\% \): Golden standard.
- 11 - \( \leq 15\% \): Good.
- 16 - \( \leq 20\% \): “Acceptable”.
- 20%: To be improved.

- \( < 5\% \): Developed countries.
Unit for sick neonates & Unit for Kangaroo Care
(minimum # of beds)

Maternity
200 deliveries per month

KC Unit 5 to 8 beds
(2.5 to 4%)

Unit for sick neonates
5 to 12 beds
(2.5 to 6%)

Unit for sick neonates & Unit for Kangaroo Care
(minimum staff)

- MDs: 1 / 20 neonates
- Nurses: 1 / 5 to 10 neonates
- Nurse Assistants: 1 / 5 to 10 neonates

Temporary proposition based on field experience & statistical data; it should be discussed according to the profile of each program
PART II

NEONATAL VITAL EVALUATION
&
NEONATAL RESUSCITATION
1. PREPARATION for DELIVERY

Anticipate need for resuscitation at every birth.

Be always prepared for resuscitation. Ensure that comprehensive resuscitation equipment is available and ready to be used.

The following situations have a higher incidence of the need for resuscitation and/or are important for determine needs of follow-up of the baby.

Table 1: Risk Factors for Neonatal Resuscitation

<table>
<thead>
<tr>
<th>Ante Partum Factors</th>
<th>Intra partum Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy-induced hypertension</td>
<td>Emergency cesarean section</td>
</tr>
<tr>
<td>Previous fetal or neonatal death</td>
<td>Forceps or vacuum-assisted delivery</td>
</tr>
<tr>
<td>Bleeding in second or third trimester</td>
<td>Breech or other abnormal presentation</td>
</tr>
<tr>
<td>Maternal infection (TORCH infection fever, HIV, UTI)</td>
<td>Premature labor</td>
</tr>
<tr>
<td>Multiple gestation</td>
<td>Chorioamnionitis</td>
</tr>
<tr>
<td>Size-dates discrepancy</td>
<td>Rupture of membranes &gt;12 hours before delivery</td>
</tr>
<tr>
<td>Drug therapy, such as Magnesium</td>
<td>Prolonged labor &gt; 24 hours</td>
</tr>
<tr>
<td>Diminished fetal activity</td>
<td>Prolonged second stage of labor &gt; 2 hours</td>
</tr>
<tr>
<td>No prenatal care</td>
<td>Macrosomia; LGA</td>
</tr>
<tr>
<td>Age &lt;16 or &gt;35 years</td>
<td>Persistent fetal bradycardia</td>
</tr>
<tr>
<td></td>
<td>Use of general anesthesia</td>
</tr>
<tr>
<td></td>
<td>conium-stained amniotic fluid</td>
</tr>
<tr>
<td></td>
<td>Prolapsed umbilical cord</td>
</tr>
<tr>
<td></td>
<td>Placenta praevia</td>
</tr>
<tr>
<td></td>
<td>Significant intrapartum bleeding</td>
</tr>
</tbody>
</table>

Table 2: Equipment for Neonatal Resuscitation

**Standard Equipment (all care providers)**
- Infant stethoscope (EMEQSTET4-- STETHOSCOPE, double cup, infant - Littmann Classic II)
- Bulb syringe and/or Pump suction mechanical (Twin pump) with tubing and/or Pump suction electrical (De Vilbiss) with tubing
- Self-inflating bag (Ambu), child/neonate + masks 0 (premature) & 1 (newborn)
- Mobile radiant infant warmer (when possible)

**Equipment for Oxygen therapy (when possible)**
- Oxygen concentrator
- Neonatal & Premature nasal prongs for oxygen (flow limited to 2 l/min maximum)
- Pulse oxymeter

**Tubes and Catheters (all care providers)**
- Suction catheters (8CH, 10CH, 12 CH, 14CH)
- Oro/Nasogastric tubes (6CH, 8CH, 10CH) with caps
**IV line**
- Butterfly set (22-25G)
- Cannulas (22-25G)
- Microdropper
- Stopcocks (two way or three way)
- IV tubing and IV poles
- Intra-osseous needles 18G + IV 19G

**Drugs & Supplies**
- Dextrose 10%, Dextrose 50%
- Normal saline
- Epinephrine (1:10 000) solution
- Needles 16 or 18G to prepare injections
- Syringes 2, 5, 10 ml

**Rapide Diagnostic Tests (when possible)**
- Glucometer
- Hemoglobin test
- Heel lancets

**Others**
- Clock & Examination mobile lamp & Examination neonatal table
- Gloves
- Warm dry blankets, warm, dry and sterile sheets, baby clothes (hats and napkins)
- Chorhexidine 4% (or dermal povidone iodine 10%)

**Infant electronic scale (EANTSCAL6)**

**Specialized Equipment (only to be used by trained pediatric or anesthesia doctor)**
- Neonatal laryngoscope (only to be used for meconium aspiration)
- Endotracheal tubes (2.5, 3.0, 3.5, and 4.0 mm) (only to be used for meconium aspiration)

PS: Items in italics are recommended but parts of the comprehensive levels of care and so, they are not mandatory at the basic level of neonatal care. They should be considered depending on each setting and operational level of neonatal care.
2. APGAR SCORE (VITAL EVALUATION) at 1, 5 and 10 minutes after birth (Total = 10)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colour</td>
<td>Extreme pallor</td>
<td>Central pink</td>
<td>Totally pink</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cyanosed extremities</td>
<td></td>
</tr>
<tr>
<td>Breathing</td>
<td>No</td>
<td>Abnormal (Shallow, apnea, ...)</td>
<td>Good</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>No</td>
<td>&lt; 100 / min</td>
<td>&gt; 100 / min</td>
</tr>
<tr>
<td>Muscular Tonus</td>
<td>No</td>
<td>Incomplete peripherical f</td>
<td>Complete peripherical flexion</td>
</tr>
<tr>
<td>Reactivity (stimulation)</td>
<td>No</td>
<td>Making faces</td>
<td>Vigorous reaction, crying</td>
</tr>
</tbody>
</table>

APGAR SCORE (VITAL EVALUATION) at 1, 5
And 10 minutes after birth (Total = 10)

<table>
<thead>
<tr>
<th>Results at 1 minute after birth</th>
<th>Score = 0 to 4</th>
<th>Asphyxia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Score = 5 to 7</td>
<td>Difficult adaptation</td>
</tr>
<tr>
<td></td>
<td>Score = 8 to 10</td>
<td>Perfect</td>
</tr>
<tr>
<td>Results at 5 minute after birth</td>
<td>Score = 0 to 6</td>
<td>Asphyxia</td>
</tr>
<tr>
<td></td>
<td>Score = 7 to 8</td>
<td>Difficult adaptation</td>
</tr>
<tr>
<td></td>
<td>Score = 9 to 10</td>
<td>Perfect</td>
</tr>
</tbody>
</table>

CORRECT SIZE of the MASK

- NEONATAL SELF – INFLATING RESUSCITATION BAG WITH ROUND MASK.
- SIZE 1 = NORMAL WEIGHT BABY.
- SIZE 0 = LOW BIRTHWEIGHT BABY (< 2 500 g).
3. RESUSCITATION AT BIRTH

1. Essential resuscitation at birth (chart for essential neonatal care)
2. Advanced resuscitation at birth (chart for advanced neonatal care)

- **HBB chart to be fully completed.**

- Only thereafter make the **advanced care** as below.
Targeted pre-ductal SpO₂ after birth (lower limitation):

- 3 min: 70%
- 5 min: 80%
- 10 min: 90%

At all stages ask: do you need help?

Positive pressure ventilation
SpO₂ monitoring

HR below 100?

Yes

Ensure open airway
Reduce leaks
Consider increasing pressure & oxygen

HR below 60?

Yes

Add chest compressions
3 compressions to each breath
100% oxygen
Consider intubation or LMA

HR below 60?

Yes

Venous access, adrenaline
Consider volume expansion

No

Ensure open airway
SpO₂ monitoring
Consider CPAP

Post-resuscitation care

Adrenaline IV 10-30 mcg/kg (0.1-0.3 mL/kg of 1:10,000 solution)
4. NEONATAL RESUSCITATION in PRACTICE

10% of newborns need help breathing properly at birth; this help comes in the form of tactile stimulation and/or airway clearing.

For half of them, these procedures are not sufficient, and if the newborn is not breathing or is gasping despite stimulation/suction, ventilation is needed as of the first minute of life. A small percentage of ventilated newborns will require more advanced resuscitation.

The birth attendant in charge of the delivery is also responsible for the newborn. She/he should start resuscitation immediately then, if necessary, call for help.

⚠️

Anticipate the potential need for resuscitation at every birth. The necessary equipment should be ready at hand and ready for use.

Hypothermia compromises resuscitation. Resuscitation should be done in a heated room, if possible under a warming lamp.

**Basic and advanced resuscitation**

Steps 1 to 6 should be performed in the first minute of life. Note all interventions on the surveillance sheet.

1 - **Check for the absence of meconium**

*If the amniotic fluid is meconium-stained but the infant is breathing spontaneously and is tonic:* suction is not indicated; simply wipe the face.

*If the amniotic fluid is meconium-stained and the infant is not breathing well or is hypotonic:* quickly but gently suction the mouth, preferably with a suction bulb (Penguin).

2 - **Stimulate the infant by drying**

Tactile stimulation can trigger spontaneous breathing. It is done by drying the infant vigorously, but not roughly. Effective respiratory effort should begin within 5 seconds. If not, stop the stimulation; the infant requires additional care.

3 - **Clamp and cut the cord**

4 - **Position the infant’s head**

Lay the infant on the back with the head in a neutral position; avoid flexion or hyperextension of the neck, as this can obstruct the airway.
5 - Clear the airway (only in the rare cases where there are copious secretions)
Suction the mouth gently – i.e., not too deeply (maximum depth 2 cm from the lips) – and quickly (maximum duration 5 seconds) with a bulb syringe (Penguin).

6 - Stimulate the infant
Rub the back and the soles of the feet (do not shake, slap or hang the infant by the feet). If effective respiratory effort has not begun after 5 seconds: stop the stimulation; the infant requires ventilation.

7 - Perform bag-mask ventilation (room air)
Fit the mask to the infant’s face covering nose and mouth. Press firmly to prevent air leaks. Hold it with one hand, with the thumb on one side and the index and middle fingers on the other.

With the other hand, squeeze the bag at a rate of 30 to 50 compressions per minute for 60 seconds. Ventilation is effective if the chest rises and falls.
Attention: excessive ventilation pressure can cause pneumothorax.

If the chest fails to rise:
  o Check the connection between the bag and the mask;
  o Correct the position of the mask on the face;
  o Correct the head position.
Manual ventilation

Check every minute for spontaneous respiratory effort (look for chest movement); do not take the mask off the infant’s face to check for spontaneous breathing. Continue manual ventilation until there is spontaneous respiratory effort.

If oxygen is available: connect the ambu bag to an oxygen reservoir after 1 to 2 minutes of ventilation, setting it at a 2 litres/minute flow rate. Ventilation is a priority and should not be interrupted to connect the oxygen (have an assistant to connect the oxygen).

**Heart Rate**

- Check the heart rate (HR) (umbilical pulse or with a stethoscope). Cord pulsations is only reliable if found to be more than 100 beats per minute (bpm). Direct cardiac rate with a stethoscope is the best option for evaluation.
- If the infant has a heart rate less than 100 beats per minute, ambu bag-mask ventilation with air should be maintained.

**Skin Color (anemia and/or cyanosis)**

- Eliminate materno-fetal hemorrhage and so severe neonate anemia / shock.
- Bluish discoloration may indicate central cyanosis (thorax and mucosis).
• Check SpO2 when possible after 2 minutes (3 minutes after birth) of effective bag and mask ventilation with air.

• Targeted preductal SpO2 after birth:

<table>
<thead>
<tr>
<th>Time</th>
<th>SpO2 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 minutes</td>
<td>70%</td>
</tr>
<tr>
<td>5 minutes</td>
<td>80%</td>
</tr>
<tr>
<td>10 minutes</td>
<td>90%</td>
</tr>
</tbody>
</table>

• Central cyanosis normally appears for SpO2 < 85%.

• At this stage, in case of central cyanosis or SpO2 < 75%, administer supplemental oxygen (premature or neonatal prongs) until the baby is pink and active or to maintain SpO2 between 90-95% (premature babies and at term babies).

**Circulation (Chest Compression - CC)**

• There are two important heart rates to remember: 60 bpm and 100 bpm.
  o Heart rate < 60 bpm generally indicates that chest resuscitative measures are necessary.
  o Heart rate > 100 bpm generally indicates that resuscitative measures may be stopped (unless the infant has apnea).

• If the infant’s heart rate is below 60 beats per minute after 60 seconds of bag-mask ventilation with air (2 minutes after birth) start chest compression (CC) while continuing bag-mask ventilation.

• Chest compressions should always be accompanied by ambu bag-mask ventilation. Therefore, it takes a minimum of two well trained health providers to perform effective chest compressions and ventilation *(see figure below).*

**Two providers are necessary for proper chest compressions**

![Chest Compression Diagram](image-url)
• Although any health provider who has been trained in pediatric resuscitation can provide chest compressions and bag-mask ventilation, **an experienced medical doctor or the most experienced medical staff should be present and supervising all resuscitations with chest compression +/- drugs.**

• Chest compressions are applied to the lower half of the sternum. The compression point should be just below an imaginary line connecting the two nipples (see the left figure below).

• The compressions should be given with the two-hand technique. The thumbs will be used to compress the lower half of the sternum while the fingers provide support for the back (see the right figure below).

• Compression depth should be approximately one-third the anterior-posterior diameter of the chest.

• Efficacy should be checked by verifying the femoral pulses.

• Chest compressions and bag-mask ventilations should be administered at a rate of 90 compressions and 30 ventilations per minute in a ratio of 3 compressions / 1 ventilation.

• Avoid giving a compression and ventilation simultaneously because one will decrease the efficacy of the other.

• **Current recommendations tell to coordinate chest compressions and ventilation in order to permit a good chest expansion during ventilation (2010 American Heart Association Guidelines, Neonatal Resuscitation).**

**Landmarks for Chest Compressions**

• After 1 minute of chest compressions and bag-mask ventilation with air (or oxygen when possible), the infant should be reevaluated.
  
  o **Improved heart rate > 60 bpm** ➔ chest compressions may be discontinued.
  
  o However bag-mask ventilation with air (or oxygen when possible) should be continued at a rate of 40 - 60 ventilations per minute until the heart rate is above 100 bpm and the infant is breathing.
  
  o **Heart rate remains < 60 bpm after 30 seconds** of chest compressions, oxygen and epinephrine should be administered while chest compressions are continued.

• Once the heart rate is above 100 bpm and the infant is breathing spontaneously and regularly ambu bag-mask ventilation should be stopped.
Circulation (drugs)

- **Epinephrine (heart arrest and persistent bradycardia)** 0.1 to 0.3 ml/kg of a 1:10 000 solution: (1 ml of epinephrine 1:1000 in 9 ml of normal saline) equal to 0.01 to 0.03 mg/kg should only be given if the heart rate remains below 60 bpm after 60 seconds of effective bag-mask ventilation with air and another 60 seconds of coordinated and effective chest compressions and bag ventilation with oxygen.

  **Epinephrine (vial 1 ml = 1 mg)**
  - Make a dilution: 1 vial + 9 ml of NaCl (NS) 0.9%
  - 1 ml of the dilution = 0.1 mg = 100 microg
  - IV injection of 0.1 to 0.15 ml/kg/dose of the dilution via the umbilical cord or 0.30 ml/kg/dose intra tracheal after intubation (or Sub Lingual)
  - If heart rate remains < 60 bpm after 1 minute of effective chest compressions and bag / mask ventilation with oxygen
  - The heart rate should increase to > 60 bpm within 30 seconds after epinephrine is given.
  - If the heart rate remains < 60 bpm, the dose of epinephrine should be repeated 1, 2 or 3 times every 3 minutes until the heart rate improves (> 100 bpm)

- **Naloxone (opiate overdose including newborn)**

  **Naloxone (vial 1 ml = 0.4 mg)**
  - A dilution is not necessary.
  - 1 ml = 0.4 mg = 400 micrograms.
  - IV injection of 0.25 ml/kg/dose via the umbilical cord (or IM).
  - Repeat 0.25 ml/kg/dose every 2 minutes (IV) (or every 15 minutes if IM).
  - Till 4 doses if required
  - If there is neonatal failure to breathe because of:
    - The anesthetics given to the mother, particularly morphine (caesarean section).
    - Newborn from mother’s drug user (morphine).

- **Atropine does not improve survival in neonatal cardiac arrest and is not indicated there.**

Oro-Gastric Tube (OGT)

- If the infant’s abdomen becomes distended during bag-mask ventilation, an 8 CH OGT should be inserted.
- It is inserted into the mouth instead of the nose, to keep the nasal airway open and because it will not last after the resuscitation.
- Maintain the superior extremity of the tube open sloping in a bag for free drainage during the resuscitation procedure.
- Therefore, if needed, a new tube will be inserted by the nostril – Refer to this chapter in part VII.

Vascular Access

- In emergency, vascular access is extremely important to administer epinephrine (persistent bradycardia), IV dextrose (prevention / treatment of neonatal hypoglycemia), IV calcium gluconate and fluids (shocks).
- When intravascular access is necessary, a small peripheral intravenous catheter should be placed. If one cannot be placed successfully within 1 minute, an intra-osseous (IO) needle 18G or IV needle 19G should be placed – Refer to this chapter in part VII.
In MSF contexts, in neonatal and pediatrics programs, IO infusion should be the reference for emergency vascular access when peripheral IV line cannot be secured within 1 minute.

Despite IV injections are possible via the umbilical vein, umbilical vein catheterization should absolutely be proscribed in emergency because it placement is considerably slower, more difficult and it also exposes the newborn to major risks of infections and thrombosis comparing with the IO. This technique, which requires very well, trained staff, adequate equipment and, rigorous aseptic measures should be reserved exceptionally to blood exchanges.

Some Specific Neonatal Resuscitation Situations

Meconium-Stained Amniotic Fluid (MSAF)

- If the baby born with meconium-stained fluid has a normal respiration, normal muscle tone, and a heart rate greater than 100 bpm, simply use a bulb syringe, a large bore suction catheter or a portable feet/electric pump suction to cautiously and shortly clear secretions and any meconium from the mouth and nose. This infant does not require any specialized treatment but should be carefully evaluated in order to assess + or – treat for maternal to neonate infection.

- However if the infant born with MSAF has depressed respiration, depressed muscle tone, or a heart rate less than or equal 100 bpm, direct, rapid and cautious suctioning of the nostrils, mouth, tracheal orifice under sight control (laryngoscope) is recommended as soon as possible after delivery and before initiating stimulation and/or ambu bag ventilation.

- Intubation and endo-tracheal suctioning normally indicated in this critical situation are very specialized procedures that can only be done by a very well trained physician. They should never be performed by none well trained physician. If the clinician does not have experience performing this procedure in neonates, the potential harm from an unskilled operator outweighs the risk of not putting a tube and suctioning the trachea.

- That should not be done:
  - Provide ventilation with bag and mask before cautiously suctioning airway.
  - Not to pay attention to signs of danger.
  - Not to think about neonatal infection.

Shock – Refer to this chapter in part IV

- If there has been a premature placental abruption, a placenta praevia, a retro-placental hematoma, or hemorrhage from the umbilical cord, the infant may be in hypovolemic/hemorrhagic shock.

- In some cases, the baby may have lost blood into the maternal circulation and there will be signs of shock with no obvious evidence of blood loss.

- Babies in shock appear pale with tachycardia or persistent bradycardia, they have weak pulses, CRT > 2 secondes and hypothermia (at least cold extremities).

- Most often these babies will not improve in response to effective ventilation with air (+/– oxygen if necessary and available) + Chest compressions + Epinephrine.

- If an infant appears to be in shock and is not responding to the first measures of effective resuscitation, you should in emergency:
  - Set up a venous access (or intra-osseous if there an experienced doctor present and no veins can be found).
  - Rapid volemic expansion: Normal Saline (NS) or if NS is not available Ringer Lactate (RL) 10 ml/kg over 10 min to be renewed x 1, 2 or 3 times (same solution, same quantity) if necessary (persistent signs of severity: abnormal vital values). One time the shock is
corrected, maintenance IV fluid according to this chapter. Do not feed immediately after a shock because of the intestinal suffering due to severe vasoconstriction.

- If hemorrhagic shock, consider total blood: 10 ml/kg over 30 minutes to be renewed 1 time if necessary (persistent signs of severity: abnormal vital values).

- In any cases, after the initial rapid volemic expansion, discuss a possible transfusion with concentrated red cells according to the level of hemoglobin. Correct anaemia if Hb < 10 g / dl: 10 ml/kg of concentrated red cells over 60 to 120 minutes.

- Slow IV over 10 minutes Calcium Gluconate (vial of 10 ml at 10%) 0.5 ml/kg but only in case of blood transfusion.

- Note that in MSF programs and settings making a difference between hypovolemic and septic shock is generally not possible (blood culture is not possible). So, any neonate with shock should receive broad spectrum antibiotics according to the recommendations in chapters 9, 10 and 11 “Omphalitis; Neonatal sepsis and meningitis; NEC”, in part IV.

- Surveillance based on vital values and clinical examination + pulse oxymeter.

**Discontinuing resuscitation**

- Re-assess the baby every 1 minute.

- If the baby has no heart rate and is not breathing after 10 minutes of continuous effective ventilation with ambu and mask, ventilation also well coordinate with chest compression, consider that the baby is dead (a newborn is extremely unlikely to survive in the contexts where MSF is working; if he survives he will have severe lifelong neurological and neuro-motor damages / sequels).

- If the baby has very slow heart rate (HR < 60 bpm) after 10 minutes of continuous effective ventilation with ambu and mask, ventilation also well coordinate with chest compression, is not breathing spontaneously, continue ventilation till 20 minutes and then stop in case of absence of spontaneous breathing.

- If the baby has midly slow heart rate (HR ≥ 60 & < 100 bpm) or good heart rate (HR ≥ 100 bpm) after 10 minutes of continuous effective ventilation with ambu and mask, ventilation also well coordinate with chest compression, is not breathing spontaneously, you can stop chest compression and continue ventilation till 30 minutes and then stop in case of absence of spontaneous breathing.

- If there is persistent apnea after 30 minutes of effective bag-mask ventilation with concentrated oxygen (even with a normal heart rate), bag-mask ventilation may be discontinued while with respect to medical ethics minimal basic needs and surveillance will be ensured (O2, dextro, temperature, feeding…). It is very unlikely that the infant will regain spontaneous respiration within a reasonable time frame.

**After any resuscitation – Refer to the chapter «Per natal asphyxia», in part IV**

- Check the infant’s immediate needs: blood glucose, head position, oxygen saturation, temperature and assessment for signs of sepsis.

- Any baby who has been resuscitating with mask ventilation for 2 minutes needs close surveillance with monitoring of glucose, temperature and vital signs (HR, RR, SpO2 if available) every 4 hours.

- Perform a retroactive Apgar score assessment, and record the results on the monitoring sheet.

  - If the Apgar score was ≤ 4 at 1 minute or ≤ 6 at 5 minutes, or if the infant was ventilated with a mask for 2 minutes or more:
    - Admission in a neonatal care unit (keep the mother and infant together if possible).
    - If transfer is not possible, keep the infant under observation for at least 24 hours. Monitor every
2 hours: look for danger signs and monitor vital signs. Ensure routine care. Start breastfeeding as soon as possible.

If the infant is floppy, has no sucking reflex or exhibits other neurological problems (e.g. seizures), check blood glucose. If blood glucose cannot be checked, start presumptive treatment for hypoglycaemia.

- Since severe foetal distress is often infection-related, refer to the algorithm for asymptomatic suspected infections, chapter 10, part IV, to decide if the child should receive or not antibiotics.

- Any symptomatic newborn with per natal asphyxia should receive antibiotics before to be transferred and should be referred to a specialized neonatal / pediatrics care unit where he will have the possibility to benefit from care and surveillance as needed – Refer to chapter 10 « Neonatal infections», in part IV.

- In the event of seizures:
  - Check blood glucose and/or treat for hypoglycaemia.
  - If the infant continues to have seizures after receiving glucose, administer a loading dose of phenobarbital (20 mg/kg) by slow IV infusion (dilute the required dose of phenobarbital in 20 ml of 0.9% sodium chloride and administer over 30 minutes). Never administer phenobarbital as a rapid, undiluted direct IV injection. If intravenous access cannot be obtained, administer the same dose of phenobarbital (undiluted) by IM injection.
  - Be cautious when administering phenobarbital; there is a risk of respiratory depression: monitor the infant closely; have ventilation equipment at hand.
  - If seizures persist after 30 minutes, give a second dose of phenobarbital (10 mg/kg) by slow IV infusion over 30 minutes as above. If IV access cannot be obtained, administer the second dose (10 mg/kg) of phenobarbital undiluted by IM injection 60 minutes minimum after the first IM dose.
  - In any cases, monitor the infant closely for at least 6 hours.
  - For recurrent seizures, administer phenobarbital PO: 5 mg/kg/day for 5 days and then according to the clinical status.
## Newborn resuscitation TRAINING MATERIALS

<table>
<thead>
<tr>
<th>ITC Code</th>
<th>NAME of the ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETMANRES2--</td>
<td>MANNEQUIN, NEWBORN, resuscitation, dark, basic (NeoNatalie)</td>
</tr>
<tr>
<td>ETMANRES2L-</td>
<td>MANNEQUIN, NEWBORN, resuscitation, light, basic (NeoNatalie)</td>
</tr>
<tr>
<td>ETMANRES201</td>
<td>(Newborn mannequin NeoNatalie) RESUSCITATOR (Cat.No.846030) = Ambu Bag newborn</td>
</tr>
<tr>
<td>ETMANRES202</td>
<td>(Newborn mannequin NeoNatalie) SUCTION BULB</td>
</tr>
<tr>
<td>ETPOHHB11F-</td>
<td>HELPING BABIES BREATHE TRAINING KIT, French</td>
</tr>
<tr>
<td>ETPOHHB11E-</td>
<td>HELPING BABIES BREATHE TRAINING KIT, English</td>
</tr>
</tbody>
</table>
PUMP, SUCTION, ELECTRICAL (DeVilbiss)

New code:
EEMDPUME3--

Former code:
EANEPUMS3--

SUCTION PUMP, ELECTRICAL (DeVilbiss VacuAide), 100-240V 7314
5. DANGER SIGNS & NEONATAL TRANSFER

Routinely check all newborns for danger signs at birth and during their stay in the maternity hospital.

The presence of danger signs indicates the presence of a severe illness. One sign should:

- Start resuscitation if indicated
- Call for help / call for a doctor
- Prior to transferring the infant, the appropriate treatment should be initiated.

<table>
<thead>
<tr>
<th>Danger signs</th>
<th>Temperature</th>
<th>Neurological signs</th>
<th>Respiration</th>
<th>Abdomen</th>
<th>Skin colour</th>
<th>Skin</th>
<th>Joints</th>
<th>Blood glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&gt; 38°C: hyperthermia &lt; 35.5°C: hypothermia</td>
<td>Seizures (including subtle* or “abnormal” movements) Bulging fontanelle Inability to suckle effectively Lethargy or coma Hypotony</td>
<td>Apnoea (respiratory pause &gt; 20 seconds or combined with bradycardia) Bradypnoea (respiratory rate &lt; 30/minute) Tachypnoea (respiratory rate &gt; 60/minute) Grunting respirations Chest indrawing</td>
<td>Severe abdominal distension</td>
<td>Generalised cyanosis (blue colouring) Extreme pallor</td>
<td>Umbilicus red or oozing blood or pus Numerous or large pustules</td>
<td>Swollen, painful joint (irritability when moved) with reduced joint movement</td>
<td>Recurrent hypoglycaemia (&gt; 2 episodes)</td>
</tr>
</tbody>
</table>

* Subtle movements: sucking or chewing, blinking or disorganised eye movements, disordered arm or leg movements (pedalling).

Danger signs should be known by all health staff in charge. Any danger sign should lead to urgently call for medical advice (medical doctor, paediatrician...), complete medical examination with evaluation of vital values, in emergency manage vital distresses.
Normal and abnormal vital values in neonates (criteria for emergency management and transfer) from birth to 2 months

<table>
<thead>
<tr>
<th>Bradycardia</th>
<th>Norme</th>
<th>Tachycardia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate (HR)</td>
<td>≤ 100</td>
<td>110 - 160</td>
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</table>

<table>
<thead>
<tr>
<th>Bradypnea</th>
<th>Norme</th>
<th>Tachypnea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Rate (RR)</td>
<td>≤ 30</td>
<td>30 - 60</td>
</tr>
</tbody>
</table>

Management of life-threatening emergencies before referral to a newborn/pediatric Unit OR before transfert to the maternity while referral is not possible

Cyanosis and/or respiratory distress
- Position the head to open the airway.
- Administer oxygen with an appropriate nasal cannula, at a maximum flow rate of 2 litres/minute and under the controle of a pulse oximeter. The oxygen saturation in full-term or premature infants should be 90 to 95%.
- Use an appropriate paediatric flow splitter so that the oxygen flow can be adjusted correctly when there are several infants on the same oxygen concentrator.
- Place a gastric tube for feeding.

Apnoea or bradypnoea
- Perform bag-mask ventilation (add oxygen if the ventilation lasts more than 1 to 2 minutes).

Impaired consciousness and/or seizures
- Check the blood glucose or, if that is not possible, treat hypoglycaemia.
- Administer phenobarbital in case of seizures.
- Place a gastric tube for feeding.

Management of an infant with one or multiple danger signs

Refer to the summary table below and to the different chapters on the subjects:
- Management of Symptomatic Neonatal Infections (sepsis and/or meningitis), chapter10, part IV.
- Case management of respiratory distresses, apnea and cyanosis, chapters 3 to 6, part IV.
- Case management of convulsions, chapter 2, part IV.
- Case management of hypoglycaemia, chapter 16, part IV.
- Case management of hypothermia, chapter15, part IV.
EMERGENCY CASE MANAGEMENT OF VITAL DISTRESSES
& Symptomatic treatment of sick neonates
Summary table

Always start treatment before transferring

| Any vital distresses | • IV/IM Ampicillin (to be replaced by IV Cloxacillin if clinical skin or umbilical entry door) + IM Gentamycin.  
Or (alternate 2nd choice if correct IV is not possible in your context in order to avoid multiple IM injections).  
• IM Penicillin G Procaine + IM Gentamycin.  
Or (alternate 3rd choice in the absence of Peni G Procaïne).  
• IM Ceftriaxone + IM Gentamycine.  
SEE DOSAGES IN THE TABLE IN THE CHAPTER ON SYMPTOMATIC INFECTIONS. |
| --- | --- |
| Cyanosis and/or respiratory distress | • If possible, according to the context of your working place:  
  o Oxygen with nasal prongs for infants or premature babies.  
  o Max 2 l/minutes.  
  o Under control of a pulse oxymeter.  
  o Targeted SpO2: 90 – 95% (all at term or premature neonates).  
• Head position and O/NGT for feeding. |
| Apnea or respiratory rate too slow (< 30/min) | • Adequat ventilation with ambu bag and mask. |
| Altered consciousness and/or convulsions ⇒ check glycaemia or systematically think there is an hypoglycaemia | • O/NGT since the baby cannot suck.  
• D10%: 5 ml/kg in the O/NGT and to be given a second time in the absence of improvement.  
• If IV possible prefer to give D10%: 2 ml/kg one time to be given a second time in the absence of improvement.  
• If neither O/NGT nor IV are possible, give D50%, 1 ml/kg one time via sublingual to be given a second time in the absence of improvement. |
| Convulsions | • D10%: 5 ml/kg dans la SO/NG à redonner une fois en l’absence d’amélioration.  
• Loading dose IM phenobarbital 20 mg/kg. |
| If not given previously | • IM Vitamin K1 (vial 2 mg/0.2 ml): 1 mg (0.1 ml) if BW ≥ 1500g and 0.5 mg (0.05 ml if BW < 1500g. |
| Adequat thermal environment | • Keep the neonate dry with a warm cap in order to decrease thermal losses by the scalp, in a warm room (25 degrees) with survival blanket or if possible under heater lamp.  
• Avoid the baby becomes cold during the clinical exam or laboratory examinations and regularly check temperature to maintain it in the norm. |
| Closed monitoring | • Systematically at this stage before transferring the baby in a neonatal / paediatrics care unit. |
6. NEONATAL IMMEDIATE POST-PARTUM ROUTINE / ESSENTIAL CARE IN DELIVERY ROOM

The healthy newborn

Immediately and rapidly assess the infant’s condition so that resuscitation can be started, if needed. The resuscitation equipment should be ready at hand and ready for use.

Clearing the airway

Wipe the nose and mouth to clear the airway. Only suction the nose and mouth if there is obvious obstruction. Do not enter the larynx/trachea (there is a risk of bradycardia or laryngeal spasm). Preferably use a suction bulb (Penguin).

Cord clamping and cord care

Wait at least 2 minutes before clamping the cord in all infants who are crying vigorously (and especially those weighing less than 2500 g).

For optimal transfusion, keep the infant on the mother’s chest.

Clamp the cord with two Kocher forceps 10 cm from the umbilicus and cut between the two forceps. Use sterile blade or scissors – a different pair than were used for episiotomy, if performed. Tie off the cord with a Barr clamp or sterile thread (double ligature), leaving a 2- to 3-cm stump. Disinfect the umbilicus with a sterile compress soaked in 4% chlorhexidine (or, if not available, 10% polyvidone with a maximum of 3 applications total).

Apgar score

The Apgar score is evaluated at 1 and 5 minutes after complete delivery of the infant and recorded in the medical chart and the infant’s health record.

The score is a tool for monitoring the infant’s adaptation to extra-uterine life. It is not used to determine whether resuscitation is indicated; this should be evaluated at birth, based on whether or not there is spontaneous respiratory effort, without waiting for the 1-minute assessment.

In case of resuscitation, the Apgar score is determined retrospectively.

If the Apgar score is \( \leq 4 \) at 1 minute or \( \leq 6 \) at 5 minutes, the midwife should call the doctor and should initiate necessary steps based on infant’s needs. Once stabilised, the infant should be kept under observation for at least 24 hours.
Table 6.1 - Apgar score

<table>
<thead>
<tr>
<th>Items evaluated/score</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin colour*</td>
<td>Extreme pallor</td>
<td>Cyanotic extremities</td>
<td>Totally pink</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No central cyanosis</td>
<td></td>
</tr>
<tr>
<td>Respiration</td>
<td>None</td>
<td>Abnormal (slow, shallow, apnoea, etc.)</td>
<td>Normal</td>
</tr>
<tr>
<td>Heart rate</td>
<td>0</td>
<td>≤ 100/minute</td>
<td>&gt; 100/minute</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Absent</td>
<td>Hypotony</td>
<td>Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Incomplete flexion of extremities</td>
<td>Complete flexion of extremities</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Nil</td>
<td>Grimace</td>
<td>Good, vigorous cry</td>
</tr>
</tbody>
</table>

* A healthy infant is usually born cyanotic but turns pink within 30 seconds after breathing starts. For infants with dark skin, assess skin colour by the soles of the feet, palms of the hands and mucous membranes.

Table 6.2 - Significance of the Apgar score

<table>
<thead>
<tr>
<th>1 minute-score</th>
<th>5 minute-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 4 Asphyxia</td>
<td>0 - 6 Asphyxia</td>
</tr>
<tr>
<td>5 - 7 Difficult adaptation</td>
<td>7 - 8 Difficult adaptation</td>
</tr>
<tr>
<td>8 - 10 Good adaptation</td>
<td>9 - 10 Good adaptation</td>
</tr>
</tbody>
</table>

Weight (BW)
- Rapidly weigh the baby and report the weight on the neonatal form for surveillance.

Gestational age (GA)
- Rapidly evaluate gestational age (GA) – Refer to chapter 1 in part V.

Thermoregulation
- At birth, dry the infant with a clean, dry cloth. Then, wrap the infant in another clean, dry cloth. Cover the head with a cap to reduce heat loss.
- Keep the infant in a warm room (at least 25°C).
- Place the infant skin-to-skin against the mother’s (dried) body and cover with a dry cloth or blanket.
- Do not bathe the infant for 6 to 12 hours after birth.
• The axillary temperature should be kept between 36 and 37°C, and the infant should have pink, warm feet.

• When feasible, install the infant under a mobile infant radiant warmer during the clinical exam or for observation when needed.

**Routine prophylaxis for gonococcal ocular infection**

For all infants:

Apply 1% **tetracycline** eye ointment: a 1 cm strip in each eye as soon as possible, preferably within an hour of birth.

Note: if the mother has a symptomatic genital infection at the time of delivery, she should be referred to the maternity or to the STD consultation.

**Routine prophylaxis for haemorrhagic disease of the newborn phytomenadione (vitamin K1)**

IM in the anterolateral aspect of the thigh within the first few hours of life:

- Infant weighing more than 1500 g: 1 mg as a single dose (0.1 ml if 2 mg/0.2 ml ampoule).
- Infant weighing less than 1500 g: 0.5 mg as a single dose (0.05 ml if 2 mg/0.2 ml ampoule).

Note:

- Administration should normally be done the first day after birth.
- Any infant less than 3 months of life who did not receive vitamin K1 at birth (home delivery) should receive the same dose the first time he is seen at the consultation (external consultation or post natal consultation, admission, other…).
- Proposed treatment allows also preventing late forms of the disease.
- Open ampoules of phytomenadione should be used immediately or discarded. Do not store open ampoules, even in the refrigerator.

**Complete clinical examination**

The birth attendant should perform a complete examination of the newborn as soon as possible and preferably within 2 hours. The examination should be done under a warmer for infants. All observations are recorded on a surveillance sheet.

The first priority is to look for danger signs: e.g. abnormal temperature, abnormal colour, difficulty breathing, neurological signs, severe abdominal distension, or symptomatic hypoglycaemia.

Assess the risk factors for neonatal infection for all infants, whether the examination reveals danger signs or not.

The examination includes:

- Respiratory rate (normal values for infants 0-1 month are 30-60 breaths/minute).
- Heart rate (normal values for infants 0-1 month are 100-160 beats/minute).
- Temperature.
- Weight (weigh the infant naked on an appropriate scale, calibrated beforehand).
- Examination of the skin and mucous membranes, oral cavity, palate, eyes, ears, fontanelles, abdomen, spine, genital organs, anus, feet, hands; neurological examination (posture, tone and reflexes, including sucking, grasp, response to stimulation).
- Check if the infant urinates and produces stools.
Exclusive breastfeeding – Refer to chapter 1 in part VI

- Exclusive breastfeeding is the best option.
- Put the infant to the breast as soon as possible within an hour of birth.
- Encourage breastfeeding on demand day and night (at least 8 times/24 hours, i.e. every 3 hours).
- Colostrum is perfectly adapted and good for the baby.

PMTCT – Refer the chapter 5 in part III

- All infants of HIV-infected mothers should receive antiretroviral treatment as soon as possible for 6 weeks or during the entire breastfeeding period according to the MSF validated protocol in the program you are working.
- For home birth, prophylaxis should be given as soon as possible and is most effective if started before H72.
- If the baby is seen for the first time after H72, prophylaxis should be given at any time to prevent breast milk transmission.

Vaccinations

The monovalent Hepatitis B, BCG and oral Polio vaccines are recommended as soon as possible after birth for all newborns, including low birth weight and premature infants.

For the Hepatitis B and oral Polio vaccines, the dose administered at birth is an extra dose (called and recorded as “Dose 0”). It does not count as one of the 3 doses required by the Expanded Programme on Immunization during the postnatal period.

The purpose of Hepatitis B Dose 0 is to prevent mother-to-child transmission of the disease. It should be administered as soon as possible, preferably within the first 12 hours of life. The vaccine dose0 may still be administered after that time, but the later the vaccine is administered, the less effective the protection. In principle, this vaccine should be administered in the delivery room.

Table - Neonatal vaccinations

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Contra-indications</th>
<th>Dose/route of administration</th>
</tr>
</thead>
</table>
| Hepatitis B      | No contra-indication, but use only the monovalent vaccine (Hepatitis B only)       | One dose = 10 micrograms
| Dose 0           |                                                                                    | IM injection, anterolateral aspect of the thigh                    |
| BCG              | Newborn whose mother has active TB as long as she is contagious (Section 10.4.6)*  | One dose = 0.05 ml
|                  |                                                                                    | Intradermal injection, deltoid region (at the junction of the lower 2/3 and upper 1/3 of the lateral aspect of the upper arm) |
| Oral Polio       | No contra-indication                                                               | One dose = 2 or 3 drops, depending on the manufacturer Oral route |
| Dose 0           |                                                                                    |                                                                   |

* Start the infant on isoniazid preventive therapy, and administer the BCG vaccination when the isoniazid therapy is completed.

Note: to perform an IM injection in newborns:
- Disinfect the skin beforehand (risk of abscess and other infections).
• Use the lateral aspect of the quadriceps muscle (thigh). Never inject into the gluteal or deltoid muscle (arm).
• Use the appropriate needle: 26G if < 2500 g; 23G if > 2500 g.
• The maximum amount to inject is 1 ml if < 2500 g; 2 ml if > 2500 g.

**Daily monitoring in the maternity**

Newborn (and maternal) mortality is the highest in the first 24 hours after birth. Women are encouraged to stay for 24 hours in the maternity.

The management of risk of sepsis or risk of hypoglycemia newborn is, according to the context, sometime done in the maternity – **Refer to the part IV chapter 10 for the risk of sepsis and to part IV chapter 16 for the risk of hypoglycemia.**

Routine monitoring and care includes:
- Temperature, heart and respiratory rate, twice daily.
- Cord disinfection once the first day (please uses the available antiseptic, *see above*).
- After that, keep it clean, dry and exposed to the air (no dressing).
- Support to breastfeeding.
- Assess danger signs.
- Urination and stool production.
- Record the observations on the newborn’s monitoring sheet.
SUMMARY of ROUTINE NEONATAL CARE TO BE DONE in the MATERNITY

1. For each newborn evaluate needs for resuscitation.
2. Delay for 1 to 2 minutes before cutting the umbilical cord for all newborns that don’t need resuscitation (specifically LBW).
3. Cautious washing of mouth and then nose. No systematic aspiration.
4. Dry the newborn with dry and warm sheets / blankets.
5. Evaluation and interpretation of the Apgar score.
6. Local application of Chlorexidine 4% (or in its absence of Iodine Povidone, solution 10%) on the umbilical cord.
7. Weigh the baby and if possible evaluate Gestational Age (GA) according to the five morphological criteria.
8. Wrap the baby in a dry and warm sheet / blanket.
9. Put a small quantity (1 cm) of tetracycline 1% ophthalmal ointment in each eye.
10. Give IM vitamin K1 (2 mg/0.2 ml) in the thigh: 1 mg (0.1 ml) if BW ≥ 1500g and 0.5 mg (0.05 ml) if BW < 1500g.
11. Make a first rapid clinical exam (+/- heater lamp if needed / possible).
12. Install the baby « skin to skin » with his mother (Kangaroo Maternal Care) as soon as possible.
13. Start breastfeeding as soon as possible (during the first hour).
14. ARV for any exposed newborn (PMTCT).
15. EPI vaccinations, neonatal doses or doses 0 (BCG, Polio and Hepatitis B).
17. Discharge when criteria are reached with a planned PNC at day8.
7. IDENTIFICATION OF NEONATES AT RISK FOR SEPSIS OR HYPOGLYCEMIA

It is important to be able to identify neonates at risk for neonatal infections – Please refer to part IV.10.1 “Management of asymptomatic neonates at risk for neonatal infections” and also IV.16 “Hypoglycaemia”.

In order to prevent nosocomial infections, asymptomatic infants, whether they be in the maternity unit or a neonatal / pediatric unit, should be managed in a location separate from symptomatic infants.
8. POST PARTUM MATERNAL & NEONATAL CARE IN THE MATERNITY

1. Postpartum evaluation of the mother – Refer to the MSF obstetrical guideline in remote settings

2. Postpartum evaluation of the newborn

Clinical exam of the newborn
A comprehensive exam should be performed for every newborn.
- Vital signs and danger signs: Consciousness, HR, RR, T°.
- Observation and examination: Skin (anaemia, jaundice, cyanosis…), abdomen, spine, orifices and palate, hands, feet, eyes, ears, and fontanel.
- Auscultation: Heart and lungs. Femoral pulses.
- Urine: ask to the mother if the baby is well passing urine.
- Neurological evaluation: Posture, tone, reflexes including suction, grasping, reactivity after stimulation.

Exclusive breastfeeding
- Ensure that the baby is fed frequently at least 8 times daily (i.e. every three hours).
- If an infant is too weak to suckle effectively, an alternate feeding method should be used – Refer to these chapters in part VI.
- Breastfeeding mothers should not take any traditional medicine and/or contraindicated drugs.
- Last WHO recommendations for mothers living in country with high HIV prevalence or for mothers known as HIV positive – Refer to chapter 5 in part III.

Steps to successful breastfeeding
- Good position of mothers and babies.
- Breast care.
- Adequate hydration (at least 3 litres daily) and feeding of the mother.
- Inform all pregnant women about the benefits and management of breastfeeding.
- Help mothers initiate breastfeeding within one hour of birth.
- Show mothers how to breastfeed and maintain lactation, even if they should be separated from their infants.
- Give newborn infants no food or drink other than breast milk, unless medically indicated.
- Practice rooming in - that is, allow mothers and infants to remain together 24 hours a day.
- Encourage breastfeeding on demand.
Daily follow up of newborns

- Disinfection of umbilical cord once the first day. Then keep it dry and without dressing.
- Examination x 1 *(refer to this paragraph above)* including vital values.
- Exclusive regular breastfeeding.
- Temperature, vital signs twice daily, check for urine and stools.
- Record on baby monitoring chart.

Criteria for discharge from the maternity hospital

- No danger signs *(see this part).*
- Appropriate management of neonatal infections *(see these parts)* and risk factors for neonatal infections *(see this part).*
- Healthy infant: good breastfeeding on demand, normal respiration and temperature, etc.
- Weight > 1500-1750 g.

AND

- Preventive treatments *(see this part)* and BCG, Hepatitis B (0) and Polio (0) vaccines administered *(see this part).*
- Clinical record filled out (including discharge weight).
- Postnatal visit appointment *(see this part)* given.

AND
Information for the mother

1) **Breastfeeding:** Refer to parts VI.1 and VI.5.

2) **Infant care:**
   - Wash the infant with soap and water once a day, and immediately dry him with a towel or cloth to avoid hypothermia.
   - Cord care: clean with soap and water each time it is soiled, rinse well and dry then let it uncovered. Do not apply an antiseptic or other product or dressing on the cord, the cord falls between the 5th and 15th day after birth.
   - Kangaroo care if weight < 2500 g (Refer to part V.4).
   - Lay the infant on the back.
   - Use a mosquito net day and night when the infant sleeps.
   - Keep the infant away from sick (contagious) children and adults.
   - Wash hands before and after caring for the infant.
   - Dispose of stool in the latrine.

3) **Danger signs requiring a consultation:**
   - Inability to breastfeed properly.
   - Abnormal movements.
   - Reduced activity.
   - Trouble breathing.
   - Abnormal colouring.
   - Redness or purulent discharge from the umbilicus.
   - Fever or hypothermia.

3. Postnatal evaluation of the mother in outpatient visit – Refer to the MSF obstetrical guideline in remote settings

4. Postnatal evaluation of the in outpatient visit

**Strategies for increasing uptake of post natal care:**
- Home visit by skilled attendant or by CHW (community health workers).
- Strengthened the message of importance of PNC through IEC teams.
- Give incentive to mothers that come to PNC (piece of cloth, sanitary pads, soap, etc).

**Recommended rate of visits**
At each visit, assess

- General condition including umbilical cord, weight and height.
- Any recognition of danger signs, problems or concerns identified by the mother.
- Exclusive breastfeeding (or alternate breastfeeding solution). A term baby should have recovered the birth weight at D10, premature babies are usually regaining their birth weight at D14 of life unless they have been sick.
- All infants less than 3 months of age who have not received IM 1 mg vitamin K1 at birth (delivery at home) should receive the same dose at the first time they are seen at the consultation (OPD, PNC, and IPD, or other…).
- Ophthalmic tetracycline ointment and BCG + doses 0 of Hep B and Polio vaccines were done at birth. Complete as needed till 3 months for Vitamin K1, D8 for ophthalmic tetracycline ointment, BCG and doses 0 of Hep B and polio vaccines.
- At weeks 6, 10 and 14 refer to the national EPI in order for the baby to get doses 1, 2 and 3 of the polio and pentavalent vaccines.
- Nutritional support for all lactating women (advantage / motivation) in order to ensure respect and adherence regarding the follow-up of the infant.
- For any LBW < 2500 g: Universal iron supplementation 2 mg/kg/d for at least 3 months from week 4. Check also systematically the colour of the conjunctives. In case of pallor, check haemoglobin. Normally haemoglobin in infants < 2 months with LBW should not be < 7 g/dl. If haemoglobin < 7 g/dl, refer to a MD for advice. See Part V, chapter 6 for Iron dosage.

5. Post natal handover of the infant at 6 weeks to the regular paediatrics consultation and the national EPI

- At 4 - 6 weeks normally the baby at term is no longer a neonate and should be seen as young infant in a general paediatrics consultation. He should also attempt the national EPI for receiving regular immunisations.
- Premature babies should also be considered according to their post-natal age for immunizations and so, to be referred to the general paediatrics consultation and the national EPI. Nevertheless the following of their growth (weight, height and head circumference) should be done according to their real or correct age that means their post-natal age minus the number of weeks between their initially planned term and their birth.

For example:
Premature baby born at 30 weeks was born 9 weeks too early (39 – 30 = 9).
So his real or correct age at 6 post natal weeks will be 3 weeks.
In this case an additional post natal visit can also be done by the PNC program.
PART III

MATERNAL TO CHILD TRANSMITTED DISEASES
1. Infant Born from Mother with GONORRHEA or CHLAMYDIA

DEFINITION

Gonococcal and chlamydial infections in pregnant women are common in developing regions. Newborns typically acquire both infections during delivery (25 to 50% of newborns delivered vaginally from mothers with Chlamydiae). Intrauterine infection also can occur after rupture of the membranes.

Infants born vaginally to infected mothers with N. Gonorrhea or Chlamydia trachomatis genital disease are at risk for acquiring newborn disease, which usually presents as conjunctivitis (both gonorrhea and chlamydia) and/or pneumonia (only with chlamydia).

Opthalmia Neonatorum (Neonatal Conjunctivitis):
The eye is the most frequent site of gonococcal and chlamydial infection in the newborn. As noted above, gonococcal infection is a serious, cause of ophthalmia neonatorum in developing countries. Infection can cause blindness. Chlamydial conjunctivitis is less severe than gonococcal conjunctivitis.

CLINICAL FEATURES

1. Conjunctivitis
   - Gonococcal infection typically causes a purulent conjunctivitis, with profuse exudate and swelling of the eyelids. Without treatment, the infection can extend from the superficial epithelial layers into the sub-conjunctival connective tissue and the cornea, leading to ulceration, scarring, and visual impairment.
   - Gonococcal conjunctivitis usually manifests 2 to 5 days after birth.
   - Chlamydial infection in the newborn also manifests as conjunctivitis. Chlamydia conjunctivitis usually manifests 5 to 14 days after birth.

   • Clinical findings of chlamydial conjunctivitis range from mild swelling with a watery eye discharge, which becomes mucopurulent, to marked swelling of the eyelids with red and thickened conjunctivae (chemosis). A pseudomembrane may form as the exudate adheres to conjunctiva. The conjunctivae may also be very friable resulting in bloody discharge.

   • If left untreated, Chlamydia infection can also cause serious ocular complications.

2. Chlamydial Pneumonia
Patients usually are not febrile or have minimal fever. Characteristic features are a staccato cough that may occur in paroxysms and tachypnea, although these are not universally present. Rales are often present on auscultation of the lungs; however, wheezing is uncommon. Approximately one-half of these infants have a history of conjunctivitis.

Pneumonia due to C. trachomatis occurs between 4 and 12 weeks of age, although essentially all are symptomatic before 8 weeks.

**TREATMENT**

- Give IM **ceftriaxone** IM (IV if IV line in place): 50 mg/kg as a single dose (maximum 125 mg) to:
  - All infants with purulent conjunctivitis, whether the mother is symptomatic or not.
  - All infants born to mothers who were symptomatic at the time of delivery, even if the infants are asymptomatic.
- In case of symptomatic conjunctivitis (purulent discharge): clean each eye with 0.9% sodium chloride at least 4 times a day. In case of use of ceftriaxone, it is useless to add a local antibiotic for the treatment.
- If the conjunctivitis persists 48 hours after the ceftriaxone injection, give oral **erythromycin**: 25 to 50 mg/kg/day in 4 divided doses for 14 days or if not available or not possible / feasible, oral **azithromycin**: 20 mg/kg once daily for 3 days
- If symptoms appear after 7 days of life, give IM ceftriaxone + oral erythromycin or if not available, oral azithromycin, as above.

**Treatment for chlamydia conjunctivitis and/or pneumonia**: PO erythromycin 50 mg/kg/day in four divided doses for 14 days. Topical therapy of chlamydial conjunctivitis is ineffective and unnecessary when treating with general ATB treatment.

PS: There is a slightly increased risk of pyloric stenosis in newborns being treated with erythromycin. Erythromycin is still the agent of choice because there are not enough studies documenting the efficacy of other drugs. One small study studied azithromycin for the treatment of neonatal chlamydial conjunctivitis and azithromycin was found to be less effective than previously published rates of erythromycin efficacy.

- **Mothers and their partners should be evaluated and treated** for gonorrhea, chlamydia, and other sexually transmitted infections.

**PREVENTION**

- The risk of contracting gonococcal conjunctivitis is greatly reduced by effective eye prophylaxis shortly after birth *(see Initial Routine Management of the Newborn)*.
2. Infant Born from Mother with CYTOMEGALOVIRUS (CMV) INFECTION

DEFINITION
- CMV or HHV5 is ubiquitous and affects 1 to 2% of newborns babies.
- Only 5 to 10% of them are symptomatic at birth.
- CMV infects newborns because of a primo – infection in mother during pregnancy (risk = 35 to 45%) or because of simple recurrence in an immune pregnant woman (risk 2 to 10%).
- Nevertheless, congenital infection due to CMV is the first cause of neuro – sensorial sequels acquired during intra uterine life.
- Sequels despite maternal infection do not affect a large number of newborns during pregnancy.

CLINICAL FEATURES OF NEONATAL CMV INFECTION
- Subclinical infection (10 times more common than clinical illness).
- IUGR, hepatosplenomegaly, jaundice, purpura, severe CNS disease (CNS and sensory impairment are seen in 50 to 90% of symptomatic newborns) including microcephaly, intracerebral calcifications, chorioretinitis, and progressive sensorineural hearing loss (10 to 20% of cases).
- Other symptoms include hemolytic anemia and pneumonia.
- By 2 years of age, 5to15% of infants who are asymptomatic at birth may experience serious sequelae, such as hearing loss or ocular abnormalities.
- With sub-clinical infection, late sequelae include mental retardation, learning disability, and sensorineural hearing loss.

TREATMENT
- Unfortunately still now, no anti-viral agent is yet routinely approved and recommended for treatment of congenital CMV. Acyclovir has no efficacy in CMV infection.
- Ganciclovir has been shown in studies to be partially effective and can be considered but only for symptomatic infants because it is poorly known in neonates and because of its significant toxicity (reversible neutropenia and thrombocytopenia).
- Ganciclovir: 7.5 mg/kg/12 hours over 2 hours x 6 weeks.
- Without treatment symptomatic infants have a mortality rate of 20 to 30%.
3. Infant Born from Mother with ACTIVE HEPATITIS B

The newborn is always asymptomatic at birth.

EPIDEMIOLOGY

Worldwide geographic distribution of chronic infection due to hepatitis B virus (CDC 2006)

![World map showing the distribution of hepatitis B infection](image)

DEFINITION

Maternal-infant transmission of hepatitis usually occurs in the perinatal period. Immunizing at-risk newborns with hepatitis B vaccine and hepatitis B immunoglobulin is the most important aspect of preventing maternal-infant transmission. The standard regimen of hepatitis vaccine starting in the 12 first hours of life after birth has a protective efficacy of 75-80%. When combined with hepatitis B immune globulin (HBIG), the protective efficacy is 95%. There is no evidence that C-section prevents maternal-infant transmission.

Neonates with hepatitis B infection are usually asymptomatic. Jaundice appears < 3% of the time. These infants often become chronic carriers.
TREATMENT

Vaccinate ALL newborns, disregarding the serological status of the mother.

1. Babies born from HBs Ag-positive mothers
   - Hepatitis B vaccine should be given at birth (mandatory before 12 hours of life, nevertheless because of the delay in MSF settings when delivery occurs at home, international recommendation is to do it during the first week of age) using the HepB monovalent vaccine.
   - A second, third and fourth dose of hepatitis B vaccine should then be given at 6, 10 and 14 weeks of age (most often included in the pentavalent conjugate vaccine DPT – Hep B - Hib).
   - Regarding preterm infants, the administration of the vaccines will be done exactly the same according to their true age (= age in weeks counted from birth, D0 = day of birth), and not according to their corrected age (= age counted with the gestational age, D0 = day when the baby would have reached 40 weeks of gestation = day when the baby would be born if he would be at term).
   - Hepatitis B Immune Globulins (HBIG) if available: IM 15 – 30 IU/kg in delivery room or mandatory before 12 hours. If the HBIG and hepatitis B vaccines are given simultaneously, they should be given at separate sites.

2. Babies born from mother with unknown HBs Ag status
   - Test the mother as soon as possible. While awaiting results, give the infant hepatitis B vaccine within 12 hours of birth (acceptable still day 7).
   - If the mother is found to be HBs Ag-positive, the infant should receive HBIG as above within 12 hours of age.

3. Breastfeeding
   - There is thought to be no risk of transmitting hepatitis B through breastfeeding in infants who have been immunized.
   - Breastfeeding should be encouraged.

4. Reminder – MSF routine vaccination recommendations for children under 1 year old + Booster doses

<table>
<thead>
<tr>
<th>Age</th>
<th>Vaccines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth</td>
<td>BCG; OPV0; <strong>HepB</strong> (only monovalent vaccine)</td>
</tr>
<tr>
<td>6 weeks minimum</td>
<td>Pentavalent 1 (DPT + <strong>HepB</strong> + Hib) + OPV1</td>
</tr>
<tr>
<td>10 weeks</td>
<td>Pentavalent 2 (DPT + <strong>HepB</strong> + Hib) + OPV2</td>
</tr>
<tr>
<td>14 weeks</td>
<td>Pentavalent 3 (DPT + <strong>HepB</strong> + Hib) + OPV3</td>
</tr>
<tr>
<td>9 months</td>
<td>Measles + YF</td>
</tr>
<tr>
<td>12 – 18 months</td>
<td>Pentavalent booster dose (DPT + <strong>HepB</strong> + Hib) + measles (booster)</td>
</tr>
</tbody>
</table>
4. Infant Born from Mother with HERPES SIMPLEX VIRUS (HSV)

**DEFINITION**

The most common mode of transmission is via direct contact of the fetus with infected vaginal secretions during delivery although intrauterine transmission from transplacental or ascending infection can also occur. Acquisition of a primary HSV infection near the time of labor is the major risk factor for transmission to the neonate.

With primary maternal infection, risk of transmission to the baby is 33-50%.

With secondary maternal infection, risk of transmission to the baby is only 1-3%.

Prevention of transmission to the neonate by reducing maternal HSV acquisition in late pregnancy is extremely important because of the morbidity and mortality associated with neonatal HSV.

Infants of mothers who have active genital herpes lesions at the time of delivery may present with neonatal herpes.

The infant is usually asymptomatic at birth. The symptoms appear sometime within the first 4 weeks of life (usually between 3 and 10 days of life).

Symptoms of neonatal herpes may include:

- Local, external involvement: skin, mouth (vesicles) and/or eyes (conjunctivitis).
- Cerebral involvement: encephalitis (with seizures in 60% of cases), accompanied in 60% of cases by local external involvement.
- Disseminated infection: primarily brain, lungs and liver. The infant may present danger signs suggesting septicaemia (fever, lethargy, respiratory distress or seizure). Local external involvement is associated in 60% of cases.

Management depends on the infant’s risk at birth:

**ANTENATAL CARE**

**PRENATAL CARE**

1. Mother with active genital HSV infection

Cesarean section significantly lowers the incidence of maternal-infant HSV infection. Women who have active genital herpes lesions during the intrapartum period should be delivered by C-section. C-section is recommended for both primary and secondary infection. If membranes have been ruptures for > 6 hours, C-section is also recommended.

2. Mother with latent HSV

If there are no visible lesions at the onset of labor or symptoms, vaginal delivery should be performed.

**POST NEONATAL CARE**
High risk of herpes infection

- Infant with symptoms of neonatal herpes, or
- Active primary or unknown maternal genital herpes at the time of delivery, or
- Active recurrent maternal genital herpes at the time of delivery, with at least one of the following risk factors: rupture of membranes \( \geq 6 \) hours before delivery (vaginal delivery or caesarean section) or birth weight < 2000 g or premature \( \leq 37 \) weeks or skin laceration or maternal HIV infection.
  - Hospitalize and isolate the mother and infant.
  - Apply one application of 3% Acyclovir eye ointment to each eye directly after birth (in these cases wait 12 hours before applying the tetracycline eye ointment)
  - IV Acyclovir for the infant: 20 mg/kg per dose every 8 hours (If the neonate weighs < 2 kg or has a gestational age of < 35 weeks: 15 mg/kg/dose every 12 hours) The total duration is 10 days if the infant is asymptomatic, 14 days if symptomatic without neurologic complications, or 21 days with neurologic complications.
  - At completion of the IV treatment, a course of oral acyclovir (10 mg/kg/dose 3x/day x 6 months) should be considered.

Low risk of herpes infection

Recurrent active genital herpes with none of the risk factors listed above.
In these cases, observe for 5 days, with isolation of the mother and infant. Apply 3% aciclovir eye ointment, as above.
If the infant becomes symptomatic, treat as above.
Discharge at 5 days of life if the infant has not developed symptoms; ask parents to seek urgent attention if symptoms appear.

Breastfeeding

The infant may breastfeed as long as no breast lesions are present on the mother. The mother should be instructed in good hand washing technique at all times when handling the infant.
Photos 1, 2, 3, 4 et 5 = Neonatal herpes.
Photo 6 = Congenital varicella.
5. Infant Born from Mother with HIV*

Please refer to the 2015 PMTCT MSF international protocol.

An estimated 260,000 (230,000 – 320,000) children under the age of 15 became infected with HIV in 2012\(^1\), 35% less than in 2009. More than 90% of these children are infected through Mother to Child Transmission (MTCT). Without intervention, the risk of transmission is 15-30% in non-breastfeeding populations. Breastfeeding by an infected mother adds an additional 5-20% risk for an overall transmission rate of 20-45%. In resource limited settings, without combined triple antiretroviral therapy (ART) treatment, 50% of HIV infected children die before the age of two.

In developed countries, effective prevention of mother to child transmission (PMTCT) has reduced HIV transmission to < 1%. The systematic implementation of these protocols has made pediatric infection an increasingly rare problem.

In resource-limited settings, the current WHO 2013 guidelines recommend two options:

- Lifelong ART for all HIV positive pregnant women regardless of their CD4 count (called option B+).
- ART for all HIV positive pregnant women regardless of their CD4 count **BUT** for those with a CD4 count > 500 cells/µl to be given the option to stop ART one week after complete cessation of breastfeeding (called option B).

The decision to stop ART may depend on the country context and the individual choice of the woman.

In resource-limited countries, these recommendations make it possible to reduce mother to child HIV transmission to less than 5%.

1. **To help the implementation of interventions that aim to reduce HIV mother to child transmission, we should promote the key messages below:**

   - HIV counselling and testing (group or individual pretest information; individual testing; individual post-test session) for any pregnant women who are ignoring their HIV status during the first AN Consultation.
   - Women tested as negative should be retested during the third trimester, delivery and then, regularly (3 to 6 months) during the entire breastfeeding period.
   - Women doing a seroconversion during pregnancy or breastfeeding are at particularly high risk for HIV transmission to their newborn.
   - Access to ARV treatment for the mother and the baby during pregnancy, delivery and after birth.
   - **See tables 1 and 2.**
   - Maternal breastfeeding (exclusive during the 6 first months) with ARV administration to the baby and/or the mother during the breastfeeding period.
   - During labor and delivery:
     - Follow universal precautions for the mother and her baby.

---

\(^1\) UNAIDS report 2013
Use the partograph as recommended for any delivery.

Avoid extended labor (increased risk of transmission with the duration).

Prevent / avoid traumatic / invasive handling during delivery (too many examinations, unnecessary artificial rupture of membranes, unnecessary trauma to the mother (e.g. episiotomy, forceps, suction) and to the infant (e.g. vigorous suctioning of the airways).

If rupture of the membranes occurs, deliver immediately.

After spontaneous rupture of the membranes, stimulate the labor in agreement with the protocol (see the MSF Obstetrics Guideline) in order to ensure a rapid progression of the labor. Cesarean section if stagnant labor.

Ensure the mother is taking ART prophylaxis / treatment as defined in protocols.

S’assurer que la mère prend la prophylaxie / traitement ARV tel que défini dans les protocoles.

- Treatment of associated STD in pregnant women.

2. **Administration of ARV drugs in women and infants**

2.1 – **Women already on ART when becoming pregnant or planning a pregnancy**

| TABLE 1. Women already on ART when becoming pregnant or planning a pregnancy |
|-----------------------------|-----------------------|------------------------|--------------------------|
| Pregnancy | Labor & Delivery | Post partum |
| Mother | Mother | Mother | Infant |
| Continue ART | Continue ART | Continue ART | Daily NVP to be started as soon as possible immediately after birth and for 6 weeks |

**Women on EFV containing regimen**

- Continue the same therapeutic regimen.

**Women on NVP containing regimen**

- Continue the same therapeutic regimen regardless CD4 level.
- Surveillance of liver toxicity.

**Women on TDF containing regimen**

- Continue the same therapeutic regimen. TDF is not at risk during pregnancy.
- Surveillance of creatinine clearance as for any adult with ART. The absence of surveillance of creatinine should not be an obstacle for using TDF since it continues to be the less toxic choice among NRTI.

**Women on d4T containing regimen**
• Replace d4T by TDF. If surveillance of creatinine is possible with a baseline of creatinine clearance < 50 ml/min, replace d4T by AZT if Hb is > 8 g/dl, and by ABC in the other cases.

Women on second line regimen
• Continue the same treatment.

2.2 – ART for newly diagnosed HIV-infected pregnant women

The ART regimen should be chosen taking into account local protocols for the preferred first line regimen for adults and adolescents in the country.

<table>
<thead>
<tr>
<th>TABLE 2. ART for women newly diagnosed HIV-infected pregnant women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pregnancy</strong></td>
</tr>
<tr>
<td>Start ART as soon as possible</td>
</tr>
<tr>
<td><strong>Mothers</strong></td>
</tr>
<tr>
<td>Daily NVP to be started as soon as possible immediately after birth and for 6 weeks</td>
</tr>
</tbody>
</table>

During pregnancy:
• **Start ART irrespective of gestational age** and continue throughout pregnancy, delivery and thereafter.
• The regimen of choice for all pregnant or breastfeeding women is [TDF/3TC (or FTC)/EFV] as a one pill/once a day, fixed dose combination.
• If TDF is not available or contraindicated (baseline creatinine clearance < 50ml/min) then AZT/3TC or ABC/3TC may be used as an alternative according to local availability.
• If EFV is contraindicated at baseline and the CD4 is > 250 then it should be substituted with a protease inhibitor (Atazanavir/ritonavir or Lopinavir/ritonavir).

2.3 – Women who present at delivery or post partum

Women/infants for whom an intervention can only be started at the time of labour/delivery
• Start ART with [TDF/3TC (or FTC)/EFV] as soon as possible.
• Infant should receive daily NVP for 12 weeks.

HIV positive mothers identified post partum with breastfeeding infants
• HIV positive women may present for the first time with a breastfeeding infant, having not been through any PMTCT intervention. In this case the baby should be tested with an age appropriate HIV test (DBS if < 18 months; rapid testing algorithm if > 18 months), the mother should be started on ART, and because it will take up to 3 months for the majority of women to achieve virological suppression the baby should receive 12 weeks of NVP syrup.
• Adapt NVP dose to the infant weight *(see annexe 1).*

• If the baby is tested positive (positive DBS if < 18 months, HIV RDT positive test if > 18 months), stop NVP prophylaxis and start ART with a PI based regimen (refer to MSF HIV Pediatric Hand book 2014)

**Note:**

• The situation is the same if the HIV *exposure* is first recognized in the infant < 18 months by a serological (antibody) test.
• Before 18 months, only a virological test can be used to confirm infection (with a confirmatory test to exclude lab errors).
• After 18 months, a positive antibody test (with a positive confirmatory test) means the child is infected.

### 2.4 – Specific considerations for choice of ART

**Women starting a TDF containing regimen**

• Lack of access to creatinine monitoring is not a contraindication to starting TDF.
• But if available, monitor creatinine clearance at month 6, 12 and then yearly.

**Women starting an AZT containing regimen**

• Check anaemia clinically and at subsequent visits during the first 12 weeks (laboratory monitoring if feasible at baseline, M1, M2, M3).
• If Hb < 8 g/dl at baseline or during monitoring, substitute AZT with an alternative NRTI (TDF, ABC) and investigate and treat anaemia.

**Women co-infected with TB**

• Choose an EFV-based ART regimen: preferably [TDF/3TC (or FTC)/EFV] as one pill/day.
• TB treatment should be started first and ART started after 2 weeks.

**Women co-infected with chronic hepatitis B**

• Choose a regimen containing TDF/3TC [TDF/3TC (or FTC)/EFV]. Monitor ALAT as per the HBV-HIV co-infection recommendations.
• DON’T FORGOT TO PROVIDE hepatitis B immunization at birth to the baby (dose 0).

### 3. Follow-up of HIV exposed infants

• During the first year, consultations should match the EPI calendar.
• From 6 weeks to 6 months, 1 consultation/month is needed.
• Thereafter, a 3-monthly schedule can be proposed.
• Ensure that the Child Health record with immunization (usually provided by MOH) is filled at each visit.
• Always assess mother and child’s care together as a family. In some settings the father may also be treated in MCH as part of the family approach.

**At each consultation**
• Check age and weight. Plot on the growth chart. If outside of normal percentiles, measure height and calculate BMI. If the growth curve is flattening or crossing lower centiles, ATTENTION!
• Check clinical status, growth and developmental status.
• Look for signs of TB. INH prophylaxis if mother on TB treatment.
• Advise on nutrition (encourage exclusive breastfeeding till M6, complementary feeding to be introduced thereafter). Check mother’s breast.
• Check immunisation completion for age.

Specificities for HIV exposed Infants

• Prescribe antiretroviral prophylaxis (NVP for 6 weeks).
• Start Cotrimoxazole at 6 weeks and continue until proven HIV negative.
• Perform HIV testing according the early infant diagnostic algorithm (see annex 2).
• Take history and examine for signs suggestive of HIV infection. If found, test the child and discuss if presumptive treatment should be started.
• Assess at each visit that cotrimoxazole is well taken (adherence to treatment).

For both mother and child

• Assess adherence to treatment issues at each consultation (check if on time to appointments).
• If any problem arises, refer to the PMTCT MSF clinical guideline and/or HIV pediatrics 2015 and/or Patient Education guideline.

For additional information, see the WHO clinical guideline on the use of anretroviral drugs to treat and/or prevent HIV infection. Recommendations for a public health approach-June 2013:
Annex 1: Dosage of NVP and Cotrimoxazole

NVP syrup should be started as soon as possible after birth and continued for 6 weeks.

Extended simplified infant NVP dosing recommendations

<table>
<thead>
<tr>
<th>Infant age</th>
<th>NVP daily dosing (OD) Syrup 10mg/ml</th>
<th>NVP daily Dosing Dispersible scored Tablets (20mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth - 6 weeks <strong>• BW &lt; 2500g</strong></td>
<td>10 mg/daily (1 ml/d - OD)</td>
<td>Half a tablet OD</td>
</tr>
<tr>
<td><strong>• BW ≥ 2500g</strong></td>
<td>15 mg/daily (1.5 ml/d - OD)</td>
<td>One Tablet OD</td>
</tr>
<tr>
<td>6 weeks to 6 months</td>
<td>20 mg/daily (2 ml/d - OD)</td>
<td>One Tablet OD</td>
</tr>
<tr>
<td>6 to 9 months</td>
<td>30 mg/daily (3 ml/d – OD)</td>
<td>One and Half Tablets OD</td>
</tr>
<tr>
<td>9 months to end of BF</td>
<td>40 mg/daily (4ml/d – OD)</td>
<td>Two tablets OD</td>
</tr>
</tbody>
</table>

Aurobindo syrup is available in 100 & 240 ml bottles (50mg/5ml). Shelf live, once open is 2 months.

Boerhinger Ingelheim syrup is available in 240 ml bottle (50 mg/5ml). Shelf life once open is 6 months.

It is advised to give the full bottle(s) to the mother with a syringe and to ask the woman to bring back the bottle with the remaining syrup (to be later discarded following waste management recommendations).

NVP 20 mg scored dispersible tablet from Microlabs (WHO PQ) are now available. Half a tablet can be given for those babies < 2500g and 20 mg can be given for those > 2500g up until 6 months where the dose will be adjusted again according to the table above (see table above).

Cotrimoxazole infant dosing

<table>
<thead>
<tr>
<th>CTX</th>
<th>Strength (mg or mg/5ml)</th>
<th>3-5.9 kg</th>
<th>6-9.9 kg</th>
<th>10-13.9 kg</th>
<th>14-19.9 kg</th>
<th>20-24.9 kg</th>
<th>25-34.9 kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid</td>
<td>200/40 per 5ml</td>
<td>2.5ml</td>
<td>5ml</td>
<td>5ml</td>
<td>10ml</td>
<td>10ml</td>
<td>-</td>
</tr>
<tr>
<td>Tab dispersible</td>
<td>100/20mg</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Tabs scored</td>
<td>400/80</td>
<td>-</td>
<td>Half</td>
<td>Half</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Tabs scored</td>
<td>800/160</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Half</td>
<td>Half</td>
<td>1</td>
</tr>
</tbody>
</table>
Annex 2: Early Infant Diagnosis (EID)

Early Diagnosis of HIV Infection in Infants and Children <18 months by DNA-PCR

Infants and children can be infected with HIV during pregnancy, delivery or post partum through breastfeeding. Infants infected in utero usually have already detectable HIV viral load when tested at birth. In contrast, infants infected during or around delivery usually have undetectable HIV viral load when tested at birth because it takes approximately 1-2 weeks following infection for the virus to be detectable by viral assays.

For infants and children under 18 months of age, serological antibody detection assays are not suitable because passive transfer of maternal antibodies may lead to a false positive result. Thus, virological assays, such as HIV DNA-PCR are recommended for early HIV diagnosis (EID) in infants <18 months of age. For infants older than 18 months, an antibody detection test can be used because the maternal antibodies have been cleared from the infant's blood. In these cases, use the adult algorithm.

Point of care devices for EID (HIV DNA PCR) will become soon available and are a practical option. Results will be immediately available.

If HIV DNA-PCR cannot be performed in the project, the specimens are to be sent to an external laboratory. Dried Blood Spots (DBS) are used (refer to annex 3), which results in delays to receive the results.

According to WHO guidelines MSF recommends:

HIV Infant Diagnosis by DNA-PCR using Dried Blood Spot (DBS)

Early testing is recommended to diagnosis HIV infected children as soon as possible in order to initiate them on ART and reduce early mortality.

Initial testing (DBS1) is usually recommended at the first post-natal visit (usually 4-6 weeks).

Some countries are starting to use DBS at birth (earlier case finding for perinatal infection and might decrease the early lost to F/up). Refer to national protocols.

Caution

- If initial testing was done at/or around birth and negative, a second test has to be performed around 4-6 weeks (intra partum and early post-partum transmission).
- 4-6 weeks is indicative. Week 6 is convenient because this is also the date of the first DPT1. But never turn away a mother because she comes earlier or later to test her infant.

Result Interpretation

- If DBS1 is NEGATIVE: Report the result as "HIV-negative". There is no need to confirm a negative result with a second DBS, unless the first test was done at or around birth.
• If the first result (DBS1) is POSITIVE: Start ART as soon as possible and collect a second specimen for confirmation (DBS2).

<table>
<thead>
<tr>
<th>Result DBS1</th>
<th>Result DBS2</th>
<th>Final Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>Not applicable</td>
<td>NEGATIVE</td>
</tr>
<tr>
<td>Positive</td>
<td>Positive</td>
<td>POSITIVE</td>
</tr>
<tr>
<td>Positive</td>
<td>Negative</td>
<td>Discordant – refer to lab or Pediatrics and/or HIV advisor (or laboratory advisor)</td>
</tr>
</tbody>
</table>

A positive HIV result obtained from virological testing of an infant or child younger than 18 months should be confirmed by a second virological test.

- The confirmation of the initial positive result is recommended in order to reduce errors during sampling, transportation and/or testing.
- The confirmation test should be performed in the same laboratory than the first test. This allows follow-up on consistency of the results and investigation on discordant results.
- Data should be collected including minimum information of age of child, results of DBS 1 and 2 and dates of blood collection.

• If the second result (DBS2) is also POSITIVE: Report final result as "HIV-positive".

• If the second result (DBS2) is negative: This is a discordant result. Refer to your HIV advisor or pediatrics advisor or laboratory advisor.
**Algorithm for EID**

**Infant born to an HIV positive mother**

*Start NVP and give for 6 weeks*

- **PCR test at 4 - 6 weeks of age**
  - **PCR Positive**
    - **HIV infected**
      - Start ART without delay
      - Confirm with second PCR test
  - **PCR Negative**
    - **Still breastfeeding (BF)**
    - **Still at risk of infection**
      - Continue close follow up
      - Do antibody test:
        - At any time if infant develops signs of HIV
        - Or
        - At 9 months of age if infant remains well
    - **Antibody test Positive**
      - Repeat PCR
      - **PCR Positive**
        - **HIV infected**
          - Start ART without delay
          - Confirm with second PCR test
      - **PCR Negative**
    - **Antibody test Negative**
      - Continue close follow up
      - Repeat antibody test after 18 months and 6 weeks after breastfeeding stopped For Final HIV Status
  - **Never BF or Stopped BF > 6 weeks ago**

**Notes**

- Children remain at risk of HIV infection as long as they are breastfed. All HIV DNA PCR negative children must be re-tested using antibody-based tests (e.g. Rapid Diagnostic Tests) to confirm the final status after 18 months and/or 6 weeks after cessation of breastfeeding, unless child was never breastfed.

- In projects which do not have the capacity to do so, earlier discharge between 12-15 months may be considered if a negative antibody HIV test is obtained and the baby has not breastfed during the past 6 weeks.
• Keep in mind that:
  o The likelihood of a false positive result decreases when clear clinical symptoms of HIV infection are present.
  o The likelihood of a false negative result increases when there are clear clinical indications of an HIV infection:
    - If a child tested negative once but has new symptoms compatible with HIV disease, testing must be repeated (and treatment started following the 2015 MSF Paediatric HIV Handbook).
    - The likelihood of false positive increases with a well-functioning PMTCT program (as HIV prevalence in infants decreases, predictive positive value of the test decreases as well and false positive results increase).

It is recommended to liaise with the HIV advisor, the pediatrics advisor and/or the laboratory advisor for any discordant results and keep track of the results.
Annex 3: SOPs for Collection, storage and transportation of DBS samples

Caution: there is a high risk of cross contamination from capillary blood sampling to laboratory testing if proper procedures are not followed.

1. Equipment

- Sample collection card: Protein Saver™ 903® Card Whatman
- Drying rack
- Low gas permeable zip-lock bag
- Desiccant bags
- Humidity card: Tropack Indicator B/1
- Rip-resistant envelope

2. Method: collection and storage of DBS

- Label card with appropriate identification number and date.
- Apply 1 drop or 50-75 µl of whole blood to each circle (heel prick sample, see chapter 5, part VII of the guideline Advanced Neonatal Care), and fill the 5 circles (at least 4 circles).
- Placing the card on the drying rack, let the card completely air dry (between 2-3 hours and overnight depending of the ambient humidity), in a clean, dust-free and insect-free area.
- Complete patient information in the appropriate laboratory register (identification number, age, date of blood collection).
- Once dry, place the card in a low gas-permeable zip-lock bag with desiccant and humidity card. The cards are either placed individually in a zip-lock bag or placed individually in a glassine bag and packed by 5 maximum in the zip-lock bag. Press as much as possible the air out of the bag and seal it shut.
- Keep packed DBS (in sealed plastic bags) in a dry place at room temperature until transportation to the external laboratory.
- Check the humidity cards weekly: if the card is pink (humidity > 30%) remove the desiccant bag and store with 6 packets of new desiccant bags in the sealable bag.

3. Transportation

- Place zip-lock bags containing DBS in a rip-resistant envelope with the necessary documents.
- DBS are not considered infectious material regarding international regulations. It is possible to transport them by normal post at room temperature.
Recommendations for infant feeding in the context of HIV (WHO 2013)

**Mothers known to be HIV-infected** should be provided with lifelong ART or ARV prophylaxis interventions to reduce HIV transmission through breastfeeding according to WHO recommendations.

**Mothers known to be HIV-infected (and whose infants are HIV uninfected or of unknown HIV status)**
- Exclusive breastfeeding for the first 6 months of life.
- Start complementary foods from 6 months.
- 6 to 11 months: mixed feeding.
- 11 to 12 months: stop breastfeeding progressively over one month + Plumpy Doz / BP 100. Stopping breastfeeding abruptly is not advisable.
- If mother or infant on prophylactic ART, discontinue prophylaxis 1 week after breastfeeding is fully stopped.

**Mothers known to be HIV-infected (and whose infants are HIV uninfected or of unknown HIV status) should only give commercial infant formula milk as a replacement feed or after deciding to stop breastfeeding when specific conditions are met:**
- Safe water and sanitation.
- **And** sufficient infant formula milk to support normal growth and development of the infant can be provided.
- **And** the mother or caregiver can prepare it cleanly and frequently enough so that it is safe and carries a low risk of diarrhea and malnutrition.
- **And** the mother or caregiver can exclusively give infant formula milk in the first 6 months.
- **And** the family is supportive of this practice.
- **And** the mother or caregiver can access health care that offers comprehensive child health services.

**HIV uninfected mother or mother with unknown HIV status**
- Strongly encourage exclusive breastfeeding until 6 months.
- Start complementary foods from 6 months of age.
- Continue breastfeeding for 24 months or beyond.

**Infants known to be HIV infected**
- Strongly encourage exclusive breastfeeding until 6 months.
- Start complementary feeding from 6 months of age.
- Continue breastfeeding for 24 months or beyond.
6. CONGENITAL & NEONATAL MALARIA

Malaria in infants less than 2 months

DEFINITION

**Congenital malaria**: malaria in the first week of life (0-7 days), which can be acquired transplacentally (vertical transmission) or at the time of birth.

**Neonatal malaria**: malaria acquired via mosquito bite or infected blood occurring in an infant from day 8 to day 28 of life.

This document discusses malaria in infants less than 2 months of age because they are highly vulnerable and they will be diagnosed and treated in the same way as neonates.

1) INTRODUCTION

- Neonatal malaria was once thought to be rare, especially in endemic areas because of the protective effect of transplacental maternal antibodies and to the protective effect of Hb F on the neonates but it may be more frequent than previously thought.
- Recent reports suggest that the prevalence of congenital malaria among newborn infants in Sub-Saharan Africa is 0-23%.
- Congenital malaria can occur in children born to clinically healthy mothers who are delivered in malaria endemic areas.
- Infants with congenital or neonatal malaria may have a different clinical presentation than older children, and diagnosis may be confused with other neonatal diseases due to an overlap of clinical manifestations.
- All types of malaria can be transmitted congenitally, but congenital disease is most often associated with *P. falciparum* and rarely with *P. vivax*.

2) CLINICAL FEATURES

Malaria during pregnancy has been known to cause miscarriage, perinatal death (stillbirth and early neonatal death), premature birth, low birth weight, and congenital malaria.

a) Associated factors

- Maternal fever during the third trimester
- Mother with severe anaemia
- Premature birth (< 37 weeks of GA)
- Low birth weight (< 2500 g)
- Fever at birth
- Mother with peripheral parasitaemia at delivery

b) Signs and symptoms of malaria in infants less than 2 months for all infants born to mothers in malaria endemic areas (regardless of maternal arrival or length of stay in endemic area).

Signs of malaria in infants are non-specific and resemble sepsis. These include:
• Fever (most common in malaria) or hypothermia (more common in sepsis)
• Poor feeding / inability to breast feed, abdominal distension
• Pallor (anaemia)
• Lethargy, irritability, seizures, coma
• Cough and/or respiratory distress, apnoea
• Hepato-splenomegaly
• Jaundice
• Poor perfusion or shock

3) DIAGNOSIS IN ENDEMIC AREAS

• Microscopy (thin and thick blood smear) is the gold standard and is highly recommended as long as reliable laboratory facilities for microscopy are available.
• Rapid Diagnostic Tests (RDT): the validity of RDT in neonatal malaria is unknown. Antigens (HRP2 protein or pLDH) might cross the placenta and might cause false positive test results. Using RDT may therefore result in over-treatment of neonates and should be only used to exclude the diagnosis of malaria. Nevertheless, RDT can be used when reliable microscopy is not available.
• Systematic routine testing of all newborns in high prevalence areas is not recommended (some neonates might clear parasitaemia spontaneously).
• Do microscopy in newborns with maternal malaria during the 3rd trimester or at delivery.
• Do microscopy in all infants less than 2 months with suspected sepsis or with above signs.
• Repeat microscopy at 24 and 48 hours if negative but malaria still clinically suspected ⇒ low levels of malarial parasitaemia can occur in infants less than 2 months.

4) TREATMENT

4.1) General considerations

• Admit all infants less than 2 months with positive malaria test or signs of malaria / sepsis to hospital.
• Treat all infants less than 2 months presenting with signs of sepsis / malaria (see above signs and symptoms) with antibiotics – refer to the chapter 10 “neonatal infections & meningitis”, in part IV.
• Treat infants less than 2 months with positive malaria testing with antimalarials – see the algorithm below at the end of this chapter.
• DO NOT treat infants with NEGATIVE malaria tests (slide or RDT) with antimalarials – see the algorithm below at the end of this chapter.
• Malaria in symptomatic neonates / infants less than 2 months should always be treated as severe malaria because of their vulnerability, more precise dosing needed and possible absorption differences in all medications.
• In case of persistent symptoms and negative testing, repeat malaria testing after 12 hours, 24, 48... hours. In some exceptional cases with a high suspicion of malaria taking into account associated factors, after consultation with a senior clinician, malaria treatment can be considered despite a negative test.
• Blood transfusion if Hb is ≤ 7 g/dl or ≤ 10 g/dl associated with respiratory distress or shock – refer to the chapter 8 “anaemia & blood transfusion for infants less than 2 months”, in part IV.

• Treat other complications according to protocols.

• Treatment: follow the algorithm below at the end of this chapter.

4.2) Antimalarials

• First choice for symptomatic infants: Artesunate IV/IM for 7 days (monotherapy).
  o IV is always preferable but if IV is not possible gives IM.
  o After a minimum of 3 doses of IV/IM Artesunate, if clinical condition allows doing it ⇒ consider switching to an oral ACT for 3 days (see below).

• If infant is asymptomatic please see below (ACT).

First choice: Slow IV/IM Artesunate 3 mg/kg at diagnosis, and then at H12 and H24 (H = Hours). Then give 3 mg/kg IV/IM once a day for 6 days to complete a total of 7 days of treatment.

<table>
<thead>
<tr>
<th>Artesunate</th>
<th>MIXING Artesunate for IV and IM administration:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIRST dissolve the powder (vial of 60 mg Artesunate) IN 1 ml of 5% sodium bicarbonate REGARDLESS of IV or IM</td>
<td></td>
</tr>
<tr>
<td>Then dissolve FURTHER according to ROUTE (IV or IM)</td>
<td></td>
</tr>
<tr>
<td><strong>For IV Artesunate</strong></td>
<td>THEN ADD 5 ml of 0.9% NaCl to the vial → Obtain 6 ml of solution containing <strong>10 mg of Artesunate/ml</strong> for IV injection</td>
</tr>
<tr>
<td><strong>For IM Artesunate</strong></td>
<td>THEN ADD 2 ml of 0.9% NaCl to the vial → Obtain 3 ml of solution containing <strong>20 mg of Artesunate/ml</strong>, for IM injection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DOSING:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artesunate</td>
</tr>
<tr>
<td>First dose</td>
</tr>
<tr>
<td>Second Dose</td>
</tr>
<tr>
<td>Third Dose</td>
</tr>
<tr>
<td>Subsequent doses</td>
</tr>
</tbody>
</table>

**Dosing for IV injection: Artesunate solution 10mg/ml**

Use a 1 ml syringe graduated in 0.01 ml when the dose required is less than 1 ml.

<table>
<thead>
<tr>
<th>CHILD WEIGHT in KG</th>
<th>DOSE in ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – &lt; 1.5</td>
<td>0.3 – 0.4</td>
</tr>
<tr>
<td>1.5 – &lt; 2</td>
<td>0.4 – 0.6</td>
</tr>
<tr>
<td>2 – &lt; 3</td>
<td>0.6 – 0.9</td>
</tr>
<tr>
<td>3 – &lt; 4</td>
<td>0.9 – 1.2</td>
</tr>
<tr>
<td>4 – &lt; 5</td>
<td>1.2 – 1.5</td>
</tr>
<tr>
<td>5 – &lt; 6</td>
<td>1.5 – 1.8</td>
</tr>
</tbody>
</table>

**Dosing for IM injection: Artesunate solution 20 mg/ml**

<table>
<thead>
<tr>
<th>CHILD WEIGHT in KG</th>
<th>DOSE in ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – &lt; 1.5</td>
<td>0.2</td>
</tr>
<tr>
<td>1.5 – &lt; 2</td>
<td>0.2 – 0.3</td>
</tr>
<tr>
<td>2 – &lt; 3</td>
<td>0.3 – 0.4</td>
</tr>
</tbody>
</table>
Rectal Artesunate: Emergency treatment before referral for CHWs in communities in malaria endemic area ➔ FOR all neonates with suspected neonatal sepsis / malaria after the initial clinical exam at home, in communities… before referral.

Second choice: Only if Artesunate is NOT AVAILABLE, or IV NOT POSSIBLE, or in very isolated contexts with no skilled staff and in the absence of signs of shock:

- IM Artemether 3.2 mg/kg on the 1st day (D1) then 1.6 mg/kg from D2 to D7.
- The advantage of Artemether in limited resource settings is that it is ready to use.

<table>
<thead>
<tr>
<th>Weight</th>
<th>Dosages of Artemether using paediatrics vials: 1 vial of 20 mg/1 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 2 kg</td>
<td>Day 1: Artemether: 3.2 mg/kg</td>
</tr>
<tr>
<td>2 - 2.9 kg</td>
<td>6 mg</td>
</tr>
<tr>
<td>3 - 3.9 kg</td>
<td>10 mg</td>
</tr>
<tr>
<td>4 - 4.9 kg</td>
<td>13 mg</td>
</tr>
<tr>
<td>5 kg</td>
<td>16 mg</td>
</tr>
</tbody>
</table>

ONLY in the Absence of shock (good central and peripheral pulses)
Reminder: normal HR with no associated pathology extremities warm and pink, normal pulses, CRT < 3 sec and normal SpO2 with no associated respiratory diseases.

Third choice in symptomatic infants or first choice in asymptomatic infants: Artemisinin-based combination therapy (ACT)

- There are few studies of ACTs in infants < 5 kg.
- Artemisinin compounds are known to be safe; therefore safety & tolerability depend on the other medication in co-formulations.
- Note: Primaquine is contraindicated in children < 4 years; avoid Pyrimethamine in the first few weeks because of hyperbilirubinaemia.
- Having accurate dosing is difficult ⇒ special dilutions need to be prepared.
- ACT should be on given IN-HOSPITAL in the following situations: as oral relay to injectable Artesunate or IM Artemeter, if the infant is alert and breastfeeding well in situations where it is not possible to complete the full course IV/IM.
- There is currently no scientific evidence to support the use of Artemether-Lumefantrine over Artesunate-Amodiaquine, so follow National Protocols.

- ACT dilutions must be administered immediately after preparation since they are not stable:
**Artesunate-Amodiaquine (AS-AQ)** - Available formulations, soluble in water in 3 minutes

Dilute 1 co-formulated tablet of AS-AQ (25 mg artesunate/67.5 mg Amodiaquine co-formulation) into 10 ml of clean water or sodium chloride.

Dose: AS: 5 mg/kg x 3 days; AQ 10 mg/kg x 3 days.

<table>
<thead>
<tr>
<th>Weight</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 2.2 kg</td>
<td>1.6 ml</td>
</tr>
<tr>
<td>2.3 - 2.4 kg</td>
<td>1.8 ml</td>
</tr>
<tr>
<td>2.5 - 2.7 kg</td>
<td>2.0 ml</td>
</tr>
<tr>
<td>2.7 - 2.9 kg</td>
<td>2.2 ml</td>
</tr>
<tr>
<td>3 - 3.2 kg</td>
<td>2.4 ml</td>
</tr>
<tr>
<td>3.3 - 3.4 kg</td>
<td>2.6 ml</td>
</tr>
<tr>
<td>3.5 - 3.6 kg</td>
<td>2.8 ml</td>
</tr>
<tr>
<td>3.7 - 3.9 kg</td>
<td>3 ml</td>
</tr>
<tr>
<td>4 kg</td>
<td>3.2 ml</td>
</tr>
</tbody>
</table>

**Artemether-Lumefantrine (AL)**

Dilute 1 tablet of AL (20 mg Artemether/120mg lumefantrine co-formulations) into 10 ml of clean water.

Dilution of Artemether - Lumefantrine (20 mg Artemether/120mg Lumefantrine co-formulation)

1 ml = 2 mg of Artemether + 12 mg of Lumefantrine.

Dosing: Artemether 1.7 mg/kg/dose; Lumefantrine 12 mg/kg/dose

<table>
<thead>
<tr>
<th>Child’s weight (kg)</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 2.4 kg</td>
<td>1 ml twice daily</td>
</tr>
<tr>
<td>2.5 - 2.9 kg</td>
<td>1.3 ml twice daily</td>
</tr>
<tr>
<td>3 - 3.4 kg</td>
<td>1.6 ml twice daily</td>
</tr>
<tr>
<td>3.5 - 3.9 kg</td>
<td>1.9 ml twice daily</td>
</tr>
<tr>
<td>4 - 4.4 kg</td>
<td>2.2 ml twice daily</td>
</tr>
<tr>
<td>4.5 kg</td>
<td>2.5 ml twice daily</td>
</tr>
</tbody>
</table>

**PREVENTIVE STRATEGIES & CONCLUSION**

- Mosquitoes netting distribution to families: Long Lasting Insecticide Treated Nets (LLITNs). Two free bed nets at first antenatal consultation in endemic areas.
- Indoor Residual Spraying (IRS) should be considered.
- Treat all malaria during pregnancy – Refer to MSF “Obstetrics in remote settings” guideline.
- Besides Intermittent Preventive Treatment in pregnancy, different preventive strategies or “Intermittent Preventive Treatment” have been described for young children.
- IPTi (for infants less than 2 years) recommended by WHO in some conditions and with standardized approach:
  - Pyrimethamine Sulfadoxine (PS) during EPI vaccinations (6, 10 and 14 weeks of life) that simplifies implementation, decreases cost and makes program more cost effective.
  - IPTi decreases frequency of malaria accesses from 6 – 7 to 2 – 3 yearly.
- In endemic areas, it can be difficult to distinguish malaria acquired congenitally (transplacental or prenatal route) from that acquired as a neonate, particularly in infants of asymptomatic mothers. The onset of symptoms is usually at 2 to 12 weeks of age and includes poor feeding, fever, vomiting, diarrhoea, and irritability. Splenomegaly, anaemia, thrombocytopenia, and hyperbilirubinaemia are common and can occur at one month of age or later.
MALARIA IN INFANTS < 2 MONTHS

Signs and symptoms of malaria / sepsis present

NO

Test only if maternal malaria during 3rd trimester or at delivery

Malaria Smear Positive in infant (RDT positive only if smear not available)

Antimalarials ACT PO in hospital for 3 days (see protocol)

IV/IM Antibiotics if infant develops ANY sign of sepsis

YES

ABCD; Stabilization of the infant; O2; Glucose

- Treat sepsis with IV/IM antibiotics
- Test for malaria

Malaria Smear Positive in infant (RDT positive only if smear not available)

NO

- Continue IV/IM antibiotics
- No antimalarials
- Retest for malaria at 12 hours

Malaria Smear Positive in infant (RDT positive only if smear not available)

YES

- Antimalarials IV/IM (see protocol)
- Continue IV/IM antibiotics

NO

- Continue IV/IM antibiotics
- No antimalarials
- Retest for malaria at 24, 48 hours

- If positive start Antimalarials (see protocol)
- Continue IV/IM antibiotics

YES

- Antimalarials IV/IM (see protocol)
- Continue IV/IM antibiotics
7. CONGENITAL RUBELLA

DEFINITION

- Rubella is a viral infection capable of causing intra-uterine infection and damage to the developing fetus.
- Rubella vaccine has virtually eliminated cases of congenital rubella syndrome (CRS) in the developed world. However, rubella can still be prevalent in non-vaccinated immigrant populations and in the developing world where rubella vaccine is not part of the national EPI.
- The incidence of fetal effects is greater the earlier in gestation that infection occurs, especially at 1 to 11 weeks, when 90% of infected fetuses will be damaged, 50% during weeks 11 to 20 and 37% from 20 to 35 weeks, while at later gestational ages they occur only occasionally.

CLINICAL FEATURES OF NEONATAL RUBELLA INFECTION

- Chronic intra-uterine infection in the placenta of the fetus may lead to resorption of the fetus, spontaneous abortion, stillbirth, fetal infection with multisystem disease (angiopathy, cytolytic changes, hepatosplenomegaly, jaundice, anemia, encephalitis, myocarditis, retinopathy, pneumonia...), congenital anomalies (IUGR, congenital heart disease, sensor neural hearing loss, cataracts or glaucoma, neonatal purpura and dermatoglyphic anomalies), or unapparent infection.
- Among newborns with congenital rubella and normal aspect at birth, the majority later develop one or more signs and symptoms of disease, including immune anomalies, hearing deficit, psychomotor retardation, micro or hydrocephaly, diabetes mellitus and thyroid disease.

TREATMENT

- Unfortunately still now, the therapy for congenital rubella is usually symptomatic.
- There is not available specific antiviral therapy.
- True prevention of congenital rubella lies in maintaining a highly immune status at least in the CBAW population. The replacement of measles vaccine by the combined vaccine measles-mumps-rubella vaccine is under discussion in the international partnership for maternal, newborn and child health.
8. CONGENITAL SYPHILIS

INTRODUCTION

Congenital syphilis occurs when the spirochete Treponema pallidum is transmitted from a pregnant woman to her fetus. Vertical transmission can occur at any time during pregnancy and at any stage of the disease. Perinatal transmission occurs in 50% of patients with primary or secondary syphilis, with fewer congenital infections among women with early latent (40%), late latent (10%), and tertiary disease (10%).

Infection can result in stillbirth, hydrops fetalis, or prematurity and associated long-term morbidity. Because of this morbidity, all pregnant women should be screened for syphilis.

Treatment of maternal syphilis is the most important factor influencing the risk of congenital infection. Infants born to mothers who received adequate penicillin treatment for syphilis during pregnancy are at minimal risk. Seventy to 100% of infants born to untreated mothers will be infected compared to 1 to 2% of those born to women adequately treated during pregnancy.

CLINICAL SIGNS

- Muco-cutaneous red rash, grey patches, blisters, bullous lesions, followed by peeling skin on palms and soles (epidermolysis)
- Disease generally involving multiple organ systems:
  - Hepatosplenomegaly
  - Jaundice
  - Lymphadenopathy
  - Haemolytic Anemia
  - Osteochondritis and perichondritis
  - Rhinitis with nasal obstruction (snuffles)
- Congenital syphilis can appears as a sepsis (danger signs)
- Late manifestations primarily result from chronic inflammation of bone, teeth, and the CNS (frontal bossing, saber shins, Hutchinson teeth, saddle nose, behavioral changes, seizures, low QI, etc...).

DIAGNOSIS

Two thirds of neonates with congenital syphilis are asymptomatic therefore an SD Bioline rapid syphilis test should be performed on all pregnant women with a maternal history of syphilis during pregnancy. False positives are possible when using the older RPR test (pregnancy, malaria)

A newer rapid treponemal test SD Bioline Syphilis 3.0 has greater sensitivity and specificity than RPR*. Since the SD Bioline is a treponemal antibody test (Ig G, Ig M, Ig A), it does not
differentiate between current and past infection. The RPR test has the advantage of documenting active versus past infection.

Since the SD Bioline rapid test has greater sensitivity and specificity, it should be used for both screening and confirmation of syphilis infection. When the SD Bioline test is positive, an RPR can also be done to monitor response to therapy (by observing decreasing titers that means making a difference between acute versus past infections). However, treatment should be administered to all positive infants even if an RPR is not available.

**TREATMENT**

- **Mothers** with a positive rapid test during pregnancy should be treated with benzathine penicillin G, 2.4 million units IM (half-dose in each buttock) each week for a total of 3 weeks. Erythromycin is non effective to protect the foetus, so it is not recommended antibiotic during pregnancy.

- **If the infant has no signs of syphilis and the mother received appropriate treatment during the pregnancy** (at least one dose of penicillin\(^1\) administered at least one month before delivery, ideally 3 doses), give to the infant: IM **benzathine benzylpenicillin**, 50 000 IU/kg as a single dose.

- **If the infant has signs of syphilis or the mother did not receive appropriate treatment** (at least one dose of penicillin\(^2\) administered at least one month before delivery, ideally 3 doses): give to the infant:
  - **IV Benzylpenicillin** for 10 days: 100 000 IU/kg/day in 2 divided doses given 12 hours apart from Day 0 to Day 7, and then 150 000 IU/kg/day in 3 divided doses given 8 hours apart from Day 8 to Day 10
  - Or **IM Benzylpenicillin procaine (Penicillin G Procaine)** for 10 days: 50 000 IU/kg once daily.

- In addition to “standard” precautions, use “contact” precautions\(^2\) during care for 24 hours after starting the treatment. Continue and encourage breastfeeding.

- **Preventive treatment of sexual partner**
  Do not forget to treat the sexual partner: IM Benzathine penicillin G, 2.4 million units (half-dose in each buttock) each week for a total of 3 weeks.
  It is crucial to avoid reinfecting the pregnant woman and so her foetus.

---

\(^1\) Un traitement par l’érythromycine n’est pas adéquat.
\(^2\) Un traitement par l’érythromycine n’est pas adéquat.
9. CONGENITAL TOXOPLASMOSIS

INTRODUCTION

• Toxoplasma gondii is an intracellular parasitic protozoan capable of causing intrauterine infection by transplacental – fetal hematogenous route.
• Toxoplasma gondii is ubiquitous in the nature and primary natural host are cats.
• The incidence of congenital infection is 1 / 1 000 to 1 / 10 000 live births.
• In most cases maternal infection is not suspected (in adults infection is most often sub-clinical).

RISK FACTORS

• Contact with contaminated soil.
• Ingestion of unpasteurized milk, raw or undercooked meats (especially pork).
• Blood product transfusion (white blood cells).
• Premature infants have a higher incidence of congenital toxoplasmosis than term infants (25 – 50% of cases in some series).

CLINICAL FEATURES OF NEONATAL TOXOPLASMOSIS INFECTION

• Clinical neonatal disease, disease in the first few months of life, late sequelae or relapsed infection, or subclinical disease.
• Clinical disease: Disseminated illness or isolated CNS or ocular disease. Late sequelae are primarily related to ocular or CNS disease. Obstructive hydrocephalus, chorioretinitis, and intracranial calcifications form the classic triade of toxoplasmosis.
• Prominent signs and symptoms in infants with congenital toxoplasmosis include fever or hypothermia, hepatosplenomegaly, anemia, seizures, chorioretinitis, lymphadenopathy, microcephaly or hydrocephalus, intracranial calcifications, cataracts or glaucoma, optic atrophy, rash, pneumonia, vomiting, diarrhea, and bleeding.
• Among newborns with congenital toxoplasmosis, subclinical infection is believed to be the most common. In these cases infection is identified by serologic testing or documented maternal infection. A large percentage may have minor CSF abnormalities at birth and later develop visual or neurologic sequelae, learning disabilities or psychomotor retardation.

DIAGNOSIS

• In MSF settings, specific lab exams are not feasible. Diagnosis should be done on the association of clinical suspicion + or – CSF examination (xanthochromia, very high protein level, mononuclear pleocytosis) + or – Radiological studies (ultra sonogram or CT scan of
the head – characteristic intracranial calcifications, long bones films – metaphyseal and epiphyseal abnormalities) and ophthalmologic exam (characteristic chorioretinitis).

- All suspected neonates should be treated.

**TREATMENT**

- Congenital toxoplasmosis is a treatable infection, although at present is not curable.
- 6-months regimen with a combination of pyrimethamine, sulfadiazine and leucovorin calcium supplements.
- After the initial 6-months regimen, a second 6-months regimen with alternatively 1-month course of spiramycin and 1-month course of pyrimethamine, sulfadiazine and leucovorin calcium supplements.
- Corticoids are somewhat controversial; often prednisone or dexamethasone is given in infants with chorioretinitis or elevation in spinal fluid protein to decrease the inflammatory response.

**PREVENTION**

- Treatment of all affected pregnant women when diagnosis is done.
- Avoid eating raw meat or raw eggs when pregnant.
- Avoid exposure to cats and contact with cat feces when pregnant.
Congenital toxoplasmosis lesions of the macula, on the left and in the middle

Healed and active toxoplasmosis lesions of the macula, on the right
10. Infant Born from Mother with ACTIVE TUBERCULOSIS

DEFINITION

Congenital trans-placental transmission of tuberculosis is rare and occurs almost exclusively when the placenta is actively infected.

Adverse fetal outcomes are more likely in extra-pulmonary than pulmonary tuberculosis infection.

PERINATAL TRANSMISSION OF TUBERCULOSIS

<table>
<thead>
<tr>
<th>Maternal Focus of Infection</th>
<th>Mode of Spread</th>
<th>Timing</th>
<th>Relative Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia with cavitary lesion</td>
<td>Inhalation of infected droplets</td>
<td>Postnatal</td>
<td>Most common</td>
</tr>
<tr>
<td>Amniotic infection after rupture of placental caseous lesion</td>
<td>Aspiration or ingestion of infected fluid</td>
<td>Congenital or intrapartum</td>
<td>Less common</td>
</tr>
<tr>
<td>Placentitis after miliary or endometrial tuberculosis</td>
<td>Hematogenous through umbilical vein</td>
<td>Congenital</td>
<td>Rare</td>
</tr>
<tr>
<td>Cervicitis</td>
<td>Direct contact, aspiration, or ingestion</td>
<td>Intrapartum</td>
<td>Rare</td>
</tr>
<tr>
<td>Mastitis</td>
<td>Ingestion of infected milk</td>
<td>Postnatal</td>
<td>Extremely rare</td>
</tr>
</tbody>
</table>

*Any caregiver with cavitary pulmonary tuberculosis can transmit infection to the infant.

CLINICAL FEATURES

Generally, congenital symptoms appear around 2 to 8 weeks (exceptionally at birth) with stopping of the growth, hepatosplenomegaly, icterus, and sometimes pneumonia.

These signs should not appear when preventive INH treatment is well managed but might occur in case of primary resistance to INH. In this case, eliminate another cause for the observed symptoms than TB with a cautious screening and start a complete treatment – Refer to the paragraph below.

PROPHYLAXIS & TREATMENT

M+ Mothers treated for less than two months prior to birth (or mothers who were diagnosed with tuberculosis shortly after birth)

- Do not administer BCG vaccine at birth.
- Pharmacologic prophylaxis of a newborn is indicated if the mother has active tuberculosis (positive microscopy or M+) and was treated for less than two months prior to birth (or if the mother was diagnosed with tuberculosis shortly after birth) 19.
- The baby should be given prophylactic Isoniazid 10 mg/kg (maximum 300 mg/d) once a day orally.
- The infant should be re-evaluated at six weeks of age. The weight gain should be recorded and a chest X-ray done if possible. If there are any findings suggestive of active disease,
start full anti-tuberculosis treatment according to protocol. If the infant is doing well and the tests are negative, continue the prophylactic Isoniazid to complete a total course of six months of treatment.

- BCG vaccination of the infant should be given two weeks after the Isoniazid treatment has been completed, so during the seventh month of age. If BCG was already given at birth, a repeat dose should be given at this time.
- All anti-tuberculosis drugs are compatible with breastfeeding thus breastfeeding should be continued. The mother and infant should be isolated together.
- BCG should not be given to infants of confirmed or suspected HIV-positive mothers.
- Newborn from M+ TB mother should not be separate from his mother with exception when the mother is too weak and not capable to take care of her baby.
- Mother should maintain breastfeeding during the 6 months.
- Close surveillance in any case.

**M- Mothers (EP) or mothers treated for more than two months prior to birth (or mothers who were diagnosed with tuberculosis a long time after birth)**

- BCG vaccine at birth.
- Pharmacologic prophylaxis of the newborn by INH is not indicated.
- Newborn should not be separated from his mother with exception when the mother is too weak and not capable to take care of her baby. No isolation.
- Mother should maintain breastfeeding during the 6 months.
- Close surveillance in any case.
11. Infant Born from a DIABETIC MOTHER (IDM) or Large Babies for GA (LGA) (> the 90th percentile or > 4 000 g)

DEFINITION

Good control of maternal diabetes is a key factor in determining fetal outcome. When adequate control of diabetes has not been accomplished, possible complications might occur in newborns including hypoglycemia, hypocalcemia, hypomagnesemia, perinatal asphyxia, RDS, other respiratory illnesses (TTN...), hyperbilirubinemia, polycythemia, renal vein thrombosis, macrosomia, birth injuries, and congenital malformations. These complications should be recognized and treated.

CLINICAL FEATURES

- Macrosomia is the classic presentation of an infant of a diabetic mother (IDM) as result of biochemical events along the maternal hyperglycemia-fetal hyperinsulinemia pathway.
- Tremors, jitteriness, convulsions, apnoeas, weak cry and / or poor sucking are possible.
- Complications are minimal in gestational diabetes and in diabetes well controlled by diet.
- Mothers with complicated diabetes (renal, retinal, vascular or cardiac diseases) are more likely to have small for gestational age or premature infants, poor foetal outcomes, foetal distress, or foetal death.
- Specific disorders frequently encountered in IDMs:
  - Hypoglycaemia (extremely common), hypocalcemia and hypomagnesemia – Refer to this chapter.
  - Peri-natal asphyxia, birth related injury (brachial plexus injury, clavicle fracture…) – Refer to this chapter.
  - RDS – Refer to this chapter.
  - TTN – Refer to this chapter.
  - Hypertrophic cardiomyopathy occurs in up to 50% of IDMs secondary to increased fat and glycogen deposition in the myocardium and may lead to congestive heart failure.
  - Hyperbilirubinemia, polycythemia and hyperviscosity – Refer to this chapter.
Congenital malformations occur in 6.4% of IDMs that is a much higher incidence than in the general population. Poor diabetic control during the first semester of gestation is suspected to be associated with a higher percentage of congenital malformations. Congenital malformations in the developing world account for up to 10% of perinatal deaths (up to 50% in developed countries) and include cardiac, renal, gastro-intestinal tract, neurologic and skeletal defects, unusual facies, and microphthalmos.

**Recap morbidity in infants of diabetic mothers**

- Congenital anomalies
- Heart failure and septal hypertrophy of heart
- Hyperbilirubinemia
- Hypocalcemia
- Hypoglycemia
- Macrosomia
- Renal vein thrombosis
- Small left colon
- Unexplained intrauterine demise
- Polycythemia
- Visceromegaly

**SURVEILLANCE**

- The large for gestational age infant should have a complete physical examination performed within 2 hours of birth.
- LGA / Macrosomic infants should be assessed for brachial plexus injury, clavicle fracture, and other injuries related to birth.
- LGA / Macrosomic infants should be fed early to avoid hypoglycemia and glucose levels (dextro) should be monitored each time before feeding or if not feeding at least every 3 hours until blood glucose remains stable > 45 mg/dl at least 2 times successively. See Part IV – Chapter on hypoglycemia management if glucose < 45mg/dl.

**PROPHYLAXIS & TREATMENT**

- Pregnant diabetic mothers should be carefully followed in ANC in collaboration with the MD in charge of their diabetes.
- Mothers with diabetes not controlled only by diet are at major risk, particularly during the first semester of pregnancy.
- Delivery should be done in the hospital (II or III level of care).
- Upon delivery, the infant should be evaluated by the paediatrician or MD in charge of paediatrics including careful medical exam (with particular attention to heart, kidneys, lungs and extremities) + blood glucose level + haematocrit.
- Surveillance during the first hours for respiratory distress.
- Surveillance during the first 48 hours for signs of jaundice and cardiac, renal, neurologic, and gastro-intestinal tract abnormalities.
- Metabolic and cardio-respiratory management – (Treatment of Hypocalcemia - see part IV, chapter 21).
12. Summary table of CM for Diseases Transmitted from the Mother to her Child (DMTCT) – With exception of HIV

<table>
<thead>
<tr>
<th>Maternal diseases</th>
<th>Main symptoms in the newborn</th>
<th>Case management at birth – Key components</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mother with untreated vaginal discharge just before or at birth.</td>
<td>• Most often, no symptoms at birth.</td>
<td>• Treat all newborns with:</td>
</tr>
<tr>
<td></td>
<td>• High risk of purulent conjunctivitis at D2 to D5 with (chlamydiae) or without (gonococci) pneumonia.</td>
<td>• IM Ceftriaxone 50 mg/kg once (max 125 mg)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+/- (see indications chapter 1, part III of this guide)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• PO Erythromycin 25 mg/kg/12h x 14 days</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• PO Azithromycin 20 mg/kg/d (once daily) x 3 days.</td>
</tr>
<tr>
<td>• Mother with active genital Herpes (first time or recurrence) Virus Simplex (HVS) at birth.</td>
<td>• Normally no symptoms at birth.</td>
<td>For all newborns: Acyclovir ophthalmic ointment 3% at birth: 1 « small round piece » in each eye x 1.</td>
</tr>
<tr>
<td></td>
<td>• Skin vesicles to bullas (~ D10).</td>
<td>• Newborn at low risk (see criteria chapter 4, part III de of this guide): IV Acyclovir 20 mg/kg/8h (if BW &lt; 2000g or 35 SA 15 mg/kg/8h) x 10 days (no clinical symptoms; x 14 days (clinical symptoms without neurological lesions); x 21 days (neuro-encephalitic disease).</td>
</tr>
<tr>
<td></td>
<td>• Encephalitis (~ D15): Seizures, lethargy…</td>
<td>• Newborn at high risk (see criteria chapter 4, part III de of this guide): observation x 5 days + isolation of the mother with her child.</td>
</tr>
<tr>
<td>• Mother with active Hepatitis B or mother living in high endemic area (&gt; 8% but also all MSF fields) or mother HIV+.</td>
<td>• No symptoms at birth.</td>
<td>Like for HIV positive mother PTME should be done systematically.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>For anyone: vaccination against hepatitis B, dose 0 or 10 microgrammes IM at birth (monovalent vaccine), as soon as possible, in thes 12 first hours, maximum at D7.</td>
</tr>
<tr>
<td>• HIV positive mother without ART / PMTCT.</td>
<td>• Normally no symptoms at birth.</td>
<td>PMTCT / ART for the mother as soon as possible (see chapter 5, part III of this guide and/or the clinical or implementation guides MSF 2015, parts 1 &amp; 2).</td>
</tr>
<tr>
<td></td>
<td>• But mortality ~ 50% before 2 years old in the absence of treatment.</td>
<td>Protective breastfeeding &amp; EID (Early</td>
</tr>
<tr>
<td>Condition</td>
<td>Actions</td>
<td></td>
</tr>
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</tr>
<tr>
<td>Mother with active Tuberculosis, or TB treated less than 2 months, or mother diagnosed with positive TB just after birth.</td>
<td>Most often no symptoms at birth. If symptomatic baby at birth, he should be referred. No BCG at birth. INH oral 10 mg/kg (max 300 mg) once daily over 6 months (after elimination of active TB). BCG 2 weeks after stopping INH. Breastfeeding and maintenance of contact with the mother are possible in any cases.</td>
<td></td>
</tr>
<tr>
<td>Mother with confirmed malaria by RDT before or during partum, or with unexplained fever, or with unexplained anemia in malaria endemic area.</td>
<td>High risk of congenital malaria. Normally neonates are symptomatic with fever, poor suction, irritability, anemia, jaundice, convulsions, LBW… BUT none of these signs is specific and the first diagnosis is still bacterial neonatal infection. Newborns sometimes are asymptomatic at birth. In the absence of available lab (thin + thick blood smear) and if the mother has symptoms before or per partum and/or if any doubt in endemic areas treat systematically by IM Artesunate: 3 mg/kg at H0, H12 and H24 then 3 mg/kg/d x 6 days (see the tables in chapter 6, part III of this guideline). Symptomatic newborns should be referred to neonatal and/or pediatrics care unit.</td>
<td></td>
</tr>
<tr>
<td>Mother with active syphilis.</td>
<td>Stillbirth, prematurity… At birth, muco-cutaneous red rash, grey patches, blisters, bullous lesions, followed by peeling skin on palms and soles (epidermolysis). Others: HSM, jaundice, lymph nodes, anemia… Well treated mothers before delivery with asymptomatic newborn: IM Benzathine benzylpenicillin, 50’000 UI/kg x 1 single dose. Untreated or poorly treated mothers and symptomatic newborns of well treated mothers: IV Benzylpenicillin 50’000 IU/kg/12h x 7 days then 50’000 IU/kg/8h x 3 days or IM Benzylpenicillin procaine 50’000 IU/kg/day x 10 days. Breastfeeding is possible in all cases. Treat the mother (if it is not already done) and her partner(s): IM Benzathine benzylpenicillin, 2.4 million IU/person x 1/week x 3 weeks.</td>
<td></td>
</tr>
<tr>
<td>Mother with gestational or preexisting diabetes type I or II (IDM – Infant from Diabetic Mother) poorly adherent to</td>
<td>At birth, macrosomia (&gt; 4 kg), per natal asphyxia, per natal trauma, hypoglycemias, respiratory distress, jaundice. Breastfeeding as soon as possible (first 30 minutes) and frequent. If feasible glycemia before each meal or every 3 hours still normal level 2 times successively. Dextrose 10% 5 ml/kg x 1 or 2 orally or by O/NGT if suspected or confirmed</td>
<td></td>
</tr>
<tr>
<td>treatment and/or poorly treated.</td>
<td>hypoglycaemia or Dextrose 50% 1 ml/kg sublingual x 1 or 2 in case oral route or O/NGT is not possible.</td>
<td></td>
</tr>
</tbody>
</table>
PART IV

UNIT FOR SICK NEWBORNS
MAIN NEONATAL DISEASES
1. PERINATAL ASPHYXIA & HYPOXIC / ISCHEMIC ENCEPHALOPATHY (HIE)

1 – CASE MANAGEMENT of the NEWBORN with PERINATAL ASPHYXIA

- May be the result of a lack of Oxygen supply to organs before, during or immediately after birth. Initial treatment is effective resuscitation – Refer to the APLS algorithm – Advanced Paediatric Life Support – on resuscitation at birth.
- Think, assess and if appropriate treat neonatal infection – Refer to this chapter.
- Adapt fluids need: Decrease the fluid load to 50 ml/kg/day on DOL 1 and then increase by 10 ml/kg/day
- Problems in the days after birth:
  - Convulsions: Phenobarbital + Check Glucose.
  - Apnoea (common after severe asphyxia): Oxygen by nasal catheter + Bag & Mask ventilation with Oxygen.
  - Inability to suck: Feed with milk via a oro/nasogastric tube (O/NGT).
  - Poor motor tone: May be floppy or have limb stiffening (spasticity).
  - Hypocalcemia: Irritability (or muscle jerking), seizure, stridor, wheezing, vomiting. See part IV, 17.
- The severity defines the long-term outcomes / prognosis:
  - Grade 1: Irritable, with poor suck and abnormal tone (floppy or stiff). Hyper alert and staring eyes. 95% normal at follow-up.
  - Grade 2: Lethargic, hypotonic. 70% have seizures. NGT for feeding is required.
  - Grade 3: Hypertonic with seizures and reduced level of consciousness, requiring respiratory support / surveillance. Only 20% will have a normal development at follow-up, but 50% will die in neonatal period.
- Prognosis might also be predicted (a week after birth) by good recovery of motor function and sucking ability.

2 - PROGNOSIS of the NEWBORN with PERINATAL ASPHYXIA

- Prognosis: Can be predicted (a week after birth) by good recovery of motor function and sucking ability.
  - A baby who, a week after birth, is normally active and is sucking well will usually do well.
  - A baby who, a week after birth, is still floppy or spastic, unresponsive and cannot suck has a severe brain injury and will do poorly (cerebral palsy, epilepsy…).
  - A baby who, a week after birth, has recovered some motor function and is beginning to suck has a less grim prognosis.
• The situation should be sensitively discussed with parents throughout the time the baby is in the hospital.

• This prognosis can and should be better evaluated with SARNAT stages:

### SARNAT STAGES for post asphyxia encephalopathies

<table>
<thead>
<tr>
<th></th>
<th>Neurological signs</th>
<th>Neuro-vegetative signs</th>
<th>Pronosis: Risk for death or severe handicap</th>
</tr>
</thead>
<tbody>
<tr>
<td>SARNAT 1</td>
<td>Hyper alert, irritable, Hyperreactivity, Tremulousness, Presence of archaic reflexes, Duration of symptoms: &lt; 24 h</td>
<td>Sympathetic tonus, Tachycardia, Dilated pupils</td>
<td>Favourable</td>
</tr>
<tr>
<td>SARNAT 2</td>
<td>Lethargy or obtundation, Hypo reactivity, Hypotonia, Archaic reflexes partly present, Convulsions (70%), Duration of symptoms: 2 to 14 days</td>
<td>Parasympathetic tonus, Heart rate relatively low, Occasional apnoea, Pupils in myosis</td>
<td>Reserved</td>
</tr>
<tr>
<td>SARNAT 3</td>
<td>Stupor, coma, Unreactivity, Floppy infant, Absent archaic reflexes, Duration of symptoms: hours to weeks</td>
<td>Frequent multi-organic failure, Periodical breathing, Apnoea, Pupils in intermediate position, often asymmetrical, poorly reactive to the light</td>
<td>Critical</td>
</tr>
</tbody>
</table>

NB: A Sarnat 2 that is prolonged after 5 to 7 days has the same prognosis as a Sarnat 3.

<table>
<thead>
<tr>
<th>Affected system</th>
<th>Clinical signs</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central nervous system</td>
<td>Convulsions / apnoea / intracranial hypertension / intracranial haemorrhage / paralysis</td>
<td>Fluid restriction, Anticonvulsant drugs</td>
</tr>
<tr>
<td>Respiratory system</td>
<td>RDS / ARDS / apnoea / persistent lung hypertension / lung haemorrhage / broncho-inhalation of meconial amniotic fluid</td>
<td>Mechanical ventilation*, Correction of acidosis</td>
</tr>
<tr>
<td>Cardio-vascular system</td>
<td>Shock / low blood pressure / cardiomegaly / cardiac failure</td>
<td>Mechanical ventilation*, Fluid restriction, Diuretics, Inotropic drugs</td>
</tr>
</tbody>
</table>
* Not possible in MSF settings

For seizures, refer to the case management described in the following chapter “NEONATAL CONVULSIONS”.

3 – INTRACRANIAL BLEEDING / HAEMORRHAGE (IVeH)

- More common in premature and low birth weight babies.
- HIE is a serious risk factor.
- Most bleeds are asymptomatic. A significant number of normal babies will be found to have intracranial blood if a cranial Ultra Sound Scanner is performed. But some bleeds are associated with poor feeding, irritability and seizures.
- The long term outlook is dependent on the degree of bleeding. Large intra-ventricular haemorrhage can extend into white matter and the presence of subsequent clot might result in venous thrombosis, leading to parenchyma damage.
2. NEONATAL SEIZURES

1 – DEFINITION

Seizures occur more often in the neonatal period than at any other time of life; during this period, they most often occur within the first week of life. Seizure incidence varies with some specific risk factors. Occurrence increases with decreasing gestational age and birth weight, and with increasing acuity of illness.

2 – MAIN CAUSES

Common causes of neonatal seizures include:

- Hypoxic-ischemic encephalopathy (HIE) (perinatal asphyxia)
- Metabolic disturbances (hypoglycemia, hypocalcaemia, hyponatremia, inborn errors of metabolism)
- Infection (sepsis, meningitis, congenital malaria). Make a LP + Pastorex test.
- Intracranial hemorrhage

Less frequent causes of neonatal seizures include:

- Structural brain lesions
- Benign familial neonatal seizures or benign idiopathic neonatal seizures (exclusion diagnosis, good prognosis)
- Neonatal abstinence syndrome (abstinence from opiates taken by the mother)

3 – CLINICAL DIAGNOSIS

Suspected seizure activity needs to be closely examined. Jitteriness is sometimes confused with seizures. In a jittery infant, eye movements are normal. The hands will stop moving if they are grasped, and movements are of a fine nature. In an infant who is seizing, eye movements are often abnormal (e.g., staring, blinking, jerking movements, tonic eye deviation). The hands continue to move if grasped, and movements are of a coarser nature.

Newborns can exhibit both generalized and focal seizures. Generalized seizures present with bilateral and / or symmetric seizure activity while focal seizures often just involve one side of the body, face, or extremity or are traduced by an “absence” (short suspension of consciousness and / or activities).

Pay attention, repeated bruxism / chewing might be convulsions.

4 – IMMEDIATE CASE MANAGEMENT of NEONATE with SEIZURES

- There is a significant risk of respiratory depression when using multiple anticonvulsants. The infant should be treated in setting for sick newborns with permanent surveillance.
• Oxygen if needed (asphyxia, central cyanosis…) – Refer to this chapter, part VI.

• Check glycaemia and treat hypoglycaemia (< 45 mg/dl or 2.5 mmol/l) if needed – Refer to this chapter in part IV.

• Systematically check for neonatal sepsis. A lumbar puncture should be performed to confirm or exclude meningitis before or just after ATB if no culture is available. Any infant with a suspicion for sepsis / meningitis should be treated with IV antibiotics as soon as possible – Refer to the chapter “Neonatal Sepsis / Meningitis” in part IV.

• The infant should also systematically be tested for malaria with a RDT and a thin / thick blood smear – Refer to this chapter in part III.

• Phenobarbital loading dose in slow IV infusion: 20 mg/kg (dilute the required dose of phenobarbital in 5 ml of 0.9% sodium chloride and administer over 30 minutes). Never give phenobarbital as a rapid, undiluted direct IV injection. If intravenous access cannot be obtained, give the same dose of phenobarbital (undiluted) by IM injection.

• Be cautious when giving phenobarbital; there is a risk of respiratory depression: monitor the infant closely; have ventilation equipment at hand.

• If seizures persist at the end of the first dose of phenobarbital (after 30 minutes), give a second dose of phenobarbital (10 mg/kg) by slow IV infusion over 30 minutes as above. If IV access cannot be obtained, administer the second dose (10 mg/kg) of phenobarbital undiluted by IM injection 60 minutes minimum after the first IM dose.

• If, after 30 additional minutes, the infant continues having seizures:
  o IV phenytoin 20 mg/kg slowly given over 30 min x 1.
  o Give only phenytoin (do not use diazepam).
  o Mix the total dose of phenytoin with 5 ml of 0.9% NaCl (other solutions can crystalize the phenytoin). Give this mixture over 30 minutes.

• In case of persistent seizure despite 2 doses of phénobarbital and one dose of phenytoin:
  o Call the MD in charge.
  o Pyridoxine (Vit B6) oral 100 mg diluted in water (via Oro/Nasogastric tube).
  o Typical situation leading to deficiency: When a mother is under anti-TB treatment (INH) without Vit B6 supplementation. So in case of evident background, Pyridoxine could be administered earlier in the management course.
  o Treatment of Hypocalcemia – see part IV, chapter 17.

5 – SURVEILLANCE of the NEONATE with SEIZURES (CONVULSIONS)

• Monitor for recurrence of seizures (including both general and partial seizures).

• If seizures recur within 2 days: PO Phenobarbital 5 mg/kg (oral solution, or if not available, IV solution per mouth) once daily until the infant is free of seizures x 7 days.

• If the seizures are not controlled by the phenobarbital, give phenytoin by mouth (IV solution given PO) 2.5 mg/kg twice daily until the infant is free of seizures x 7 days.

• If seizures reappear after 2 days free of seizures: Repeat the initial management of the seizures by phenobarbital as described above and then complete treatment with PO phenobarbital 5 mg/kg daily until the infant is seizure free over 7 days.
Anticonvulsants

How to give Phenobarbital

- 200 mg/1ml - vial (200mg/ml) for IV infusion and deep IM injections in the absence of IV/IO access.
- DON’T GIVE IT RAPIDLY: can cause a respiratory distress.
- To give it in infusion: make a dilution of the necessary dose in a solution of 5 ml NaCl 0.9% or D5% and then give it over a minimum of 30 minutes.
- Don’t give more than 1 mg/kg/min.
- To give it IM:
  - Can be used without dilution (IM only).
  - If the necessary dose is < 1 ml, use a syringe with graduations of 0.1ml.
  - DON’T GIVE IT SC (risk of necrosis).
  - Can be responsible of a deterioration and/or DESTABILISATION of a pre existing respiratory distress.

How to give Phenytoin

- 50 mg/ml - vial of 5 ml - DON’T GIVE IT IM.
- Make a dilution of the necessary dose in a solution of 5 ml NaCl 0.9% - Don’t use Dextrose solutions → risk of precipitation in IV → increased risk of venous lesions including phlebitis.
- Give Phenytoin via IV infusion over 30 minutes and directly in a large vein.
- After each IV injection of phenytoin → 5 cc of NaCl in flush in the same IV in order to avoid veinous inflammation and phlebitis.
- Phenytoin was associated with Stevens-Johnson syndrome and toxic epidermitis necrosis → STOP if a rash / eruption appears.

- If an infant stop breathing because of the injection / use of anticonvulsants → START IMMEDIATELY AMBU BAG VENTILATION AND CONTINUE still the infant restarts breathing spontaneously.
- CALL the anaesthetist, the Paediatrician or any person experienced in manual ventilation with Ambu bag.
3. NEONATAL RESPIRATORY DISTRESS SYNDROME (RDS) – MANAGEMENT & MAIN ETIOLOGIES – NEONATAL APNOEAS

1 – INTRODUCTION

Case management of infant with respiration distress is one of the most common functions in neonatal medicine. The level of case management is related to the health staff’s skills and to the technical tools available but the optimal treatment is usually difficult to define.

This chapter describes the basic management of neonatal respiratory problems within MSF settings along with the main causes of Respiratory Distress Syndrome (RDS).

2 – CLINICAL ASSESSMENT OF SEVERITY AND OXYGENTHERAPY – See also the chapter 1 Oxygentherapy, part VII

- Clinical presentation
  Signs of respiratory distress syndrome (RDS) include:
  o Tachypnea with RR > 60/minutes
  o Nasal flaring
  o Expiratory grunting
  o Retraction of the chest wall (sternal, intercostal, sub-costal) or chest indrawing
  o Central cyanosis (visible when SpO2 is < 85%) (acrocyanosis is quite common after birth and it is not related to hypoxemia; difficult to be evaluated in case of anaemia)

  Abnormal respiratory sounds can also be associated:
  o Inspiratory stridor
  o Expiratory wheezing / Whistles
  o Various rales at auscultation
• HR (pulses) and SpO2 measurement by pulse oximeter
  o Re-calibration 1 x/day
  o Change the measurement site every 4-6 hours
  o The measure is poorly reliable in case of poor perfusion due to shock, acidosis or hypoxia and in case of oedema or anaemia.

The pulse oximeter is the best tool to guide oxygen therapy in children, regardless the age. Oxygen should be given to all neonates (at term and premature babies) with a saturation < 90% in room air.

An excessive or inappropriate use of oxygen (high oxygen flow rate or high oxygen saturation) can directly lead to pulmonary lesions and can be related to pre-term retinopathy.

When oxygen is being administered, the flow rate should be adjusted to provide the minimum flow of oxygen while maintaining the following saturations:
  o 90 to 95% in babies born at term (≥ 37 weeks of pregnancy).
  o 90 to 95% in preterm babies (< 37 weeks of pregnancy).

If the newborn’s SpO2 is > 95%, the flow has to be progressively reduced. Once the SpO2 is ≥ 95% in room air, oxygen can be stopped.

If an oximeter is not available, oxygen should be provided according to the following indications:
  o Persistent expiratory grunting
  o Severe chest indrawing
  o Central cyanosis

<table>
<thead>
<tr>
<th>Signs</th>
<th>Hypoxia</th>
<th>Hyperoxia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measures</td>
<td>SpO2 &lt; 85%</td>
<td>SpO2 &gt; 95%</td>
</tr>
<tr>
<td>Risks</td>
<td>Cerebral lesions, Hepatic, renal, intestinal lesions Increased mortality</td>
<td>Retinal lesions Pulmonary lesions Blindness</td>
</tr>
</tbody>
</table>

3 – MAIN CAUSES OF RESPIRATORY DISTRESS

• Acquired acute diseases of the lung parenchyma
• Transient tachypnea of the newborn (TTN) – See chapter 5 below, part IV
• Hyaline membrane disease (HMD) – See chapter 6 below, part IV
• Pneumonia or other respiratory infections, including staphylococcal infections – See chapter 10 below, part IV
• Meconium broncho-inhalation – See chapter 4, part II, «Neonatal resuscitation in practice»
• Persistent pulmonary hypertension
• Pulmonary oedema
• Pulmonary hemorrhage (more frequently, 5-7%, among neonates with a birth weight < 1500 g, in severe conditions or with respiratory distress, particularly HMD)
• Pleural effusion
• Pneumothorax

• Acquired sub-acute or chronic diseases of the lung parenchyma
  o Chronic respiratory failure of prematurity
  o Bronchopulmonary dysplasia (BPD) (neonatal form of chronic lung disease that follows a primary course of acute respiratory failure, especially among newborns < 1500g, defined as oxygen dependency for > 28 days after birth)
  o Wilson-Mikity syndrome (particular form of chronic respiratory failure related to rapid onset of pulmonary emphysema few days after birth)

• Congenital lung diseases
  o Congenital lobar emphysema
  o Pulmonary cystic malformation
  o Bronchogenic cyst
  o Cystic adenomatoid malformations (including several kind of cystic formations with different degree of severity)
  o Pulmonary sequestration (piece of intra or extra lobar abnormal tissue that is not vascularized by the normal pulmonary arterial blood supply but by a systemic artery)
  o Pulmonary arteriovenous fistula
  o Congenital pulmonary lymphangectasia
  o Pulmonary agenesis
  o Pulmonary hypoplasia

• Diaphragm and chest wall diseases
  o Congenital diaphragmatic hernia
  o Diaphragmatic paralysis
  o Sternal malformations
  o Thoracic malformations
  o Chest muscular disorders

• Upper respiratory tract diseases
  o Diseases of the nose, mouth and pharynx
    • Choanal atresia (congenital blockage of the posterior nares caused by persistence of a bony septum (90%) or a soft tissue membrane (10%)
    • Pierre Robin Syndrome (mandibular hypoplasia in association with cleft palate)
    • Macroglossia
    • Glossoptosis syndrome (falling back of the tongue) – Apnoea
    • Pharyngeal incoordination
  o Disease of the larynx
    • Laryngomalacia
    • Vocal cord paralysis
Sub-glottic stenosis
Laryngeal tumours

- Diseases of the trachea
  - Oesophageal atresia and tracheoesophageal fistula (several types)
  - Laryngo-tracheo-esophageal cleft (rare, no complete separation between oesophagus and trachea common pathway)
  - Tracheal agenesis
  - Congenital tracheal stenosis
  - Tracheobronchomalacia
  - Vascular rings around the trachea and/or oesophagus (congenital anomalies of the aortic arch)

- Acyanotic congenital heart disease with left → right shunt

  Mild forms are usually well tolerated and asymptomatic or pauci-symptomatic.

  In poorly tolerated or severe forms the passage of blood from the left to the right heart (from the higher pressures, the arterial system, to the lowest pressures, the pulmonary system) causes a pulmonary flood with risk of recurrent pulmonary overinfections, persistent respiratory distress, hypoxemia and secondarily arterial pulmonary hypertension with its serious consequences and/or right ventricular failure (RVF).

  - Large Atrial Septal Defect (ASD)
  - Large Ventricular Septal Defect (VSD)
  - Patent Ductus Arteriosus (PDA) (vessel connecting the main pulmonary trunk or proximal left pulmonary artery with the descending aorta). This vessel is essential in fetal life and in full-term healthy newborns functional closure of the ducus occurs rapidly after birth. Final functional closure occurs in almost half of full term infants by H24 of age, in 90% by H48 and in all by H96 after birth. This closure is more random in preterm and PDA risk increases at lower gestational age.

    Risk factors associated with PDA: prematurity, TTN, excess fluid intake during the first days of life, birth asphyxia, high altitude, some congenital heart defects (transposition of the great vessels, aortic coarctation, pulmonary atresia with intact ventricular septum, total abnormal pulmonary venous return) or some congenital malformation syndromes (congenital Rubella in 60-70% of cases ...).

    Factors associated with a decreased risk of PDA: Administration of corticosteroids before birth, IUGR, prolonged rupture of membranes.

  - Case management
    - Symptomatic treatment of the respiratory distress as reported above.
    - Adequate treatment of the respiratory infections.
    - Avoid hyper-hydration (for neonates/small babies: 120-130ml/kg/day of total fluid intake). If they have breathing problems or edema because of cardiac problems in acute situation, just give 100ml/kg/day
    - In case of right ventricular failure, consider treatment with spironolactone and hydrochlorothiazide in combination only if regular surveillance is feasible and try to refer to specialized partner (eg Terre des Hommes Lausanne and others) for surgical correction.
    - In case of PDA, but only for prematures during the first month of life, reduce fluid intake reasonably enough to avoid severe dehydration (about 2/3 of the normal amount – See part VI), consider red pack cells transfusion in case of anaemia (an increased haematocrit reduce the shunt left → right), consider IV ibuprofen (it is a cyclo-oxygenase inhibitor that can induce the closure of the ductus arteriosus – as effective as the indometacine and less side effect): initial dose 10 mg/kg IV over 15 minutes followed by 5 mg/kg at H24 after the first dose and 5 mg/kg at H48 after the first dose. Do not repeat the treatment.
Contraindication to ibuprofen: renal failure or shock, digestive or renal bleeding, or coagulation diseases, NEC, infections that are not under control and stabilized.

### 4 – MAIN CAUSES OF RECURRENT NEONATAL APNOEA

<table>
<thead>
<tr>
<th>Causes</th>
<th>Newborn at term</th>
<th>Premature newborn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolic</td>
<td>Hypoxia</td>
<td>Hypoxia</td>
</tr>
<tr>
<td></td>
<td>Hypoglycaemia</td>
<td>Hypoglycaemia</td>
</tr>
<tr>
<td>Infection</td>
<td>Septicaemia - Meningitis</td>
<td>Septicaemia – Meningitis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Necrotizing entero-colitis</td>
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<tr>
<td></td>
<td></td>
<td>Urinary infection</td>
</tr>
<tr>
<td>Circulation</td>
<td></td>
<td>Patent Ductus Arteriosus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anaemia</td>
</tr>
<tr>
<td>Digestive</td>
<td>Gastro-oesophageal reflux</td>
<td>Gastro-oesophageal reflux</td>
</tr>
<tr>
<td>Cerebral</td>
<td>Epilepsy</td>
<td>Intra ventricular haemorrhage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Periventricular leukomalacia</td>
</tr>
<tr>
<td>Others</td>
<td>Drug-related respiratory depression</td>
<td>Too high external temperature</td>
</tr>
<tr>
<td></td>
<td>Bronchial inhalation</td>
<td>Bronchial inhalation</td>
</tr>
<tr>
<td>Immaturity of respiratory</td>
<td><em>(Not existing in at term babies)</em></td>
<td>Apnoea of prematurity (diagnosed by ruling out the other possible causes)</td>
</tr>
<tr>
<td>control centres</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4. NEONATAL CYANOSIS

1 – INTRODUCTION

The management of a newborn with cyanosis is one of the most common conditions in neonatology. The level of management is related to the health staff’s skills and to the technical tools available, but the optimal treatment is usually difficult to define.

This chapter describes the basic cardio-circulatory management of the newborns (Case management of respiratory failure – See the previous chapter) within MSF settings along with the main causes of neonatal cyanosis.

2 – CLINICAL ASSESSMENT OF SEVERITY AND OXYGENTHERAPY – See also the chapter 1 Oxygentherapy, part VII

- Description of the problem:
  - Cyanosis appears clinically when more than 3 g/dl of haemoglobin is desaturated. Therefore, cyanosis depends on both haemoglobin level and SpO2.
  - Cyanosis appears earlier in newborns that are polycytic.
  - Cyanosis appears later or is absent in anaemic newborns.
  - Cyanosis can be due to severe cardiac failure, respiratory failure or to severe neurological troubles.

- Clinical management
  - Rule out acrocyanosis, quite common in newborns in the first 48 hours of life.
  - Look for respiratory distress and auscultate lungs – See previous chapter.
  - Look for a cardiac murmur, assess pulses on the four limbs and the CRT – A cardiac murmur associated with severe cyanosis in neonates strongly suggests a cyanogenic congenital
cardiopathy. However the absence of a murmur cannot rule out this diagnosis as less than 50% of newborns with congenital cardiac malformation have a murmur in the neonatal period.

- Cyanosis can be persistent (suggesting a cardiac or respiratory origin), intermittent (suggesting severe neurological problems, apnoea…), of sudden onset (possibly related to pneumothorax), or related to crying and breastfeeding (suggesting oesophago-tracheal congenital malformation or gastro-oesophageal reflux).
- A cyanosis localized at the upper or lower part of the body is always related to a severe cardio-circulatory problem with PDA.
- Assess the abdomen for: enlarged liver (RVF? pulmonary hyper-distension? Infection?…), flat abdomen (suggesting diaphragmatic hernia).
- Complete neurological assessment.
- Associate malformations or other problems…

Para-clinical management:

- Measure HR, pulse and SpO2 (using a pulse oximeter) – See previous chapter
  - Re-calibration 1 x/day
  - Change the measurement site every 4-6 hours
  - The measure is poorly reliable in case of bad perfusion due to shock, acidosis or hypoxia and in case of oedema or anaemia
  - Hyperoxia test: Measure SpO2 in room air and then after 10-20 minutes of hyperoxygenation at 100%. Usually in cyanogenic congenital cardiomyopathies, SpO2 do not increase significantly as it does in most of respiratory problems. Only in case of very severe respiratory problems, and particularly neonatal persistent arterial pulmonary hypertension, SpO2 might not improve either.

- Assess haemoglobin (haemocue) and glycaemia (dextro).
- Emergency thoracic trans-illumination to rule out a pneumothorax, if suspected.
- Chest X-Ray when feasible.
- Systematically consider and rule out infections and/or shock.

3 – MAIN CAUSES OF CYANOSIS

- Respiratory distress – See previous chapter

- Cyanogenic congenital cardiac malformation (most frequently)
  - Fallot Tetralogy (cyanosis can initially be mild or appear only episodically but it can also be very severe)
  - Transposition of the great vessels (aorta and pulmonary artery)
  - Atrioventricular canal defect (AVCD) (often associated with trisomy 21)
  - Persistent truncus arteriosus
  - Tricuspid atresia
  - Total abnormal pulmonary venous return
  - Hypoplastic left heart syndrome

If we have severe RDS and the saturation doesn’t go up with O2, it’s probably cardiac (and +/- hepatomegalie oedema).
Respiratory distress could be absent, mild or severe, cyanosis is severe and does not improve with O2, and survival often depends on the ductus arteriosus which allows the mixing of arterial and venous blood. Therefore it has not to be closed in any case.

**Some cardiac malformations can successfully be treated surgically** (Fallot tetralogy, Transposition of the great vessels, AVCD…) but surgery is not always feasible (hypoplastic left heart syndrome, tricuspid atresia …). In MSF settings it is recommended to provide psycho-social support to the family, palliative care if needed (consider treatment with spironolactone and hydrochlorothiazide in combination and 100-120ml/kg/day of fluid intake) and, when possible, to search for a surgical partnership with TDH-Lausanne (be aware that a Doppler ultrasound has to be performed before transfer to verify that the cardiopathy can be treated surgically and to rule out persistent arterial pulmonary hypertension).

- **Neonatal persistent arterial pulmonary hypertension (PAPH)**
- **Right heart failure (RHF)**

- **Severe central nervous system (CNS) or neuromuscular diseases**
  - Intra and/or periventricular haemorrhage – See related chapter
  - Meningitis – See related chapter
  - Convulsions – See related chapter
  - Early onset of severe congenital myopathies

- **Other causes**
  - Congenital methemoglobinemia (sometimes familiar, SpO2 within the normal limits)
  - Polycythaemia or blood hyper-viscosity syndrome (SpO2 within the normal limits)
  - Hypothermia – See related chapter
  - Hypoglycaemia – See related chapter
  - Severe infections / Neonatal meningitis / Shock – See related chapters
  - Pseudo-cyanosis
  - Respiratory depression due to maternal drugs (magnesium sulphate, narcotics…)
  - Upper respiratory airway obstruction – See previous chapter
5. TRANSIENT TACHYPNOEA OF THE NEWBORN (TTN)

1 – DEFINITION

The transient tachypnoea of the newborn (TTN) is a lung condition characterized by a pulmonary oedema due to a delay in the absorption and elimination of the foetal alveolar liquid. TTN is a frequent cause of respiratory distress immediately after birth. Despite being a transient and spontaneously improving condition, it has to be differentiated from other severe causes of neonatal respiratory distress. The diagnosis can be done after excluding other possible causes in a newborn in good general condition without signs of infection and/or maternal risks of infection.

2 – RISK FACTORS

- Prematurity
- Caesarean section (CS) (TTN is 3 times more frequent in babies born by CS than by natural delivery)
- Diabetic mother
- Asthmatic mother
- Hydramnios

3 – CLINICAL PRESENTATION

The diagnosis can be done after eliminating other possible causes of respiratory distresses (eg infections...).

TTN usually appears within 2 hours after birth. Tachypnoea (RR > 60/min) is the main clinical feature. Neonates can present cyanosis and increase respiratory effort, with nasal flaring, several degrees of chest indrawing, expiratory grunting. However isolated tachypnoea can be the only sign. The chest antero-posterior diameter can be increased (chest distension).

In affected infants, respiratory sounds are generally subnormal, without bronchi rales or crepitation. Symptoms usually persist for 12 to 24 or 48 hours and then spontaneously improve. Some of these neonates might need an oxygen therapy – See chapter I, part VII.

4 – CASE MANAGEMENT

- Given that TTN is a self-limiting condition, the management is usually symptomatic. Oxygen therapy is indicated to maintain SpO2 > 90%. The increasing respiratory effort and the RR > 60-80/min impair oral feeding; in this case O/NGT or IV infusion have to be provided until improvement.
• If tachypnoea persists for more than 12 hours or clinical conditions worsen (grunting, signs of shock...), antibiotic treatment should be started with IV Cefotaxime + IV Gentamycin to treat a bacterial pneumonia that can be possibly associated.

• Furosemide has no impact on this condition and it is not indicated.

• In severe forms NCPAP can be used if available and feasible – See related chapter, part VII.

• See below typical TTN chest X-ray (left, hyper-insufflation; right, severe hyper-insufflation with horizontal ribs and air bronchogram)
6. HYALINE MEMBRANE DISEASE (HMD)

1 – DEFINITION

Respiratory distress is a frequent condition in newborns, especially in premature babies. A major cause of respiratory distress that typically involves premature babies and is rare in full-term babies is the Hyaline membrane disease (HMD). HMD is due to a deficiency of the pulmonary surfactant (a tension-active film that covers the alveoli to avoid their collapse during expiration, it is mainly produced during the 3rd trimester of pregnancy).

2 - CLINICAL PRESENTATION

Clinical signs of the HMD are due to an impairment of the pulmonary function leading to hypoxemia. It usually appears at birth (development trouble with defect of the production of surfactant) and progressively worsens during the first 48 hours of life. In some cases, babies look healthy at birth and they develop respiratory distress and cyanosis within few hours of life. These babies can have a minimal quantity of surfactant that is consumed or altered and so, becomes inactive.

3 – MANAGEMENT

- In MSF settings, HMD treatment is mainly symptomatic.
- Oxygen should be provided according to needs.
- NCPAP is indicated if available and feasible – See related chapter, part VII.
- At this evolving stage, steroids are not recommended in newborns with HMD.
- In MSF settings a neonatal infection cannot be eliminated and treatment for sepsis should be started. Systematically consider antibiotics – See chapter 10 «septicaemia and neonatal meningitis», part IV.

4 – PREVENTION

- Antenatal treatment with steroids in case of pre-term delivery reduces the incidence of HMD along with intra-ventricular haemorrhage, NEC and septicaemia. Neonatal mortality in general is reduced about 50%.
- Steroids should be given to pregnant women at risk of premature delivery between 24 and 34 weeks of pregnancy.
- HMD prevention: betamethasone IM 12 mg the first dose, repeated after 24 hours (total = 2 doses). If betamethasone is not available, dexamethasone IM 6 mg every 12 hours for 2 days (total = 4 doses).
See below chest X-ray 1, 2 and 3: HMD with increasing degree of severity I, II, III and IV
### RESPIRATORY DISTRESSES – SUMMARY TABLE
Including X-Ray and TREATMENT

<table>
<thead>
<tr>
<th>Risk factors / Clinical signs</th>
<th>SpO2</th>
<th>Chest X-ray</th>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prematurity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Progressive RDS after birth</td>
<td>↓ -</td>
<td>Bell shaped chest</td>
<td>HMD</td>
<td>O2</td>
</tr>
<tr>
<td>Severe chest indrawing</td>
<td>↓↓</td>
<td>Diffused ground glass infiltrates</td>
<td></td>
<td>IV D10%</td>
</tr>
<tr>
<td>Often, expiratory grunting</td>
<td>↓↓↓</td>
<td>Air bronchogram</td>
<td></td>
<td>Prevention: antenatal steroids</td>
</tr>
<tr>
<td>Prematurity (or at term)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elective caesarean section</td>
<td>Normal or ↓</td>
<td>Hyperinflation</td>
<td>TTN</td>
<td>O2</td>
</tr>
<tr>
<td>Late cord clamping</td>
<td></td>
<td>Peri-hilar vascular surcharge</td>
<td></td>
<td>IV D10%</td>
</tr>
<tr>
<td>Moderate RDS, mainly</td>
<td></td>
<td>Signs of pulmonary oedema</td>
<td></td>
<td>with moderate fluid restriction (40-60 ml/kg/d)</td>
</tr>
<tr>
<td>associated to tachypnea that</td>
<td>Normal or ↓ -</td>
<td>Mild pleural effusion</td>
<td></td>
<td>Observation</td>
</tr>
<tr>
<td>can be severe (&gt; 100/min)</td>
<td>↓↓↓</td>
<td>Cardiomegaly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>within the first 4 hours of life</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prematurity or at term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious risk</td>
<td>Normal or ↓</td>
<td>Not specific infiltrates (localized or diffused)</td>
<td>Pneumonia</td>
<td>O2</td>
</tr>
<tr>
<td>Moderate or severe RDS</td>
<td></td>
<td></td>
<td></td>
<td>IV Ampicillin / Gentamycin</td>
</tr>
<tr>
<td>appearing within few days</td>
<td>Normal or ↓ -</td>
<td></td>
<td></td>
<td>IV D10%</td>
</tr>
<tr>
<td>after birth or apnoea</td>
<td>↓↓↓</td>
<td></td>
<td></td>
<td>Observation</td>
</tr>
<tr>
<td>General signs of infection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prematurity or at term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate RDS since birth</td>
<td>Normal or ↓</td>
<td>Localized infiltration, usually basal, uni or bilateral</td>
<td>Broncho inhalation of clear amniotic fluid</td>
<td>O2</td>
</tr>
<tr>
<td>Hyper-expanded chest</td>
<td></td>
<td></td>
<td></td>
<td>IV D10%</td>
</tr>
<tr>
<td>Babies at term, foetal distress</td>
<td>↓ -</td>
<td>Not homogeneous infiltrates (diffused, patchy, with hyper-clear areas)</td>
<td>Broncho inhalation of meconium stained fluid</td>
<td>O2 ++</td>
</tr>
<tr>
<td>Meconium staining</td>
<td>↓↓ -</td>
<td>Hyper-inflation</td>
<td></td>
<td>IV D10%</td>
</tr>
<tr>
<td>Progressive RDS since birth</td>
<td></td>
<td></td>
<td></td>
<td>ATB (IV Ampicilline / Gentamycine)</td>
</tr>
<tr>
<td>Severe RDS with expiratory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>grunting and cyanosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyper-expanded chest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crackles and ronchi</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prematurity or at term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>With or without underling</td>
<td>Normal or ↓ -</td>
<td>Pneumothorax ± pneumomediastinum</td>
<td>Pneumothorax</td>
<td>O2 100% for 4 hours (no in prematures!)</td>
</tr>
<tr>
<td>pulmonary disease</td>
<td>↓↓↓</td>
<td></td>
<td></td>
<td>Thoracic drainage if needed</td>
</tr>
<tr>
<td>RDS since birth or later</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thoracic asymmetry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prematurity or at term</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sudden RDS, sometimes severe</td>
<td>↓↓ -</td>
<td>Intestinal loops (± stomach) visible in the thorax</td>
<td>Diaphragmatic hernia</td>
<td>O2</td>
</tr>
<tr>
<td>with cyanosis</td>
<td></td>
<td>Heart and mediastinum displaced on the other side</td>
<td></td>
<td>Do not ventilate with Ambu bag!</td>
</tr>
<tr>
<td>Asymmetric lung murmur</td>
<td></td>
<td>Lung hypoplasia</td>
<td></td>
<td>OGT and air aspiration</td>
</tr>
<tr>
<td>Heart sounds displaced on the side opposite to the hernia</td>
<td></td>
<td>Follow the direction of the O/NGT</td>
<td></td>
<td>IV D10%</td>
</tr>
<tr>
<td>Flat / hollow abdomen</td>
<td></td>
<td></td>
<td></td>
<td>Palliative care</td>
</tr>
</tbody>
</table>
CASE MANAGEMENT of SEVERE DEHYDRATION AND NEONATAL SIMPLE HYPOVOLEMIC SHOCKS

- **Case management of diarrhea without dehydration or shock.**
  Dextrose 10% between each breastfeeding / alternate solution to compensate watery stools stools (10 ml/kg for each important watery stool).

- **Case management of diarrhea with mild / moderate dehydration (no shock).**
  Exceptionally in case of severe diarrhea leading to dehydration despite an optimal maternal milk intake give low osmolarity ORS for enteral rehydration and in addition compensate important watery stools with Dextrose 10% (10 ml/kg for each important watery stool).

- **Case management of diarrhea with severe dehydration and shock** – *Refer to this chapter below.*
  In case there are signs of severe dehydration (lethargy, poor consciousness, weight loss, dry mucosis, sunken eyes, depressed fontanel, tachycardia, weak or absent peripheral pulses, cold extremities, CRT > 3 seconds, no urine):
  1. Bolus of NaCl 0.9% (or RL) 10ml/kg en IVL (20 min) x 1, 2 ou 3 according to clinical vital values.
  2. NaCl 0.9% en IV 100ml/kg/d (if enteral feeding is possible) or mixed solution of NaCl 0.9% 100ml/kg/d + D10% 100 ml/kg/d (if enteral feeding is not possible) to be adapted to the age of the infant, to the degree of dehydration and/or to the various probable losses and, to thereafter to the possibilities of enteral feeding.

INTRODUCTION & DEFINITION of shock

- Shock is an acute, dramatic syndrome, characterized by inadequate circulatory provision of oxygen comparing with needs.
- Insufficient oxygen is available to support aerobic cellular metabolism. There is a shift to less efficient anaerobic metabolism, which leads to lactic acidosis.
- The brain has no capacity for anaerobic metabolism and can be severely affected during periods of poor oxygen supply.
- Shock is a progressive / dynamic process. Initially shock may be compensated, but may progress to an uncompensated condition, which requires greater interventions to respond to therapy.
- Untreated or poorly treated shock will lead to irreversible tissue injury (irreversible shock) – multiple organ dysfunction / failure (MOF) syndrome and death.
- The mortality rate for shock in neonates has decreased as a consequence of educational efforts (APLS), which emphasize on early recognition, rapid transfer of these critically ill infants to a Neonatal Care Unit (NCU) for rapid and adequate intervention.
### CLASSIFICATION & CAUSES of shocks in Paediatrics


<table>
<thead>
<tr>
<th>Type of Shock</th>
<th>Main Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypovolemic shock</strong></td>
<td>Haemorrhage (at birth: maternal haemorrhage…)&lt;br&gt;Dehydration (vomiting, diarrhoea, insufficient intake)&lt;br&gt;Intensive sudation (young infants); Extensive burns</td>
</tr>
<tr>
<td><strong>Distributive shock</strong></td>
<td>Septic shock (sepsis)&lt;br&gt;Anaphylactic shock (allergy)&lt;br&gt;Third fluid sector (NEC…)</td>
</tr>
<tr>
<td><strong>Cardiogenic shock</strong></td>
<td>Myocardial failure (long hypoxia such as decompensate shock or post – prolonged resuscitation; toixinic in septic shock – bacterial toxin – or after traditinal / accidental drug intoxication; fluid overload due to poor evaluation or surveillance…)&lt;br&gt;Congenital heart malformations&lt;br&gt;Cardiac arrhythmias&lt;br&gt;Primitive or secondary cardiomyopathies, myocarditis, mainly of viral origin</td>
</tr>
<tr>
<td><strong>Obstructive shock</strong></td>
<td>Tension pneumothorax&lt;br&gt;Congenital heart malformations&lt;br&gt;Cardiac tamponade (pericarditis)</td>
</tr>
</tbody>
</table>

### PRACTICAL STEPS for case management of shock in Neonatology

- **For any children the first step** is to early recognize a shock (better chance for survival).
- **The second step** is to try to confirm that it is really a hypovolemic or a septic shock (> 95% of shocks in children) in order to manage it adequately. Making the difference between hypovolemic and septic shocks in MSF contexts, only on the base of clinical signs (bacterial diagnosis is not feasible) is not possible.
- **The third step** in the hypovolemic or septic shocks is to restore as soon as possible a good perfusion to vital organs (i.e. brain, heart, kidneys) in order to eliminate the debt in oxygen linked with the shock and so, to decrease the subsequent risk of Multiple Organ Failure (MOF), major cause of irreversible shock and death after a couple of days among these children.
- **The fourth step** is to implement a good surveillance of vital signs based on Heart Rate (HR), Respiratory Rate (RR), Capillary Refill Time (CRT – Norm < 3 seconds) and Neurological Status (NS), every 15 minutes during bolus infusions, then every hours after bolus infusions (during 6 hours) – *Thanks to refer to the table with the norms of vital values according to age in neonates.*
- **The ultimate step** is to replace IV rehydration by progressive gastric feeding as soon as possible based on vital and digestive surveillance in order to restore physiological processes (the major risk after digestive hypoperfusion and so, digestive suffering is paralytic ileus with severe abdominal distension).

### CRITERIA FOR DIAGNOSIS of neonatal hypovolemic and septic shock
- *See normal and abnormal vital values in the paragraph on surveillance*
Early or Compensate Shock

The presence of the 3 criteria listed below = Early or Compensate Shock so should be managed as such

- Increased HR or tachycardia (according to age and temperature)
- Capillary Refill Time > 2 seconds
- Cold extremities (hands and feet) or temperature gradient from extremities to trunk (to be researched passing the back of the hand on the extremities, the limbs and then the trunk)

Late or Decompensate Shock

The 3 criteria listed above in early shock should be present:

- Increased HR or tachycardia (according to age and temperature) but it can be replace at the late stage by a bradycardia
- Capillary Refill Time > 2 seconds
- Cold extremities (hands and feet) or temperature gradient from extremities to trunk (to be researched passing the back of the hand on the extremities, the limbs and then the trunk)

+ 2 criteria among those listed below

- Weak and difficult to detect (equivalence of low Blood Pressure) or absent (no BP) pulses
- Drop of consciousness (brain hypoperfusion and hypoxoxygenation)
- Increased and sweeping RR (according to age and to a possible associate lung disease) (kussmaül dyspnea due to metabolic acidosis)
- Drop of urine output or anuria (kidney hypoperfusion)

CRITERIA FOR DIAGNOSIS of neonatal cardiogenic shock - See normal and abnormal vital values in the paragraph on surveillance

Cardiogenic shoks (myocardial disease and failure)

The 3 criteria listed below should be present:

- Increased HR or tachycardia (according to age and temperature) but it can be replace by a bradycardia
- Capillary Refill Time > 2 seconds
- Cold extremities (hands and feet) or temperature gradient from extremities to trunk (to be researched passing the back of the hand on the extremities, the limbs and then the trunk)

+/- 1 or several criteria among those listed below:

- Weak and difficult to detect (equivalence of low Blood Pressure) or absent (no BP) pulses
- Drop of consciousness (brain hypoperfusion and hypoxoxygenation)
- Increased and sweeping RR (according to age and to a possible associate lung disease) (kussmaül dyspnea due to metabolic acidosis)
- Drop of urine output or anuria (kidney hypoperfusion)

+ At least one (often more) of the following criteria that are very suggestive:

- Recently enlarged tender liver (the size of the liver should be drawn on the skin at the admission / during the first clinical exam)
SURVEILLANCE of neonatal shocks

- Evaluation and surveillance of neonatal shocks are based on the assessment and regular analysis of vital values:
  - Emergency phase or phase of clinical unstability (variable duration from < 1 hour to several hours) = Phase where rapid infusions or bolus are done: vital values any 15 minutes.
  - Immediate post-emergency phase or maintenance phase = Transitional medical phase between clinical unstability and consolidation, risk of recurrency or worsening process (variable duration from several hours to 24 – 48 hours): vital values any 6 hours.
  - Consolidation phase or medical convalescence: The neonate is well stabilized and his nutritional issue becomes the first priority; go back to the usual surveillance.

- Surveillance of vital values:
  - HR (Heart Rate according to age and body temperature) & Pulses (weak or not)
  - RR (Respiratory Rate according to age)
  - CRT (Capillary Refill Time) normally < 3 seconds
  - Extremities (temperature, colour and gradient)
  - NS (Neurological Status) – AVPU Score in the context of vital emergencies
  - Changes in the size of the liver and/or jugular veins

- Note that weight is not a criterion for diagnosis and/or surveillance. It is not reliable and in the context of vital emergencies, it is loss of time and the way and / or time to take it might be a cause of deterioration for the child. You should have a reference weight but not more at the emergency ou unstable phase.

- Note that urine output is not a reliable criterion for diagnosis and/or surveillance in the contexts MSF is working. Nevertheless it is important to verify there is urine after the unstable phase before going to maintenance. Just ask to the mother and look at the bed.

- Any abnormalities – Refer to the table below should be reported on the surveillance sheet / form and to the MD in charge for further action.

Normal and abnormal vital values in neonates (criteria for emergency management and transfer) from birth to 2 months

<table>
<thead>
<tr>
<th></th>
<th>Bradycardia ⇒ Transfer</th>
<th>Norm</th>
<th>Tachycardia ⇒ Transfer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Rate (HR)</td>
<td>&lt; 100</td>
<td>110 - 160</td>
<td>&gt; 180</td>
</tr>
<tr>
<td></td>
<td>Brapdypnea ⇒ Transfer</td>
<td>Norm</td>
<td>Tachypnea ⇒ Transfer</td>
</tr>
</tbody>
</table>
ALGORITHM FOR CASE MANAGEMENT of neonatal shocks

In remote, poorly medicalized and poorly trained settings or in not installed programs working in difficult conditions, only the algorithm for early shocks (hypovolemic and/or septic shocks at the early / compensate phase should be used and this applies even for neonates seen at the late or decompensate phase.
General principles for therapeutic case management of neonatal hypovolemic and septic shocks – Refer to the algorithm below

1. Ensure free airways and adequate position of head and neck (neither flexion, nor hyper extension of the neck) and stop bleeding if it applies.
2. Weight the baby as rapidly as possible (if it was not done before).
3. Install in NCU / Unit for sick newborns and try to keep the place as calm as possible.
4. Nasal oxygen (nasal prong for newborns or preterm babies – Refer to this chapter in part VII, technical procedure).
5. Nothing orally and empty stomach (absolute priority during the first or unstable phase to avoid bronchial inhalation).
6. Set-up a peripheral venous access (or IO if needed 18/19G < 5 kg – Refer to this chapter in part VII, technical procedure).
7. Control Glycemia and treat accordingly. In case a control is not possible 2 ml/kg IV D10% systematically x 1 or 2 according to the level of consciousness before starting rapid / bolus infusions.
8. Once the child’s airway, breathing, circulatory access, and dextrose are stabilized, treatment specific to shock can be initiated = Rapid volemic expansion: Normal Saline (NS) is preferable (Ringer Lactate (RL) if NS is not available) 10 ml/kg over 30 minutes to be renewed x 1, 2 or 3 times at the maximum (same solute, same quantity) if necessary (persistent abnormal vital values – Refer to the above paragraph on surveillance).
9. Note that early and adequate treatment of hypovolemic shocks in neonates allows 96% survival (Nelson 2007 & Huault 2010). Most of the neonates stabilize after 1 or 2 bolus infusions. Severe diarrheal diseases can need more bolus. Fluid management is the same at any age but the small global circulatory volume of the youngest (80 ml/kg = total circulatory volume) requires a meticulous prudence, smaller quantities and increased surveillance of vital values.
10. If hemorrhagic shock, consider total blood: 10 ml/kg over 30 minutes to be renewed one time if necessary (persistent abnormal vital values – refer to the above paragraph on surveillance).
11. In any cases, after the initial rapid volemic expansion, discuss a possible transfusion with concentrated / sedimented red cells according to the level of hemoglobin. Correct anemia if Hb < 10 g/dl: 10-15 ml/kg of concentrate / sedimented red cells over 60 to 120 minutes. Note that if there is initially anaemia < 10g/dl in a neonate with shock, a blood transfusion can be considered before the first bolus if blood is immediately available in optimal conditions.
12. IV Furosemide is not recommended on a systematic manner before or during transfusion.
13. Slow IV Calcium Gluconate (vial of 10 ml at 10%) 0.5 ml/kg over 10 minutes systematically only if a transfusion was done.
14. IV Antibiotics: In MSF settings making a difference between hypovolemic and septic shocks is generally not possible. So, any neonates with shock should receive broad spectrum IV antibiotics as soon as possible according to the recommendations in chapters 9, 10 and 11 further in this same part IV. One exception for severe dehydration with shock without risk factors, history for sepsis or other alarming clinical signs and with rapid recovery after rehydration – Refer to the first paragraph of this chapter.
15. RDT malaria and Thin / Thick blood smear +/- IV Artesunate according to the neonatal malaria protocol – Refer to this chapter in part III.
16. Surveillance based on vital values, clinical examination and pulse oxymeter (SpO2).
17. One time shock is corrected, *refer to the chapter “Management of feeding / infusions in neonates”, part VI*. Do not feed immediately after a shock because of the intestinal suffering due to severe vasoconstriction, particularly in very severe and/or late diagnosed shocks.

**General principles for therapeutic case management of cardiogenic shocks in newborns and also shocks diagnosed at the late / decompensate stage in ELBW babies (< 1 000 g) and/or newborns less than 24 hours**

1. In these situations according to the contexts MSF is working (remote and poor settings, lack of well trained staff, lack of closed reference hospital capable to cope with such situations…), the severity of possible causal diseases, the usual very poor prognosis (high risk of rapid brain damage and heavy sequels, absence of possible heart surgery…), we strongly recommend to call the more qualified MD or a paediatrician in order:

2. To confirm the diagnosis

3. To rapidly organize a small brainstorming on the newborn file with the MDs and thereafter with the complete medical team for transmission of the information and potential consensus or team adhesion on the best way to manage including palliative care (“make the baby “comfortable”).

4. To discuss palliative care including pain management.

5. To discuss psycho-social support to the family.

6. To delegate the MD or a responsible to inform the parents….

7. Etc…

**BLOOD VOLUME ACCORDING TO AGE**

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>Blood Volume (ML/KG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEONATES</td>
<td>85 - 90</td>
</tr>
<tr>
<td>CHILDREN</td>
<td>80</td>
</tr>
<tr>
<td>ADULTS</td>
<td>70</td>
</tr>
</tbody>
</table>

20 ml/kg = ¼ of the total circulating volume in children that is the reason why we cannot prescribe initially bigger volumes
**Hypovolemic and septic shocks in neonates**

**ACTIONS**
- Weigh the infant
- Give oxygen (if available) + SpO2
- Check glycaemia and/or systematically give IV D10% 2 ml/kg x 1 or 2
- 1st injection IV Ampi (or IV Cefotaxime) + IV Genta *(see tables on ATB: indications, dosages, duration of ttt)* during or just after the 1st bolus
- Thin / Thick blood smear +/- IV Artesunate +/- Hb
- IV or IO NS (Normal Saline = NaCl 0.9%)
  - or (if NS not available)
    - RL (Ringer Lactate)
  - 10 ml/kg over 30 minutes
- Check HR, RR, CRT, Extremities, Neurological Status (NS)

**SURVEILLANCE**
- Every 15mn during bolus infusions, every hour after bolus infusions (for 6 hours):
  - HR (Heart Rate)
  - RR (Respiratory Rate)
  - CRT (Capillary Refill Time)
  - Extremities (temperature)
  - NS (Neurological Status)
  - Weigh the infant
  - Check urine output after the resuscitation phase

**Clinical normalisation**
- Decrease and normalisation of HR
- CRT < 3 seconds
- Normal RR (or other cause)
- Normal NS

**Improvement without reaching the norm**
- Discuss the indication for a transfusion: Hb ≤ 10 g/dl
- Calcium gluconate 0.5 ml/kg x 1 *(Only if a transfusion was done)*
- Repeat the administration of NS / RL 10 ml/kg over 30 minutes
- Check HR, RR, CRT, Extremities, Neurological Status (NS)

**Deterioration =**
- HR, RR, CRT, NS are worsening or
- Signs of myocardial failure (prolonged oxygen debt with myocardial lesions, primitive cardiopathy or fluid overload)

**Worst vital values**
- Bradycardia
- HR
- CRT >>> 2 seconds
- Weak pulses
- Abnormal NS
- Generalized haemorrhagic signs

**Myocardial failure**
- Liver
- HJ turgor
- HJ reflux
- Gallop rhythm
- Basal recent fine symmetric rales or disseminate crackles

**Clinical normalisation**
- Decrease and normalisation of HR
- CRT < 3 seconds
- Normal RR (or other cause)
- Normal NS

**Improvement without reaching the norm**
- Repeat the administration of NS / RL 10 ml/kg over 30 minutes
- Check HR, RR, CRT, Extremities, Neurological Status (NS)

**No Bicars in Néonat**

**Call a MD**
Discuss adrenaline infusion versus the end of the resuscitation and palliative care + Psycho-social support to the family

Repeat the administration of NS / RL 10 ml/kg over 30 minutes

Discuss the indication for a transfusion: Hb ≤ 10 g/dl

Calcium gluconate 0.5 ml/kg x 1 *(Only if a transfusion was done)*

Check HR, RR, CRT, Extremities, Neurological Status (NS)
8. BLOOD TRANSFUSION IN NEONATOLOGY

**Definition of anemia**
- Hematocrit (Hct) or [Hemoglobin (Hb)] < - 2 DS comparing with the mean for age
- Consequences of anemia
  - of the oxygen delivered to tissues (depending also of many other factors)
  - At term neonates, anemia if Hct < 45%
    - 0 – 48h Hb : < 16g/100ml
    - 3rd – 7th day Hb : < 14g/100ml
    - > 7 days Hb : < 10g/100ml

**Hemorrhagic anemia**
- Loss of placental integrity: Abruptio P., P. Previa, traumatic amniocentesis
- Abnormalities of the umbilical cord (velamentous insertion & Benckiser syndrome, hematoma) or placental vessels
- Fetomaternal hemorrhage (8% of normal pregnancies)
- Twin-twin transfusion (monochorial p. / monozygotic multiple births); Enclosed hemorrhage (caput succedaneum, cephalhematoma, subgaleal 2.5%, HIV, visceral…); Hemangioma (Kasabach-Merritt syndrome)
- Failure of placental transfusion (loss 25 to 30 ml); Iatrogenic blood losses (number of blood sampling in LBW)...

**Hemolytic anemia**
- Non immune hemolysis
  - Bacterial sepsis
  - Congenital TORCH
  - Other infections (malaria, parvovirus B19…)
  - Medicine / drugs / intoxications
- Immune hemolysis
  - Rh incompatibility
  - ABO incompatibility
  - Minor blood groups incompatibility (Kell, Kidd, Duffy, Lewis…)
  - Others (congenital erythrocyte defect…)

**Hypoplastic anemia - Physiologic anemia of the prematurity**
- Variable symptoms according to age, birth weight and severity of anemia
- After 15 days of life but generally around 3 – 6 weeks; more important in LBW / VLBW / ELBW
- Conjunctivae pallor
- Failure to gain weight / thrive
- Apnea with bradycardia
- No appetite and poor suction
- Tachycardia & Tachypnea
- Hypotonia

1 – INDICATIONS FOR BLOOD TRANSFUSION IN NEONATES
- Hb ≤ 7 g/dl +/- signs of poor tolerance (apnea, bradycardia…) (vital prognosis is engaged) in the absence of associated disease.
- 7 > Hb ≤ 10 g/dl in case of existing associated disease (i.e. Hypovolemic or septic shock, NEC, severe LRTI or RDS, HMD).
- 9 > Hb ≤ 12 g/dl in case of cyanotic congenital cardiopathy and only in these cases.
2 – CHOICE OF THE BLOOD GROUP TO BE TRANSFUSED IN NEONATES (BEFORE 2 MONTHS)

ABO GROUP ⇒ always give blood from the same ABO group than the group of the neonate.

RHESUS GROUP ⇒ take into account the Rhesus group of the mother and of the neonate according to the table below:

<table>
<thead>
<tr>
<th>RHESUS of the Neonate</th>
<th>ABO Group of the Neonate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative (RHd)</td>
<td>O</td>
</tr>
<tr>
<td>Positive (RHD)</td>
<td>A</td>
</tr>
<tr>
<td>Positive (RHD)</td>
<td>B</td>
</tr>
<tr>
<td>Positive (RHD)</td>
<td>AB</td>
</tr>
</tbody>
</table>

Attention: doing a blood transfusion with whole blood or sedimented whole blood, there is not universal donor.

In MSF contexts, recommendations are the same as for whole or « concentrated red cells » (prepared by the blood bank or via sedimentation by suspension of the blood bag because this concentrated bag is not optimal (persistent maternal antibodies).

Explanation: doing a whole blood or sedimented whole blood transfusion in MSF contexts, you should not take into account the ABO group of the mother but only the ABO group of the baby because the risk due to transfuse antibodies is more important than the risk due to maternal antibodies already present in the blood of the neonate.

On the other side, managing bags of true concentrated red cells (non applicable in current MSF contexts), it is better to also take into account ABO maternal group.

According to the Rh group make the transfusion with the same Rh group than for the neonate (+ Rhesus/RHD or – Rhesus/RHd) except if the mother is negative Rh (RHd). In this case, transfuse negative Rh (RHd) to the neonate disregarding his own Rh group, positive (RHD) or negative rhesus (RHd).

Situation is very different when you manage ABO or Rh group. Maternal Rh antibodies are not present at birth (they are not natural). On the other side anti-A or anti-B antibodies are natural (they are present in all individuals who don’t have the correspondent antigen). So it is rare and not natural for a negative Rh (RHd) donor to have anti-D antibodies.

Practically, during the neonatal period (< 2 months), in front of a negative Rh mother and a positive Rh neonate, you should consider the possibility to have immune anti-D in the mother (previous immunization for example due to the passage of red cells from a precedent foetus to the mother). So it is better to give negative Rh blood from a donor (not the blood of the mother) to
avoid a possible transfusional accident. Probability for a negative Rh donor to have anti-D antibodies is low, specifically for male donors (no previous pregnancy).

Try giving blood from the same donor (politics of the unique donor) when several blood transfusions are necessary for the same neonate.

3 – BLOOD TRANSFUSION SHOULD BE DONE AFTER TRANSFER IN A UNIT FOR SICK NEWBORNS OR IN PEDIATRICS

1. Blood transfusion 10-15 ml/kg over 3 hours (ideally packed red blood cells obtained after sedimentation of the red cells by simple suspension of the blood bag in the refrigerator).

2. Among children 3 ml/kg of concentrated red cells are necessary to increase Hb level of 1 g/dl.

3. When there is a bad tolerance to severe anemia, start transfusion with a very rapid flow over the first 30 minutes and then, as soon as vital distress is decreasing, come back to the normal transfusion flow.

4. It is not necessary to warm up the pockets since the transfused quantities are always small (WHO “The clinical use of blood”, 2002, p.120-121).

5. Furosemide: 0.5 to 1 mg/kg IV (at the start of the transfusion) to be discussed according to clinical exam but it is never systematically indicated particularly if red cells are well prepared by sedimentation and so, a minimal quantity of plasma is transfused.

6. Systematic treatment with Artesunate IV or orally (depending on the existence and severity of signs of vital distress, the associated pathologies etc.) from the day of the transfusion (see dosages in the chapter on “Congenital / Neonatal Malaria”).

7. Surveillance of blood transfusion:
   - Continuous surveillance during the first 30 minutes when it is necessary.
   - Transfusion flow rate (every 15 minutes) and estimation of the quantity of blood received.
   - Monitor the respiratory and cardiac frequency (every 15 minutes for 1 hour, then every hour until the transfusion is over, then every 3 hours for 24 hours), liver size, colour and warmth of extremities, CRT, apparition of oedema, temperature, and auscultation. Document them on the transfusion form.

8. Transfusion security rules:
   - Systematically: Respect the cold chain, blood group tests, VIH testing, hepatitis B and C tests, Syphilis test, RDT malaria. No transfusion is authorized if one of the tests is missing.
   - The syphilis and RDT malaria tests are optional in the event of a vital emergency but in this case; consider treating the child for syphilis in addition to administering anti-malaria treatment, which is systematic in all cases (see chapter on syphilis).
   - An experienced person requires at least 25 minutes for carrying out all the pre-transfusion tests, and this cannot be cut back (15 minutes for HIV, Syphilis, Hepatitis B, malaria, 10 minutes for Hepatitis C, 5 minutes for leaving the tests to reach room temperature and 5 minutes for centrifuging the blood).
   - No tests are carried out on total blood (except RDT malaria and blood group). The blood must be centrifuged.
   - Compatibility should be checked at the bed of the child receiving blood.
     - Always prefer iso-group transfusions since plasma O contains natural regular antibodies anti-A and anti-B. In addition, some donors O are named universal “dangerous” donors because their plasma contains one haemolysin of the ABO system capable to induce immediate massive haemolyse. If the percentage of such donors is low in developed countries (about 3% of the group O), prevalence of these “dangerous” donors in tropical
area is poorly known and possibly it might be higher. These donors are not detected in MSF settings.

**Pre blood transfusion testing**
- HIV, Hep B, Hep C, Syphilis, Malaria
- CAIT (dépistage de la maladie du sommeil en zone endémique)
- Blood group, Rh factor
- Hemoglobin

**Minimal duration of the whole tests:**

25 minutes

**Flow of the blood transfusion**

- Calculation of the number of drops to be transfused:
  - 30 ml (volume) x 15 (drops/ml) = 450 drops

- Calculation of the duration of the blood transfusion:
  - 3 (hours) x 60 (minutes) = 180 minutes

- To get the flow, divide the number of drops by the number of minutes:
  - 450 (drops) / 180 (minutes) = 2 to 3 drops by minute

**REMINDER**

- Major risk of antigen – antibody conflict during blood transfusion.
- Risk management due to natural regular antibodies anti-A and anti-B respecting compatibility ABO rules.
- Risk due to the haemolysins anti-A or anti-B present in the O universal “dangerous” donors.
- Risk due to the presence of irregular immune antibodies in the blood of the recipient and their detection by the research of irregular antibodies (RIA).
- The various numbers of antigenic systems concerned by pathological situations: at the minimum ABO, Rh D to extended phenotype and in vitro verifications of compatibility between recipient’s serum and donor’s red cells.

**4 – TRANSFUSIONAL REACTIONS**

Any abnormal reaction during blood transfusion should lead to immediately stop the blood transfusion transitorily or permanently according to the results of the etiologic analysis that should be done immediately.

1. Severe acute allergic transfusion reaction to Ig A (anaphylaxis, Quincke oedema, bronchospasm / wheezing, angioneurotic oedema, giant urticaria, severe pruritus):
   - Stop the transfusion immediately if bronchial spasm and/or vital distress.
   - IV Epinephrine 0.1 ml/kg (solution at 1:10 000) or subcutaneous 0.01 ml/kg (solution at 1:1 000).
   - IV Dexamethasone 0.5 mg/kg.

2. Reactions associated with a possible infectious contamination (shivers, fever, septic shock):
   - Stop the transfusion immediately if vital distress. If not, slow down the rhythm.
   - If fever – Refer to the chapter “Hyperthermia”, part IV.
   - Consider the possibility of malaria, bacteremia septicaemia and / or septic shock – Refer to the chapter on “Shocks & Sepsis / Meningitis”, part IV.
   - Wide spectrum antibiotics – as for septicemia - should be considered.
3. Acute haemolytic reactions - ABO incompatibility or others (fever + symptoms of haemolysis with haemoglobinuria):
   • Dangerous because both transfused and autologous red cells are destroyed. Hb count after transfusion is therefore lower than before transfusion, and further red cell transfusion exacerbates ongoing haemolysis.
   • Stop the transfusion immediately.
   • Hyperhydration to maintain a diuresis – 20 ml/kg/30 minutes, to be repeated x 2 if necessary.
   • Discuss IV furosemide 1 to 2 mg/kg in the absence of urine.
   • HemoCue for evaluating the depth of the anaemia.
   • Subsequent transfusions should be covered with:
     o IV Immunoglobulin: 1 mg/kg/day for 2 days (not yet available in MSF).
     o IV Dexamethasone: 0.5 mg/kg + Oral Prednisolone: 1 mg/kg subsequently.
# FICHE DE SURVEILLANCE DES TRANSFUSIONS

**Date :**

**Enfant**

- **Nom :**
- **Age :**
- **Groupe sanguin :**

**Transfusion**

- **Numéro de l’unité de sang :**
- **Médecin prescripteur :**
- **Infirmière chargée de la transfusion :**
- **Volume de sang à administrer :** ml

**Surveillance**

<table>
<thead>
<tr>
<th>Heure</th>
<th>T°</th>
<th>Pouls</th>
<th>TA</th>
<th>FR</th>
<th>Diurèse</th>
<th>Etat général</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avant transfusion</td>
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<td>5 min</td>
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<td>30 min</td>
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<td>45 min</td>
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<td>1 heure</td>
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<tr>
<td>1 heure 30</td>
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<tr>
<td>2 heures</td>
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<tr>
<td>2 heures 30</td>
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<td>3 heures</td>
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<td>3 heures 30</td>
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<tr>
<td>4 heures</td>
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<tr>
<td>4-6 heures après la fin de la transfusion</td>
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</tr>
</tbody>
</table>

**Heure de fin de la transfusion :**

**Volume transfusé :**

**Problèmes rencontrés**

<table>
<thead>
<tr>
<th>Heure</th>
<th>Symptômes</th>
<th>Traitement</th>
<th>Evolution</th>
</tr>
</thead>
</table>

**Signature de l’infirmière ayant administré la transfusion :**
## FICHE DE NOTIFICATION DES ACCIDENTS / REACTIONS TRANSFUSIONNELLES

<table>
<thead>
<tr>
<th>NOM DE L’ENFANT:</th>
<th>Age:</th>
<th>Sexe:</th>
<th>No de dossier de l’enfant:</th>
<th>Date:</th>
</tr>
</thead>
</table>

Groupe sanguin de l’enfant: A__ B__ AB__ O__ Rh D Positif____ Négatif____

Groupe sanguin de la poche transfusée: A__ B__ AB__ O__ Rh D Positif____ Négatif____

No de la poche de sang transfusée:

Poche envoyée au laboratoire pour analyse : Oui_____ Non_____

Résultats :

Indication de la transfusion:

Heure de survenue de la réaction après le démarrage de la transfusion:

Volume transfusé avant la réaction: ________ml

Signes et symptômes:

Type de la réaction transfusionnelle:
9. OMPHALITIS

DEFINITION
Omphalitis is an infection of the umbilicus and/or surrounding tissues. It is predominantly a disease of the neonate and is characterized by purulent discharge from the umbilical cord stump with surrounding induration, erythema, and tenderness (see figures below). Umbilical stump bleeding may occur with omphalitis as a result of delayed obliteration of the umbilical vessels.

NEONATAL RISK FACTORS
- Low birth-weight, prolonged labor, prolonged rupture of membranes or maternal infection, non-sterile delivery, home birth and, umbilical catheterization.
- Improper cord care or traditional / cultural care also increases the risk of omphalitis, such as for example traditional application of cow dung.

CLINICAL SYMPTOMS
- Locally: peri-umbilical erythema, edema, pain, with or without purulent discharge / bleeding.
- Progression: ecchymoses, bullae, crepitus or black discoloration suggesting anaerobic or mixed infection.
- Systemic (most common complication) +/- coagulopathy, shock and septic embolization with metastasis to lungs, kidneys, and skin: sepsis with danger signs – Refer to the next chapter “Septicemia and bacterial neonatal infections”.
- Necrotizing fasciitis.

TREATMENT
- Local omphalitis: 7-10 day-course of IV cloxacillin + 3-5 day course of IV gentamicin.
- Progressive omphalitis with crepitus or black discoloration: 10 day-course of IV clindamycin + 5 days-course of IV gentamicin.
- Sepsis with omphalitis as entry point: danger – Refer to the next chapter NEONATAL INFECTION: RISK OF SEPSIS, SEPSIS AND BACTERIAL NEONATAL MENINGITIS.
- Local treatment with chlorhexidine 4% x 3 daily as long as necessary (still disappearance of lesions).
- Necrotizing fasciitis requires extensive surgical debridement in addition of broad spectrum antibiotics as below and supportive care.
10. NEONATAL INFECTION: RISK OF SEPSIS, SEPSIS AND BACTERIAL NEONATAL MENINGITIS

1 – Management of asymptomatic newborns at risk of neonatal infection

Definition of risk factors

Neonatal sepsis and meningitis are more common in the first month than at any other time of life.

« Prophylactic » Streptococci Group B (SGB) treatment: the newborn is treated on the basis of risk factors below. These risk factors give evidence for the risk of contamination and so of possible mother to child possible infection. The goal of the treatment is to avoid sudden deaths due to Group B Streptococci since these infections can be initially asymptomatic but they can worsen rapidly and be responsible of death in few hours.

In asymptomatic newborns (no danger signs), neonatal infection should nevertheless be suspected if any of the risk factors below are present.

Major risk factors (RF)

• Peripartum maternal fever ($T > 38°C$ before delivery or during labour)
• Chorioamnionitis (foul-smelling, cloudy amniotic fluid)
• Prolonged rupture of membranes lasting > 18 hours before delivery

Minor risk factors

• Birth weight < 2000 g
• Resuscitation at birth with manual ventilation
• Meconium-stained amniotic fluid: this is a risk factor for neonatal infection, but not in itself an indication for antibiotic therapy. Meconium-stained amniotic fluid is also a risk factor for pneumothorax and aspiration pneumonia.

Criteria for suspecting asymptomatic neonatal infection

• 1 major RF if the mother did not receive antibiotics during labour (or received less than 2 doses
  3*
) or
• 1 major RF and birth weight < 2000 g, whether the mother received antibiotics during labour or not
• $\geq 2$ major RFs, whether the mother received antibiotics during labour or not
• 1 major and $\geq 2$ minor RFs, whether the mother received antibiotics during labour or not
• $\geq 3$ minor RFs, whether the mother received antibiotics during labour or not
Note*:
When there is a prolonged rupture of membranes, antibiotics given during labour reduce the risk of septicaemia in the newborn. Coverage is considered effective if at least 2 doses have been administered 4 hours apart during labour.

Management of suspected asymptomatic neonatal infection (one of the criteria above)

- The newborn will be either kept in the newborn Unit / pediatric Unit (but if possible not too close from the sick babies) or in the maternity, depending of the strategy and possibility in the field.
- Administer antibiotics for 48 hours: IV ampicillin + IV/IM gentamicin or IM fortified penicillin procaine + IM gentamicin if the first choice is not possible.
- For the dosage, see below.
- Monitor for danger signs. If the infant presents at least one danger sign, treat according to the chapter on management of symptomatic neonatal infections and refer to newborn Unit / pediatric Unit
- If the infant has not presented any of the danger signs during the first 48 hours, stop the antibiotics and keep under observation for an additional 48 hours.
- If the infant has not presented any of the danger signs during the observation period or at the discharge clinical examination (preferably done by a doctor): send home. In this case, tell the parents which signs require immediate consultation.
- When feasible, do bacteriological culture (hemoculture).

Management for all other asymptomatic newborns (none of the criteria above)
- Keep under observation in the maternity hospital for 24 hours.
- Monitor for danger signs. If the infant presents at least one danger sign.
- If the infant did not present any danger signs during observation: send home. In that case, tell the parents which signs require immediate consultation.

2 –Management of symptomatic neonatal infections (septicaemia and/or meningitis)

A neonatal infection is likely and an antibiotic therapy and transfer to neonate unit are required:

| In presence of one of these danger signs:                                                                                   | • Hyperthermia  
|                                                                                                                              | • Séizures  
|                                                                                                                              | • Bulging fontanelle  
|                                                                                                                              | • Apnoea  
|                                                                                                                              | • Severe abdominal distension  
|                                                                                                                              | • Generalised cyanosis  
|                                                                                                                              | • Umbilicus red or oozing blood or pus  
|                                                                                                                              | • Numerous or large pustules  
|                                                                                                                              | • Swollen, painful joint with reduced joint movement  
|                                                                                                                              | • Recurrent hypoglycaemia (> 2 episodes) |
In presence of two of these danger signs or
If one these danger signs persist for more than one hour:

- Hypothermia
- Inability to suckle effectively
- Lethargy or coma
- Hypotony
- Bradypnoea
- Tachypnoea
- Grunting respirations
- Chest indrawing
- Extreme pallor

When feasible, do bacteriological culture (hemoculture).

3. Treatment of sepsis without concurrent meningitis

**IV Ampicillin + IV Gentamycin** if symptoms present during the first 7 days of life AND there is no suspicion of a cutaneous origin (pustules, bullae, omphalitis…)

**OR**

**IV Cloxacillin + IV Gentamycin** if symptoms present after the first 7 days of life OR if there is a suspicion of cutaneous origin (regardless of timing of onset of symptoms).

**Length and second line treatment regimens:**

- If there is only one danger sign and this resolves within 24 hours of treatment: IV Ampicillin (or IV Cloxacillin) x 5 days + IV Gentamycin x 3 days.
- If there is > 1 danger sign or if only one danger sign resolving between 24 – 48 hours of treatment: IV Ampicillin (or IV Cloxacillin) x 7-10 days plus IV Gentamycin x 5 days.
- If danger signs persist beyond 48 hours of treatment, consider a second line antibiotic regimen:
  - **IV Ampicillin IV** x 10 days + **IV Amikacin** x 5 days
    OR (if Amikacin is not available)
  - **IV Cloxacillin** x 10 days + **IV Cefotaxime** x 10 days.

The length of treatment mentioned above corresponds per antibiotic and not as the total duration of the treatment using different antibiotics one after the other one. You should restart from zero after each change of antibiotics.
It is often difficult to determine the cause of the clinical signs and symptoms of the neonate (sepsis vs. asphyxia vs. respiratory distress syndrome, etc…). Knowing maternal history, birth history, and monitoring the infant’s evolution during the first 24 – 48 hours will often help you better determine the etiology of the symptoms.

Due to the potential toxicity of gentamycin and amikacin, these antibiotics are used for a shorter duration than the penicillins.

Notes:

Never give oral antibiotics for treatment of neonatal sepsis. In the chaotic environment of the fields, the exact timing of disappearance of symptoms may not be all the time well tracked. In these cases, always consider the longest length of treatment.

**4. Treatment of meningitis with or without associated sepsis**

**IV Amoxicillin + IV Cefotaxime**  
OR  
**IV Cloxacillin + IV Cefotaxime** (meningitis with skin and/or umbilical entry door that is evocative of Staphylococcus).

Alternate choice: **IV Amoxicillin (or Cloxacillin) + IV Ceftriaxone** (if Cefotaxime is not available AND the infant has not jaundice).

**Length of second line treatment regiments:**

- If LP is positive for gram negative organisms: 21 days of treatment.
- If LP is positive for non-gram negative organisms: 14 days of treatment.
- In the presence of clinical signs of meningitis with a negative LP: 10 days of treatment.
- If the infant’s clinical condition does not improve after 72 hours of treatment consider a second line antibiotic regiment: **Cloxacillin IV x 10 days + Ceftazidine IV x 10 days.**

Note:

- Ceftazidine has a sufficient penetration into the blood-brain barrier when meninges are inflamed.
- Amikacin has a poor penetration into the blood-brain barrier even when meninges are inflamed.
- It is often difficult to determine the cause of the clinical signs and symptoms of the neonate (sepsis vs. asphyxia vs. respiratory distress syndrome, etc…). Knowing the maternal history, birth history, and monitoring the infant’s evolution during the first 24 – 48 hours will often help you better determine the etiology of the symptoms.

**5. Specific treatments to be considered in rare well documented situations**

- In case the diagnosis of herpetic encephalitis is considered (mother with known active genital herpes at the time of delivery, skin lesions, neurological or other characteristics in neonates…), in addition to the above mentioned antibiotics, add IV acyclovir – Refer to this chapter, part III, Diseases Transmitted from Mother To Child (DMTCT).

- In case the diagnosis of fungal infection is considered – see risk factors below, in addition to the above mentioned antibiotics, add one anti-fungal agent such as IV fluconazole: 6 mg/kg/d (3
mg/kg/d in case of kidney failure) in one single daily dose over 1 to 2 hours (generally well tolerated) for 10 to 21 days.

6. General principles

- If antibiotics are indicated, start treatment even before transferring the neonate to the neonatal / pediatric ward in order to prevent loss of time between the recognition of the infection and initiation of treatment.

- It is preferable to use IV gentamycin and IV ampicillin. However, the IM route (same dosing) can be used if an IV cannot be secured. Once the infant has been transferred to a neonatal or pediatric ward, the antibiotic regimen can be reevaluated – Check Essential Drug MSF guideline for IV and IM dilutions.

- If transfer to a neonatal / pediatric ward is not possible, the infant has to be managed in the maternity ward. In this case, in order to prevent multiple IM injections, the antibiotic regimen can be changed to: IM penicillin procaine + IM Gentamycin OR, as a last resort (if penicillin procaine is not available) IM Ceftriaxone + IM Gentamycin.

- Penicillin procaine G replaces fortified penicillin (same dosing). These two penicillin formulations SHOULD NEVER BE USED IV.

- If you suspect meningitis, do not use penicillin procaine. Penetration across the blood-brain barrier is poor, despite inflamed meninges.

- Premature and small for gestational age infants are at increased risk of developing a potentially life threatening infection.

- In all cases, while awaiting the transfer in a neonatal care unit:
  - Start antibiotic therapy.
  - Ensure routine newborn care.
  - Keep the infant warm in a 25°C room, wrapped in a survival blanket or under a warming lamp if possible, and cover the head with a cap.
  - Closely monitor temperature, respiratory rate and oxygen saturation.
**TABLE with ANTIBIOTICS INDICATIONS - SUMMARY**

<table>
<thead>
<tr>
<th>Description</th>
<th>Antibiotic Combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonatal infections without meningitis nor clinical signs suggestive of a specific pathogen</td>
<td>IV Ampicillin + IV Gentamycin</td>
</tr>
<tr>
<td>1st line</td>
<td></td>
</tr>
<tr>
<td>Neonatal infections <strong>but with clinical signs (skin or umbilical infection) suggestive of staphylococcus</strong></td>
<td>IV Cloxacillin + IV Gentamycin</td>
</tr>
<tr>
<td>1st line</td>
<td></td>
</tr>
<tr>
<td>Neonatal infections <strong>with meningitis</strong> but without clinical signs suggestive of a specific pathogen</td>
<td>IV Ampicillin + IV Cefotaxime</td>
</tr>
<tr>
<td>1st line</td>
<td></td>
</tr>
<tr>
<td>Neonatal infections <strong>with meningitis and with clinical signs (skin or umbilical infection) suggestive of staphylococcus</strong></td>
<td>IV Cloxacillin + IV Cefotaxime</td>
</tr>
<tr>
<td>1st line</td>
<td></td>
</tr>
<tr>
<td>Neonatal infections without meningitis nor clinical signs suggestive of a specific pathogen</td>
<td>IV Ampicillin + IV Amikacin</td>
</tr>
<tr>
<td>2nd line</td>
<td></td>
</tr>
<tr>
<td>Neonatal infections <strong>but with clinical signs (skin or umbilical infection) suggestive of staphylococcus</strong></td>
<td>IV Clindamycin + IV Amikacin</td>
</tr>
<tr>
<td>2nd line</td>
<td></td>
</tr>
<tr>
<td>Neonatal infections <strong>with meningitis</strong> but without clinical signs suggestive of a specific pathogen</td>
<td>IV Ampicillin + IV Ceftazidime</td>
</tr>
<tr>
<td>2nd line</td>
<td></td>
</tr>
<tr>
<td>Neonatal infections <strong>with meningitis and with clinical signs (skin or umbilical infection) suggestive of staphylococcus</strong></td>
<td>IV Cloxacillin + IV Ceftazidime</td>
</tr>
<tr>
<td>2nd line</td>
<td></td>
</tr>
<tr>
<td>NEC 1st line</td>
<td>IV Cefotaxime + IV Metronidazole +/-</td>
</tr>
<tr>
<td></td>
<td>IV Gentamycine</td>
</tr>
<tr>
<td>NEC 2nd line</td>
<td>IV Ceftazidime + IV Clindamycin +/-</td>
</tr>
<tr>
<td></td>
<td>IV Amikacin</td>
</tr>
</tbody>
</table>
## TABLE of ANTIBIOTICS DOSAGES BEFORE 2 MONTHS

<table>
<thead>
<tr>
<th>Antibiotics</th>
<th>Neonatal period</th>
<th>Infants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>≤ 7 days</td>
<td>&gt; 7 days – 1 month</td>
</tr>
<tr>
<td>Pénicillin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procaïne G IM</td>
<td>50 mg/kg or</td>
<td>50 mg/kg or</td>
</tr>
<tr>
<td>(DON’T USE IV)</td>
<td>50 000 IU/kg/24h</td>
<td>50 000 IU/kg/24h</td>
</tr>
<tr>
<td></td>
<td>Once daily</td>
<td>Once daily</td>
</tr>
<tr>
<td></td>
<td><strong>Don’t use in case of meningitis</strong></td>
<td><strong>Don’t use in case of meningitis</strong></td>
</tr>
<tr>
<td>Ampicilline</td>
<td>• &lt; 2000g:</td>
<td>• &lt; 1200g:</td>
</tr>
<tr>
<td>IV/IM</td>
<td>50 mg/kg/12h</td>
<td>50 mg/kg/12h</td>
</tr>
<tr>
<td></td>
<td>• ≥ 2000g:</td>
<td>• 1200–2000g:</td>
</tr>
<tr>
<td>(in Slow IV</td>
<td>50 mg/kg/8h</td>
<td>50 mg/kg/8h</td>
</tr>
<tr>
<td>over 30</td>
<td>• Meningitis:</td>
<td>• ≥ 2000g:</td>
</tr>
<tr>
<td>minutes or in</td>
<td>&lt; 2000g: 50 mg/kg/6h</td>
<td>50 mg/kg/6h</td>
</tr>
<tr>
<td>IV over 5 min</td>
<td>≥ 2000g: 75 mg/kg/6h</td>
<td>≥ 2000g: 50 mg/kg/6h</td>
</tr>
<tr>
<td>minimum)</td>
<td>• Meningitis:</td>
<td>• Meningitis: 25-40 mg/kg/6h</td>
</tr>
<tr>
<td></td>
<td>25 mg/kg/6h</td>
<td>25-40 mg/kg/6h</td>
</tr>
<tr>
<td>Cloxacilline</td>
<td>• &lt; 2000g:</td>
<td>• &lt; 2000g:</td>
</tr>
<tr>
<td>IV/IM</td>
<td>25 mg/kg/12h</td>
<td>25 mg/kg/8h</td>
</tr>
<tr>
<td>(in Slow IV</td>
<td>• ≥ 2000g:</td>
<td>• ≥ 2000g:</td>
</tr>
<tr>
<td>diluted in D5%</td>
<td>25 mg/kg/8h</td>
<td>25 mg/kg/6h</td>
</tr>
<tr>
<td>or NaCl 0.9%</td>
<td>• Meningitis:</td>
<td>• Meningitis: 25-40 mg/kg/6h</td>
</tr>
<tr>
<td>over 30-60 min</td>
<td>25 mg/kg/6h</td>
<td>25-40 mg/kg/6h</td>
</tr>
<tr>
<td>or in IV 5 min</td>
<td>• Meningitis:</td>
<td>• Meningitis: 25-40 mg/kg/6h</td>
</tr>
<tr>
<td>minimum)</td>
<td>25 mg/kg/6h</td>
<td>25-40 mg/kg/6h</td>
</tr>
<tr>
<td>Cefotaxime</td>
<td>• 50 mg/kg/12h</td>
<td>• 50 mg/kg/8h</td>
</tr>
<tr>
<td>IV/IM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(diluted over 20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>min or in IV</td>
<td>• To be avoided in &lt;</td>
<td></td>
</tr>
<tr>
<td>over 3 min</td>
<td>2 Kg when possible</td>
<td>• Meningitis: 50 mg/kg/12h</td>
</tr>
<tr>
<td>minimum)</td>
<td>• Meningitis:</td>
<td>• Meningitis: 50 mg/kg/12h</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>• 50 mg/kg/24h</td>
<td>• &lt; 2000g:</td>
</tr>
<tr>
<td>IV/IM</td>
<td>• To be avoided in &lt;</td>
<td>50 mg/kg/24h</td>
</tr>
<tr>
<td>(in Slow IV</td>
<td>2 Kg when possible</td>
<td>≥ 2000g: 50 mg/kg/24h</td>
</tr>
<tr>
<td>over 60 min</td>
<td>• Meningitis:</td>
<td>• Meningitis: 100 mg/kg/24h</td>
</tr>
<tr>
<td>or in IV over 3 min</td>
<td>50 mg/kg/24h</td>
<td>100 mg/kg/24h</td>
</tr>
<tr>
<td>Medication</td>
<td>Weight Range</td>
<td>Dosage</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Gentamycin IV</td>
<td>&lt; 1500g</td>
<td>5 mg/kg/36 hours</td>
</tr>
<tr>
<td></td>
<td>&lt; 2000g</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≥ 2000g</td>
<td>4 mg/kg/24h</td>
</tr>
<tr>
<td></td>
<td>4 to 7.5</td>
<td>mg/kg/24h</td>
</tr>
<tr>
<td>Clindamycin IV</td>
<td>&lt; 2000g</td>
<td>5 mg/kg/12h</td>
</tr>
<tr>
<td></td>
<td>≥ 2000g</td>
<td>5 mg/kg/8h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceftazidime IV</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>50 mg/kg/12h</td>
<td>50 mg/kg/8h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metronidazole IV</td>
<td>Loading dose:</td>
<td>15 mg/kg then:</td>
</tr>
<tr>
<td></td>
<td>&lt; 2000g</td>
<td>7.5 mg/kg/12h</td>
</tr>
<tr>
<td></td>
<td>≥ 2000g</td>
<td>7.5 mg/kg/8h</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amikacin IV</td>
<td>&lt; 1200g</td>
<td>15 mg/kg/48h</td>
</tr>
<tr>
<td></td>
<td>Meningitis:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt; 2000g</td>
<td>10 mg/kg/24h for the first 3 days</td>
</tr>
<tr>
<td></td>
<td>≥ 2000g</td>
<td>20 mg/kg/24h for the first 3 days</td>
</tr>
</tbody>
</table>

Secondary to risk of localized tissue necrosis, cloxacillin must be administered via IV infusion. It should be mixed with D5% or 0.9%NaCl over 30-60 minutes (or at least slowly injected over 5 minutes). Dilute one dose of cloxacilline with 5 ml/kg of D5% or 0.9%NaCl.

⚠️ The solvent of ceftriaxone for IM injection contains lidocaine. Ceftriaxone reconstituted using this solvent must NEVER be administered by IV route. For IV administration, water for injection should always be used.
Amikacin and gentamycin have potential auditory and renal toxicity. This risk increased with prolonged duration of treatment. Therefore, it is recommended to limit the duration of treatment with these antibiotics to 5 days (with respect to rare exceptions).

If newborn < 1500g, 5 days gentamycin treatment corresponds to 4 doses only.
If newborn < 1200g, 5 days amikacin treatment corresponds to 3 doses only.

For Amikacin: Give other antibiotics, such as penicillins and cephalosporins, at least 1 hour before or after an Amikacin dose; simultaneous administration may result in reduced antibacterial efficacy. Infuse over 30-60 minutes. Final concentration should not exceed 10 mg/mL. Solution is stable after dilution with Glucose, LR and Normal Saline.

7. For more info about neonatal meningitis

- Symptoms and clinical signs of sepsis and meningitis are even less specific in newborn/infant compare to older children. In the neonatal period it can be very difficult, often impossible to distinguish between meningitis and septicemia.
- In MSF settings, diagnosis is mainly clinical. Neonatal meningitis can be diagnosed by performing a lumbar puncture at any doubts (if no contraindication). A normal CSF result only excludes meningitis, not sepsis. In an endemic area, it is essential to test for malaria (thin / thick malaria smear > RDT because of the HRP-2 protein transmitted from mother to neonates during pregnancy) prior to perform a lumbar puncture.

MORE SPECIFIC SIGNS OF MENINGITIS

- Convulsions / Seizures (from 3 to 21 days of age consider tetanus in front of spasms, abnormal rigidity and opisthotonus, particularly in case of omphalitis or history of poor umbilical care and unvaccinated mother). Seizures could also be present in case of sepsis without meningitis.
- Bulging fontanel (most neonates with meningitis do not have a bulging fontanel since it is a very and too late sign).

PARA CLINICAL DIAGNOSIS (LABORATORY): LUMBAR PUNCTURE (LP)

- Any clinical sign listed above in neonates should lead to LP.
- Make sure there is no contraindication for the LP.
- Macroscopic aspect of CSF: Start antibiotic therapy without delay if the LP yields a turbid CSF.
- Microscopic exam: look for WBC’s and perform a Gram stain (a negative gram stain however does not exclude the diagnosis).
- Use Rapid test if available (Pastorex*) to determine bacterial etiology. Use is limited in neonates (only some gram negative bacilli are tested).
• If a neonate with suspected meningitis has a normal CSF examination but remains symptomatic, the CSF exam should be completed by a Pastorex* test and the infant should be treated for neonatal sepsis +/- meningitis but in all cases with a full course of antibiotics.

• Contraindications to LP: Focal neurologic signs, signs of raised intracranial pressure (falling pulse, dilated or slowly reactive pupils, setting sun eye), continuous seizure activity, and bleeding diathesis.

• If an infant is clinically unstable, a lumbar puncture should not be done. They should be treated for presumed sepsis / meningitis.

<table>
<thead>
<tr>
<th></th>
<th>Aspect</th>
<th>Germs (Gram and/or Pastorex)</th>
<th>White Cells</th>
<th>Proteins</th>
<th>Glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal CSF</td>
<td>Clear</td>
<td>Negative</td>
<td>&lt; 30/mm³</td>
<td>&lt; 0.2 – 2.9 g/l</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pandy -</td>
<td>1.5–5.5 mmol/l = 0.3–1 g/l</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(in principle &gt; 60% of the glycaemia)</td>
</tr>
<tr>
<td>Bacterial meningitis</td>
<td>Troubled , +/- thick</td>
<td>Positive</td>
<td>↑↑↑↑ 100–20 000/mm³ mainly neutrophil leucocytes</td>
<td>Pandy +</td>
<td>X</td>
</tr>
<tr>
<td>Viral meningitis</td>
<td>Clear</td>
<td>Negative</td>
<td>30 – 700/mm³ mainly lymphocytes</td>
<td>Pandy -</td>
<td>Normal</td>
</tr>
</tbody>
</table>
• Be careful about interpretation of haemorrhagic LP. It should be classified as not interpretable.

• In MSF context any neonate with abnormal non traumatic CSF (leucocytes and/or proteins) should be treated as bacterial meningitis.

• Laboratory features that are characteristic of neonatal bacterial meningitis include:
  o A positive CSF (Cerebral Spinal Fluid) Gram stain.
  o Increased CSF (Cerebral Spinal Fluid) white blood cell (WBC) count (typically > 100 WBC / microl, but may be lower, especially with gram-positive organisms), with a predominance of neutrophils.
  o Elevated CSF (Cerebral Spinal Fluid) protein concentration (> 3g/l in preterm and > 2 g/l in term infants).
  o Decreased CSF (Cerebral Spinal Fluid) glucose concentration (< 60% of the glycaemia).

If possible, a LP should be done prior to the initiation of antibiotics (or as soon as possible after initiation of antibiotics). Do not perform an LP if it is contraindicated, if you do not have the appropriate lab test available, or if you do not have an experienced clinician comfortable with performing an LP on small infants. The duration of antibiotic therapy depends on the results of the LP.

8. Extra notes concerning neonatal sepsis

Risk Factors for Invasive Candidiasis in Neonates
- Very and extreme prematurity (GA < 32 weeks).
- Very and extreme Low Birth Weight (BW < 1500g).
- Per natal asphyxia with APGAR < 5 at 5 minutes.
- Ventilation with bag and mask.
- Installation of an IV catheter.
- Absence of enteral feeding and so total parenteral feeding.
- Necrotizing enterocolitis (NEC) – See this chapter.
- Fungal skin and/or digestive colonisation.
- Administration of cephalosporine (cefotaxime, ceftriaxone, ceftazidime).
- Prolonged administration of antibiotics.
- Administration of steroids.
- Administration of antagonist drugs of type 2 histaminic receptors.
- Suspicion of nosocomial infection.
9. Prevention of neonatal infections

- Prevention of Early Neonatal Infections:
  - Intrapartum antibiotics for women with risk factors for sepsis.
  - Good basic hygiene and cleanliness during delivery of the baby.
  - Special attention to cord care.
  - Special attention to eye care.

- Prevention of Late Neonatal Infections (a large part is acquired in hospitals):
  - Exclusive maternal breastfeeding.
  - Strict procedures for hand washing for all staff and for families before and after handling babies.
  - Limitation of visits of the family and staff at the minimum level in the neonatal unit.
  - Concerning the equipment, refer to the specific maintenance documentation (open incubators, phototherapy lamp…).

N.B. regarding closed incubators, they are in principle contra-indicated in the MSF programs (difficulties of correct utilisation and colonization by Pseudomonas aeruginosa), but in case they are already in the neonatal unit (MoH, donations…), for maintenance refer to Neonatal Procedures in Part VI.
11. NECROTIZING ENTEROCOLITIS (NEC)

1 – DEFINITION

Disease that usually affects low birth weight babies and that associates two components:

- One vascular component: Ischemia and necrosis of a plus or minus large part of the digestive tract.
- One infectious component: Pathogen pullulating.

This disease always occurs after a free interval from few days to few weeks.

2 – PHYSIOPATHOLOGY

- Still under discussion.
- Stress or suffering, which might be responsible of mesenteric ischemia and digestive stasis or external bacterial pathogens penetration in an immature digestive tract (poor immunity), might also cause the invasion of a fragile intestinal barrier + Bacterial translocation (blood dissemination).
- Feeding (too high osmolarity, too rapid, too important, not enough fractionated…) might be an aggravating factor (refer to risk factors).
- Equally, any element increasing blood viscosity or decreasing mesenteric perfusion (transfusion, severe dehydration with poor mesenteric perfusion, patent ductus arteriosus…) might be an aggravating factor.
- The two components (vascular and infectious one) are commonly associated in very premature babies.

3 – RISK FACTORS

- Prematurity (particularly GA < 33 SA, BW < 1.75 kg).
- Hypoxia – Ischemia to the Bowel:
  - Pre – natal: IUGR, particularly if antenatal absent / reversed end – diastolic flow of umbilical and foetal arteries (AN Doppler).
  - Per – natal: Asphyxia / Perinatal suffering.
  - Post – natal: PDA, reduced blood flow (all shocks…).
- Feeding:
  - Too rapid increase of digestive feeding (normally we should increase from 10 to 15 ml/kg/day with a maximum of 20 ml/kg/day).
  - Formula feeds are more frequently incriminated than breast milk. The worst are hypertonic formula (too high osmolarity). Mother milk is recognized as protective.
  - Too rapid iron supplementation.
• Hyper viscosity of blood: Blood transfusion, severe dehydration with low blood pressure and poor mesenteric perfusion.

• Infection:
  o Bacteria in the intestinal wall  
  Ischemia & Infection of Intestinal Mucosa.
  o Passage of bacteria in the blood stream (bacteraemia and septicaemia)  
  Necrotizing Enterocolitis.

4 – CLINICAL SIGNS at THE ONSETand at the EARLY STAGE

• Onset: Generally after 1 – 2 weeks (possibly up to several weeks of age).

• Non specific, various and inconstant features of sepsis: temperature instability, slight jaundice, apnoea, bradycardia, lethargy, peripherical hypo perfusion (cold hands and feet and increased CRT)…

• Feeding intolerance: Regurgitation, green bilious vomiting or green bilious aspirates, even if they are scarce (< 3 ml/kg/meal).

• Surveillance of gastric aspirates and management:

<table>
<thead>
<tr>
<th>Description of gastric aspirates</th>
<th>Management</th>
</tr>
</thead>
</table>
| Gastric aspirates ≥ 3 ml/kg/meal **and** dirty, bloody, green or greenish and/or fetid | Stop enteral feeding, install O/NGT with the extremity opened, downward sloping in a bag for gastro-intestinal drainage. Make a complete clinical exam including the abdominal wall, stools, vital values and discuss a possible infectious cause such as NEC  
  - See the chapter 11 in Part IV. |
| Gastric aspirates < 3 ml/kg/meal **and** dirty, bloody, green or greenish and/or fetid | Throw gastric aspirates, don’t give the next meal, make a complete clinical exam including the abdominal wall, stools, vital values and discuss a possible infectious cause such as NEC:  
  - Absence of danger sign and/or alarming general condition  
    Re evaluation just before the next meal in order to decide to restart or not enteral feeding, to install IV line, etc…  
  - Danger sign and/or alarming general condition  
    stabilize the neonate adequately; start again the management of feeding / infusion according to the cause and the clinical evolution. |
| Gastric aspirates < 3 ml/kg/meal **and** clean with red or black blood in small quantity | Throw gastric aspirates, don’t give the next meal, make a complete clinical exam including the abdominal wall, stools, vital values and discuss a possible infectious cause such as NEC:  
  - Absence of danger sign and/or alarming general condition  
    Think about acute gastritis due to stress and treat with PO (slow IV) oméprazole 0.7 mg/kg, a single daily morning dose, **without stopping enteral feeding.**  
  - Danger sign and/or alarming general condition  
    stabilize the neonate adequately; treat with oméprazole, start again the management of feeding / infusion according to the cause and the clinical evolution. |
Gastric aspirates $\geq$ 3 ml/kg/meal $\geq$ 2 times successively and clear (or milky)

| Reinject gastric aspirates and continue enteral feeding but maintain the quantity planned for the previous meal with deduction of gastric aspirates for the next meal (don’t increase = no change) still gastric aspirates return to the norm. |

Gastric aspirates < 3 ml/kg/meal and clear (or milky)

| Reinject gastric aspirates and continue enteral feeding with respect to the established program with deduction of gastric aspirates. |

**Attention to stop enteral feeding adequately (critical general condition, abnormal abdominal signs, bloody stools in the absence of anal fissure, bilious / greenish gastric aspirates…) but don’t stop enteral feeding to all neonates with plus or minus clear gastric aspirates when they have a good general condition and normal clinical exam.**

- Fetid and greenish stools, +/- bloody fillets (in the absence of anal fissure).
- Abdominal distension +/- visible bowel loops. A sensitive abdominal wall with tenderness is very significant and suggestive of NEC, even if sensitivity is moderate.
- Stopping intestinal transit with silent auscultation.
- Any one of the above signs and a forci or if they are associated, should lead to call a MD, make a complete clinical exam including vital values, stabilize and refer the as needed to a neonatal care unit (or paediatrics care unit) for adequate case management.
- A good case management at this stage should normally avoid the evolution toward the characteristic triad of the late stage (bilious aspirates or vomiting / bloody stool / sensitive or painful abdominal distension).

5 – CLINICAL SIGNS at THE LATE STAGE

- Constants and severe features of sepsis: hypothermia, jaundice, apnoea, bradycardia, lethargy, peripheral hypo perfusion with CRT $>>>$ 2 seconds and septic shock.
- Severe digestive signs with:
  - Repeated important bilious aspirates and/or vomiting.
  - Feeding intolerance.
  - Bloody stools when there are stools (in the absence of anal fissure).
  - Abdominal distension +/- visible abdominal loops and sensitive / painful tenderness, with paralytic ileus which may progress to perforation.
  - Clinical signs of peritonitis / perforation: Abdominal sensitive tenderness, guarding, tense, discoloured abdominal wall (redness then pallor), and abdominal wall oedema, absent bowel sounds, abdominal mass.

6 – CASE MANAGEMENT (in the order listed below)
• Maintain adequate oxygenation / ventilation and oxygen with nasal prongs (but pay attention to put the minimum O2 flow necessary for good oxygen saturation, max 2l/min, because of increased risk of gastric or intestinal distension and/or lung / retinal toxicity if the O2 flow is more important).

• Stop totally enteral feeds.

• Control sugar level in the blood and treat accordingly.

• Proclivity 30 degrees.

• Pass an oro/nasogastric tube and leave it on free drainage in a bag. Take note of the quantities that are produced.

• Secure IV line and make an infusion with RL or NaCl 0.9%: 10 ml/kg in 30 minutes to be renewed x 1, 2 or 3 according to needs (vital signs).

• Then start IV infusion of D10% + NaCl 10% (3 mEq or mmol/kg/d) (or neonatal solution if existing) according to the protocol « Management of Feeding and Infusion in Neonates », Part VI, Chapter 4, giving all the planned quantities into the infusion until a maximum of 150 - 160 ml/kg/day (can be increased in case of important fluid losses by vomiting or diarrhea).

• Add KCl 10% (2 mEq or mmol/kg/day) as soon as the neonate urinates well.

• Correct anaemia if Hb < 10g/dl: 10 - 15 ml/kg of concentrated red cells over 60 to 120 minutes (only after correction of shock). In case of hemorrhagic shock, use total blood in place of concentrated red cells: 10 - 15 ml/kg over 30 minutes to be renewed one time if necessary (persistent signs of severity).

• **Start first line ATB treatment:** IV Cefotaxime + Slow IV Metronidazole for 10 days (+/- IV/IM Gentamycin for 3 to 5 days at the maximum) – *See dosages in the table in the chapter on “neonatal sepsis”.*

• Always consider to associate an antifungal agent such as slow IV Fluconazole: 6 mg/kg/d (3 mg/kg/d in case of renal failure) as a single daily dose over 1 to 2 hours (usually well tolerated) for 10 days.

• Infants under 2 months:
  o Ceftriaxone should be avoided in neonatal sepsis / NEC / meningitis. It can cause biliary pseudolithiasis and increases the risk of bilirubin encephalopathy.
  o If Cefotaxime is not available, in this case IV Ceftriaxone should be given because severity of NEC is much more damaging that possible side effect of Ceftriaxone.

• **If clinical deterioration after 3 days of well done first line treatment, start second line ATB,** IV Ceftazidime (third generation cephalosporine with antibacterial broad spectrum against Gram negative pathogens and with excellent activity against Pseudomonas aeruginosa) + slow IV Clindamycine over 10 days (+/-IV/IM Amikacin over 3 to 5 days maximum) – *Refer to the antibiotic tables at the end of the previous chapter.*

• When feasible, abdominal X – Rays (supine & lateral decubitus) to look for perforation (if yes surgeon advice; nevertheless most of them might be resolve on medical treatment).

• Surgery and post surgical care are generally not possible in MSF programs. In case of unfavourable evolution, please consider pain management and palliative care.

• Note also that some severe NEC with perforation might evaluate spontaneously favourably without surgery (surgery is exceptionally necessary: extensive digestive necrosis that need resection). Even in developed countries, surgery is becoming rare. So, don’t stop treatment too rapidly in front of severe NEC and in any case make your best to prevent rather than to treat.

**7 – SURVEILLANCE and RE FEEDING**
• Examine the baby carefully 2 to 3 times daily.
• Note regurgitation, bilious or not vomiting and bilious or not aspirates (quantity, colour).
• Regular abdominal exam (skin aspect, tenderness, new visible bowel loops, sensitivity, pain, meteorism, auscultation).
• Systematically verify the NGT position and change it every 3 days changing also the nostril for introduction.
• Stools: Quantity, colour, odour, consistence, blood.
• Vital signs: colour, HR, RR, CRT, Extremities, Neuro Status.

As long as there is persistence of digestive abnormalities, feeding cannot be re started.

When the abdominal wall looks normal and soft, when the baby is passing normal stools without blood and when gastric aspirates are < 4 ml/kg every 3 hours + clear 3 times successively, feeding can be cautiously re started as below.

• Quality: **Exclusively maternal milk** (no formula) starting by D10% at Day 0 (change for breast milk only if good tolerance of D10%).
• Frequency: Continuous (like a perfusion) or 12 times daily (every 2 hours).
• Quantity: 10 ml/kg/d at D1, D2 and D3.
• Slowly increase by 0.5 to 1 or 2 ml per each feed daily (according to weight: basically 10 ml/kg/d) maintaining IV line and D10% + NaCl 10% infusion (but decreasing it according to the quantity given orally, basically you decrease infusion on the same proportion that you increase digestive feeding and vice – versa in case of deterioration) still feeding reaches 100 ml/kg/d.
• When the optimal feeding is reached (180 – 200 ml/kg/d), if clinical exam is still good, the number of meals can be decrease to 10 or 8 daily with the same total daily quantity.
• Regular surveillance of gastric aspirates and adequate management should be permanent at each evolving step – Please refer to the table above inside paragraph 4.
• Any bilious aspirates should interrupt the re feeding, impose re assessment and to re start the NEC protocol with respect to the clinical exam.
• Any regurgitation, vomiting, meteorism, bloody stools or greenish and fetid stools should impose a systematic careful clinical exam by the MD in charge.
• Daily surveillance of weight.
• Check regularly temperature and sugar in blood.
• Non pharmacologic management of pain: touching, dextrose, music, etc…

Abdominal distension with visible bowel loops under the skin (picture below on the right), collateral circulation and inflammation (3 other pictures below).
8 – PREVENTION

- Carefull examination of each neonate (including vital values) 2 to 3 times/d and of the abdomen before each meal if BW is ≤ 1500g or ≤ 33 weeks of GA.
- Carefully respect the progression and the number of the meals according to BW, age and feeding tolerance.
- Any bilious aspirates should lead to stop the enteral feeding, at least temporarily still normalisation of the clinical exam and gastric spirates.
- So, bilious/bloody aspirates should lead to parenteral feeding (infusion) and strict surveillance with regular assessments before any attempt to restart enteral feeding. Clinical condition and abdominal status should also be part of the regular assessments – Please refer to the table above inside paragraph 4.
- Note also stools, vomitings, regurgitations, general condition and vital values.
12. NEONATAL SKIN CANDIDIASIS (“DIAPER RASH”)

1 – CLINICAL FEATURES WHEN ISOLATED SKIN DISEASE

- Common rash in neonates and young infants (particularly in those wearing any kind of closed diapers).
- Characterized by an erythematous rash around the peri-anal area.
- Occurs because of local irritation.
- Candidiasis over infection is common if the rash lasts more than 2 to 3 days.
- It appears as a “beefy red” rash with satellite lesions, particularly in and around skin folds – see the photos below (to distinguish from the simple napkin rash which is on the convex parts and not in the skin folds).
- Secondary bacterial infection (particularly with Staphylococcus aureus) may also occur.

2 – SIGNS of DANGER: SEPSIS & MENINGITIS DUE TO FUNGUS (SYSTEMIC CANDIDIASIS)

There is no specific sign that allow making a differential diagnosis with bacterial sepsis & meningitis with exception for the context (most often very premature baby and probable nosocomial infection) and possible entry points such as extensive skin candidiasis and / or digestive candidiasis.

Neonates and young infants present with non-specific symptoms and signs that indicate severe illness. These signs include:

- Inability to breastfeed normally
- Seizures
• Drowsiness or unconsciousness
• Respiratory rate less than 20 / min or apnea (cessation of breathing for a period of time > 20 seconds)
• Respiratory rate greater than 60 / min
• Grunting
• Severe chest indrawing
• Central cyanosis
• Temperature instability (fever, hypothermia)
• Important pallor
• Hypotonia

In front of any of these signs the diagnosis of severe sepsis / meningitis should be considered – Refer to this chapter.

3 – CASE MANAGEMENT

• Skin candidiasis
  o No diaper and keep the neonate peri-anal area dry and clean.
  o Prevention: Oxyde zinc cream 10% after each change or stool before having candidiasis or bacterial over infection.
  o Curative treatment:
    • Gentian violet x 6 daily in case of over infection by candida and/or staphylococcus (if it is available since it was recently removed from the essential drug list).
    • Miconazole cream 2% (antifungal): 1 application x 4/d till recovery in case of over infection by the candida.
    • Sulfadiazine silver cream 1% (sulfamide): 1 application x 4/d till recovery in case of bacterial over infection.
• Oral / digestive candidiasis:
  o First intention treatment: Nystatine 100'000 IU = 1 ml 4 x / day during 10 days.
  o Second line treatment (if no improvement after 5 days of well conducted Nystatine treatment):
    Oral Fluconazole (suspension 50 mg / 5ml) 3 mg / kg once daily x 14 to 21 days.
• Sepsis & Meningitis – Refer to this chapter since ATB should be systematically added to the antifungal agent: IV Fluconazole: 6 mg/kg/d (3 mg/kg/d in case of renal failure) as a single daily dose over 1 – 2 hours (usually well tolerated) for 10 (sepsis) to at least 21 days (meningitis or complicated sepsis with fungal visceral abscesses).
  o Always consider fungal infection in case of sepsis associated with NEC – See this chapter above.
  o Always consider fungal infection in case of nosocomial sepsis / meningitis.
  o Always consider fungal infection in case of sepsis / meningitis associated with digestive or extensive skin candidiasis.
  o Always consider fungal infection in case of sepsis / meningitis in very low birth weight babies (< 1250g).
• Mother should also be treated in case of vaginitis and/or mycosis of the breast or nipple.
13. NEONATAL TETANUS

1 – DEFINITION

Tetanus is caused by the toxin of Clostridium tetani. Tetanus is responsible for 5 to 7% of worldwide neonatal mortality. The disease does not confer immunity and is not contagious. Clostridium tetani is found in soil as well as in animal and human feces. Tetanus spores are resistant to various disinfectants.

Neonatal tetanus is caused by contamination of the umbilical cord in infants of poorly immunized mothers (mortality is 10 to 60% even with hospital care). The application of unconventional substances to the umbilical stump (e.g., butter, juices, and cow dung) has been implicated as common cultural practices that contribute to neonatal tetanus. Neonatal tetanus can also result from unclean hands and instruments or contamination by dirt, straw, or other non-sterile materials in the delivery field.

2 – NATURAL COURSE

Day 0

• Unclean cord cutting
• Contaminated covering of umbilical stump

Day 1 to 3 minimum (possibly still day 21)

• Silent interval: Incubation period

Days 3 to 21

• First symptoms of the disease
• The onset of illness is typically more rapid in neonatal tetanus than in older individuals and may progress over hours rather than days.
3 - CLINICAL SYMPTOMS

Early signs (3 to 21 days after birth)
- Excessive crying
- Inability to suck and feed
- Sardonic smile, trismus

Late signs
- Rigidity and opisthotonos
- Sudden muscle spasms and tonic seizures
- Glottic spasmus

Case fatality rate
- District hospital 50 to 80%
- Optimal care 10 to 20%

4 – CASE MANAGEMENT

Basic life support
- Meticulous supportive care is essential.
- The infant should be hospitalized in a quiet environment, with the eyes covered (you can use the same covering as you would use for phototherapy). Placing the infant in a dark room is ideal but it may interfere with proper surveillance. External stimuli often aggravate muscle spasms. Spasms are extremely painful. So exposure to non essential external stimuli should be limited.
- Timing of medical interventions should be coordinated in order to avoid precipitation of spasms and seizures.
- Secure and maintain a free airway, gently suction only if necessary to free the airway of secretions.
- Electronic suction and an ambu bag should be readily available.
- Close surveillance by nursing staff. Assure that the nurse stays with the infant as often as possible.
- Educate and « empower » the mother to monitor the infant. She should be encouraged to call the nurse for any respiratory concerns (cough, trouble breathing, apnea, secretions, cyanosis, etc…).
- Verify the bladder empties spontaneously. If it does not, consider applying gentle bladder pressure.
- Proper monitoring by the nursing staff and family, in order to ensure rapid management of respiratory symptoms, is a key for successful management of these infants.

Neutralize toxin and prevent new production
- Human tetanus immunoglobulins (HTIG) 500 IU intramuscularly should be given in 2 separate injection sites (so 250 IU each site) as soon as possible to neutralize the tetanus toxin. It is important that the HTIG is administered at a different site than the tetanus vaccine. Ideally, the tetanus vaccine should be given not at admission, but at discharge.
Different guidelines exist regarding the proper administration of HTIG. We are using the WHO «Current Recommendations for Treatment of Tetanus during Humanitarian Emergencies», 2010.

Systemic antibiotic treatment should be given for 10 days with IV Metronidazole 15 mg/kg single loading dose, followed after 24 hours by 7.5 mg/kg every 12 hours. The Metronidazole should be given as an infusion over 60 minutes.

If Metronidazole is not available (treatment of choice), give IV Benzylpenicillin 50 mg/kg/6 hours (alternative antibiotic) for 10 to 14 days.

Co-administration of an antibiotic to treat sepsis is advised. Therefore the recommended treatment regimen is Ampicillin + Gentamycin + Metronidazole or Cloxacillin + Gentamycin + Metronidazole (or otherwise tailored towards the suspected bacterial etiology). Refer to the chapter on neonatal sepsis for further details.

Disinfect any wounds and the umbilical cord with chlorhexidine or iodine.

Treat spasms and hypertonia

The goal of treatment is to diminish the spasms that cause asphyxia and broncho-aspiration. The goal is not to prevent all spasms but rather to diminish the intensity and the frequency of the spasms.

If a syringe pump (electronic syringe) AND staff qualified to use the syringe pump are available, diazepam and phenobarbital could be given with the syringe pump. In most MSF settings, these medications are given via IV injection due some inherent risks associated with the electrical syringe pump (setting the rate of administration of the medication too fast or forgetting to refill the syringe).

1st line:
- Diazepam 0.5 mg/kg/dose rectally every 4 hours.

If this is not sufficient ⇒ 2nd line:
- Increase the frequency of the diazepam to 0.5 mg/kg/dose rectally to a maximum frequency of every 1 hour.

If this is not sufficient ⇒ 3rd line:
- Substitute the rectal diazepam with IV diazepam 0.1 – 0.3 mg/kg via slow injection over 3-5 minutes every 1-4 hours (dilute 10 mg/2 ml vial of diazepam in 8 ml of Dextrose 5% or 0.9% Normal Saline). There is a risk of respiratory depression when using IV diazepam. Infants must always be cared in an intensive care unit with Ambu bag and mask at bedside.

If this is not sufficient ⇒ 4th line:
- Decrease the frequency of diazepam administration to once every 4 hours. Administer a loading dose of phenobarbital 15 mg/kg IV or IM and then a maintenance dose of 5 mg/kg/dose once daily. Refer to the chapter on seizures for specific administration instructions (essentially the loading dose should be given over 20-30 minutes and the maintenance dose should be given over 5 minutes).

If this is not sufficient ⇒ 5th line:
- Continue the 5 mg/kg phenobarbital daily and increase the frequency of the diazepam doses.

If this is not sufficient ⇒ 6th line:
- Continue the diazepam and increase the frequency of the phenobarbital to 5 mg/kg/dose twice daily.

- If this is still not sufficient ⇒ consider magnesium sulfate and seek further medical advice.

**Note:** For diazepam (and even more when high dose is needed), «diazepam EMULSION» use is recommended. «Diazepam EMULSION» does contain neither Benzyl Alcohol nor Propylene Glycol, making it safer to use. «Diazepam EMULSION» is not yet into the ITC catalogue (February 2015) but should be ordered and used for all the neonatal tetanus as soon as it will be available. Its only particularity is the contraindicated use IR (intra-rectal), thus only IV use is possible: «Diazepam EMULSION» IV 0.1 – 0.3 mg/kg via slow injection every 1-4 hours, as the first line to treat spasm in neonatal tetanus.

**Treat comorbidities**

- In neonates, comorbidities are quite common. Therefore, treat for associated septicemia / sepsis, meningitis, or pneumonia – Refer to this chapter – since it is quite common.

**Feeding**

- Tetanus causes increased caloric needs (secondary to spasms).
- Give fluids, electrolytes and calories by infusion or oro/nasogastric tube (O/NGT).
- In neonates, mother's breast milk extracted manually or by pump should be administered by O/NGT. Due to decreased gut mobility, give frequent small volume of milk (ideally hourly feeds).

**Treat pain and ensure daily surveillance**

- For pain, cautiously give (high risk for respiratory failure in association with diazepam) oral morphine (PO or OG) 0.1 mg/kg every 3-4 hours according to needs.
- If this is insufficient, switch to IV morphine with a maximum dose of 0.15 mg/kg (administered over 5 minutes) every 4-6 hours.

- Pay attention to the infant respiratory status since you are combining two medications (morphine and diazepam+/- phénobarbital) that decrease respiratory drive.
- Lay the infant on his side on a soft surface (place neonates on urine bags filled with water and covered with cloth).
- For IV injections inject into the infusion tubing.
- Avoid unnecessary tests but always be aware of possible hypoglycemia.

**Weaning of morphine, diazepam, and phenobarbital:**

- In order to prevent withdrawal syndrome, these medications should be decreased progressively rather than abruptly discontinued.
- Decrease the morphine by half daily over 2 days. Observe the infant for 24 hours off of morphine. Then decrease the phenobarbital by 25% every day for 4 days.
• Observe the child for 24 hours off of phenobarbital. Then start to wean the diazepam by 25% every day x 4 days.
• Monitor the child x 24-48 hours off diazepam prior to discharge. It may take about 10 days to completely wean the infant off of all his sedating medications.

5 – PREVENTION

• All pregnant women should receive at least 2 tetanus toxoid vaccinations during pregnancy with a minimum 4 week-interval between the 2 doses. The final dose must be given more than 2 weeks before delivery in order to ensure protective immunity to the newborn.
• All women of childbearing age should be vaccinated with 5 total injections during the childbearing years.
• Clean umbilical cord care during childbirth and the early neonatal period is paramount.

Tetanus Prevention

Tetanus Toxoid (TT) Vaccination Scheme for non or incompletely immunized pregnant women

<table>
<thead>
<tr>
<th>Doses to be given</th>
<th>Protective effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>TT1 ASAP if 1st pregnancy</td>
<td>None</td>
</tr>
<tr>
<td>TT2 &gt; 4 weeks after TT1</td>
<td>1 to 3 years</td>
</tr>
<tr>
<td>TT3 &gt; 6 months after TT2</td>
<td>5 years</td>
</tr>
<tr>
<td>TT4 &gt; 1 year after TT3</td>
<td>10 years</td>
</tr>
<tr>
<td>TT5 &gt; 1 year after TT4</td>
<td>Long reproductive life</td>
</tr>
</tbody>
</table>

6 – MAIN ENTRY POINT of NEONATAL TETANUS: OMPHALITIS – Refer to this chapter

7 – VACCINATION POST TETANUS

• If the newborn survives after a neonatal tetanus, the vaccinations are still indicated, as the tetanus disease doesn’t immunize.
• The neonate will have to follow as usual the national EPI program: 5 doses of anti-tetanus vaccine.
14. MANAGEMENT of NEWBORN with HIGH FEVER

Definition:

- Neonates are at increased risk of serious bacterial infection, especially Very and Extremely LBW.

- All infants less than 2 months of age with an axillary temperature $\geq 38^\circ$C that persists more than 15 minutes after clothes removal and without an obvious source of infection (i.e., malaria, soft tissue infection) should be treated as a neonatal severe infection – Refer to this chapter.

- The following should be done:
  
  1°) In malaria endemic areas: RDT. If RDT is positive, complete systematically (if feasible) by a thin / thick malaria blood smear (maternal antibodies can across the placenta, so RDT is not reliable) prior to the lumbar puncture in order to exclude malaria – Refer to this chapter, part III.

  2°) There after a lumbar puncture should always be considered before starting the antibiotics or just after if culture is not available – Refer to these chapters “Neonatal infections”, part IV and “Procedures in neonatology”, part VII.

  Note that cell count, protein and glucose level in the CSF and Pastorex results will be unchanged if the LP is done shortly after the first dose of antibiotics was given.

Symptomatic case management:

- FIRST CONTROL THE ENVIRONMENT
  
  o If necessary, undress the neonate.
  o Cautious fresh wrapping.

- SECOND, only if absolutely necessary, PARACETAMOL oral or per O/NG tube:
  
  o 10 mg/kg/6 h.
15. MANAGEMENT of NEWBORN with HYPOTHERMIA

Definition:

- Newborn infants are susceptible to hypothermia especially if they are preterm babies. If a newborn has an axillary temperature less than 35.5°C the infant should be treated for hypothermia and investigated for neonatal infection.

- The infant should be screened for hypoglycemia and shock whenever hypothermia is present (dextro and vital values – Refer to the chapter on shock and the ETAT program) and, treated adequately.

Management:

- Wrap the infant in a warm dry blanket and feed immediately. Ensure that the head is covered with a bonnet. Place the bare child on the mother’s bare chest or abdomen (skin-to-skin) and cover both with a warm blanket or clothing – Refer to the chapter on Kangaroo Mother Care in the part V.

- If the infant does not respond or is unstable, an alternate solution to Kangaroo Mother Care can be the emergency survival blanket* according to it technical form with the infant installed close to his mother.

- If an external heat source, heater or lamp** is available, it might also be used according to it technical form and be installed close to the infant but only for a short period of time (30 minutes maximum for the Ceratherm).

- If an electrical heating pad*** is available, it should be used according to it technical form.

- If the infant’s temperature does not improve within 30 minutes, IV antibiotics should be given to treat for possible sepsis / meningitis – Refer to the chapter on Neonatal Sepsis / Meningitis.

Monitoring:

- Take the infant’s axillary temperature every 2 hours until it rises to more than 36°C. Take the temperature more often if an external heating source is being used.

- Maintain surveillance (clinical exam and vital signs) during 24 hours.

- Ensure that the child is covered at all times, especially at night. Keep the head covered at all times.

Prevention:

- Feed the infant every 2-4 hours depending on the gestational age (verify that the child is really fed according to the tables in part V), including throughout the night (with exception of a possible contraindication: i.e. shocks…).
• Change wet diapers, clothing, and bedding regularly to keep the infant dry.

• Let the infant sleep with the mother (skin to skin) for warmth at night.

**PS**

*Emergency Survival Blanket:*

If it is difficult to reach thermo stability, you can use an emergency survival blanket on the following way:

• Golden face outside & Silver face inside to fight against hypothermia.
• Silver face outside & Golden face inside to protect against the external heat.

Explanation: the golden surface has a capacity of heat absorption of 50% and the silver face reflects the infrared radiation at 90%. A human body is transmitting thermo radiation in the field of infrared.

• To fight against hypothermia, the golden face outside allows to the interior infrared radiation to be conserved and to the one coming from the external environment to be absorbed and to complete the heat contribution.
• To fight against external heat, the silver face outside allows to reflect the infrared radiation at 90%.
** EEMDWAIE3-- Mobile Warmer for Infants (Ceratherm 600-3), mobile (figure on the right below)

*** EEMDHEPE765 & EEMDHEPE650
Heating Pad, electrical (figure on the left below)

EEMDHEPA765  (heating pad ARDO Amecosy) MATTRESS + COVER 765x600x40
EEMDHEPA650  (heating pad ARDO Amecosy) MATTRESS + COVER 650x330x40
16. MANAGEMENT of NEWBORN with HYPOGLYCEMIA OR RISK OF HYPOGLYCEMIA

1 – DEFINITION
Hypoglycemia is a common neonatal problem. Infants who are premature or too large or small for gestational age are at higher risk. Persistent or recurrent hypoglycemia can result in neurologic sequels.

2 – CLINICAL PRESENTATION
Hypoglycemic infants frequently are asymptomatic and hypoglycemia is detected by routine monitoring of blood glucose in infants at risk.

Criteria defining newborns at risk for hypoglycaemia
- Presence of at least one of the following signs:
  - Hypothermia (axillary temperature < 35.5°C)
  - Irritability or trembling
  - Bradypnoea or apnoea or cyanosis
  - Difficulty breastfeeding (difficulty attaching to the breast, difficulty sucking, inadequate milk production)
  - Hypotony or poor response to stimulation (impaired consciousness)
  - Seizures
- Birth weight < 2500 g or > 4000 g
- Maternal diabetes
- Mother treated with Labetalol

Always check blood glucose if at least one of the above criteria is present.

Also consider a newborn at risk of hypoglycemia when:
- Small for gestational age
- Infants with conditions requiring intensive care (i.e., sepsis, asphyxia)

3 – CASE MANAGEMENT (CM)
- Management of hypoglycemia depends upon anticipation and prevention if possible. Healthy infants are fed as soon as possible after birth. It is important to maintain a normal axillary temperature between 35.5° and 37°C. Routine glucose monitoring should be performed in infants at risk for hypoglycemia or in those with clinical signs.

- If the blood glucose is normal (> 2.5 mmol/l or > 45 mg/dl):
  - Breastfeeding every 3 hours (add 10% dextrose PO if breastfeeding is insufficient).
  - Keep the infant warm.
  - Check the blood glucose before each meal until there are 3 consecutive normal results.

- If the hypoglycaemia is moderate (2 to 2.5 mmol/l or 35 to 45 mg/dl) and it is the first episode of hypoglycaemia:
- Put to the breast and give 5 ml/kg of 10% dextrose over 5-10 minutes PO or by gastric tube.
  - Or
- Administer 2 ml/kg of 10% dextrose by IV infusion as below, if an IV line is already in place and if the newborn is symptomatic.
- Check the blood glucose after 30 minutes; administer IV dextrose if blood glucose is < 2.5 mmol/l (< 45 mg/dl).
- Check the blood glucose before each meal until there are 3 consecutive normal results.

- **If the hypoglycaemia is severe (< 2 mmol/l or < 35 mg/dl) or recurrent:**
  - Place an IV line and administer 2 ml/kg of 10% dextrose.
  - If not feasible, administer 10 ml/kg of 10% dextrose by orogastric tube.
  - Then start a continuous infusion of dextrose 10%: 80 ml/kg/day for at least 24 hours (usually for 1-3 days). Initiating a D10% perfusion prevents rebound hypoglycemia (after a bolus) and decreases the risk of recurrent hypoglycemia. If hypoglycemia persists despite a D10% perfusion, administer a bolus of 2 ml/kg D10% for every hypoglycemic episode AND increase the concentration of glucose in the perfusion (maximum 15%).
  - Check the blood glucose after 30 minutes and then before each meal until there are 3 consecutive normal results.
  - Also check the blood sugar anytime you are decreasing of stopping a perfusion. Repeat the blood sugar prior to each meal until you have three consecutive normal results.
  - The use of 50% glucose (1 ml/kg) sublingually is recommended only if it is impossible to do an infusion or place an orogastric tube.
  - In addition to the above mention blood sugar checks, all infants (or at least all infants < 1500g) admitted to the neonatal ward should have their blood sugar checked at least once daily prior to discharge. The optimal time for checking blood sugars is in the early morning (i.e. 6 AM) because this is when the risk for hypoglycemia is highest (low ambient air temperature, forgotten night time feeds, etc…).

Always keep in mind that hypoglycemia can be an early sign of neonatal sepsis, so IV antibiotics can be indicated – Refer to the chapter “Neonatal Sepsis / Meningitis” in part IV.

Keep glycemia below 180 to 200 mg/dl and analyse situation since transient hyperglycemia due to stress (severe clinical situations) are an exception and not an indication to stop glucose intake / infusion but only to decrease a bit the concentration (try to maintain the flow according to the needs of the baby) for the time to return to the norm. Do NOT give NaCl 0.9% bolus to “correct” the hyperglycemia. Monitor the diuresis and rule out dehydration due to possible osmotic diuresis.
Material:

- ELAEGLUC2-- GLUCOMETER, blood glucose monitor (Nova StatStrip) + strips.
- ELAEGLUC2S: (glucometer Nova StatStrip) STRIP (50 strips per Unit ordered).
17. HYPOCALCEMIA

Hypocalcemia is a common metabolic problem in newborns.

The causes of early neonatal hypocalcemia (in the first two to three days after birth) include prematurity, intrauterine growth restriction, newborn from diabetic mothers (IDMs) and after perinatal asphyxia. **Maternal vitamin D deficiency** is among the causes of late neonatal hypocalcemia.

**Treatment**

**Treatment in case of clinical sign(s)**

- Severe irritability (or muscle jerking) without associated hypoglycemia
  - Or
- Seizure without associated hypoglycemia
  - Or
- Persistent Seizure despite appropriate treatment (**see chapter 2 “Seizures”, part IV**)
  - Or
- Newborn with at least one of the following signs (stridor, wheezing or vomiting) PLUS at least one of the following risk factor (birth weight < 1.5 kg, infant of diabetic mother or perinatal asphyxia)

If convulsion, follow the algorithm on neonatal seizures (which should include at a stage the treatment with Gluconate Ca 10%).

**Gluconate Ca 10% (DINJCALG1A-)**:

- 1ml/kg (= 100mg/kg) IV over a minimum of 10 minutes (monitor for bradyarythmia and make sure IV line in place as potential risk of subcutaneous necrosis).

- If still symptomatic, repeat same dose 10 minutes after the end of the first dose.

- If still symptomatic 10 min after the end of the second dose, make sure the absence of hypoglycemia, the absence of O2 desaturation (SpO2), and then discuss for use of MAGNESIUM sulfate, 0.5 g/ml, 10 ml, vial (DINJMAGS5V-): 1 ml= 2 mmol. Give IM MAGNESIUM sulfate 0.1 ml/kg, and repeat once the same dose after 1 hour.

- Then if oral route is not contraindicated, give directly after the dose above, **oral** Gluconate Ca 10% (DINJCALG1A-): 125 mg/kg/6 h x 3 days.

- Formulation : Vial 1 g, 100mg/ml, 10 ml, solution 10%.
  Example: If child 3kg ⇒ 375 mg/6 h so 3.8 ml/6 h x 3 days.

- If oral route is contraindicated, give Gluconate Ca ++ 10% (DINJCALG1A-) in the IV perfusion: 2 ml/kg of Gluconate Ca 10% into the IV perfusion over 6 hours. Repeat such infusion every 6 hours for a total of 2 days then stop. If still convulsing after 2 days, continue with oral Gluconate Ca 10% (DINJCALG1A-) as mentioned above.
Table: Oral treatment with Gluconate Ca 10% (DINJCALG1A-), Ampule 1 g, 100mg/ml, 10 ml, solution 10%

<table>
<thead>
<tr>
<th>Weight (in Kg)</th>
<th>Gluconate Ca 10% (Dose in ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>1.250</td>
<td>1.6</td>
</tr>
<tr>
<td>1.500</td>
<td>1.9</td>
</tr>
<tr>
<td>1.750</td>
<td>2.2</td>
</tr>
<tr>
<td>2</td>
<td>2.5</td>
</tr>
<tr>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>3</td>
<td>3.8</td>
</tr>
<tr>
<td>3.5</td>
<td>4.4</td>
</tr>
<tr>
<td>4</td>
<td>5.0</td>
</tr>
<tr>
<td>4.5</td>
<td>5.6</td>
</tr>
</tbody>
</table>

**Treatment in case of asymptomatic newborn but with risk factor:**

This includes all the newborn with at least one of the following risk factor:
- Birth weight < 1.5 kg
- Infant of diabetic mother and birth weight > 4 kg
- Severe asphyxia

As soon as feeding is started, give:
- Oral Gluconate Ca 10% (DINJCALG1A-): 125 mg/kg/6 h x 3 days ⇒ See above for formulation, table of dosage and example of calculation.
18. MANAGEMENT of NEWBORN with JAUNDICE

1 – PREVALENCE & NATURAL HISTORY

Jaundice is yellow colouring of the skin and mucous membranes due to hyperbilirubinaemia

Hyperbilirubinemia is a common transitional finding occurring in > 50% of term newborns and > 80% (almost all) of preterm newborns (liver immaturity).

It appears first on the face, and then moves to the chest and then the extremities.

The examination should be done in day light. It is done by pressing the infant’s skin and looking to see if it is yellow immediately after the pressure is removed.

Jaundice can be physiologic, with a yellowish skin colour, without the criteria for pathological jaundice below.

Physiologic jaundice is a diagnosis of exclusion in an infant in excellent general condition who is feeding well and whose neurological examination is normal.

Pathological jaundice starts the first day of life (the second day of life if < 35 weeks), and lasts more than 14 days in full-term infants or more than 21 days in premature infants. It has an intense colour that affects the palms of the hands and soles of the feet, and may be associated with a neonatal infection.

In cases of jaundice, consider septicaemia or congenital malaria.

Hyperbilirubinemia presents in neonates as either unconjugated or conjugated hyperbilirubinemia. The two forms involve different physiopathological origins, different causes with distinct potential complications.

**IMPORTANT RISK FACTORS FOR SEVERE HYPERBILIRUBINEMIA**

- Predischarge total serum bilirubin (TSB) or transcutaneous bilirubin (TcB) measurement in the high-risk or high-intermediate-risk zone
- Lower gestational age
- Exclusive breastfeeding, particularly if nursing is not going well and weight loss is excessive
- Jaundice observed in the first 24 h
- Isoimmune or other hemolytic disease (e.g., G6PD deficiency)
- Previous sibling with jaundice
- Cephalohematoma or significant bruising
- East Asian race
2 - CAUSES of pathological JAUNDICE (with exclusion of physiologic jaundice as explained above)

UNCONJUGATED (INDIRECT) HYPERBILIRUBINEMIA
- Congenital haemolytic anaemia (Hereditary Spherocytosis, Thalassemia, Pyruvate kinase and G6PD deficiencies) or acquired haemolytic anaemia (ABO or Rh blood group incompatibility, infection, drug-induced hemolysis).
- Polycythemia.
- Blood extravasation (cephalhematoma...).
- Breastfeeding and breastmilk jaundice (interruption of breastfeeding for 24-48 hours at unacceptable bilirubin levels results in a rapid decline).
- Increased entero-hepatic circulation of bilirubin.
- Defects of conjugaison.
- Metabolic disorders (hypothyroidism, galactosemia).
- Substances and/or disorders affecting binding of bilirubin to albumin: drugs, asphyxia, acidosis, sepsis, hypothermia, hypoglycaemia...

CONJUGATED (DIRECT) HYPERBILIRUBINEMIA
- Extra-hepatic biliary diseases (biliary atresia, bile duct stenosis, cholelithiasis, neoplasms, choledochal cyst...).
- Intra-hepatic biliary diseases.
- Hepatocellular diseases (metabolic and genetic disorders, infections, total parenteral nutrition, neonatal haemochromatosis, idiopathic neonatal hepatitis).
- Miscellaneous (Shocks; Hypoperfusion State; ECMO).
- Intra-hepatic cholestasis with normal bile ducts (viral, bacterial, other infections; genetic disorders and inborn errors of metabolism, idiopathic neonatal hepatitis – giant cell hepatitis; total parenteral nutrition-induced cholestasis).

3 - INVESTIGATIONS of ABNORMAL JAUNDICE
(In case it is available and easy to do)
- Haemoglobin or hematocrit.
- Full Blood Count.
- Blood Type of baby and mother, and Coombs Test.
- Syphilis Serology such as VDRL tests.
- Hepatitis serology and transaminases.
- G6PD Screen, Thyroid Function Tests, Liver Ultrasound.
4 – CRITERIA TO PROVIDE PHOTOTHERAPY TREATMENT for newborns with jaundice

a. Treatment based on clinical exam (when laboratory is not available)

<table>
<thead>
<tr>
<th>Time of onset</th>
<th>Criteria according to the clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 0</td>
<td>– All newborns, regardless of birth weight</td>
</tr>
</tbody>
</table>
| Day 1         | – Newborns < 1500 g  
– Newborns > 1500 g with extensive jaundice: head, chest, abdomen, upper arms and thighs |
| Day 2 or later | – Newborns < 1200g with jaundice  
– Newborns 1200 - 1500g with very extensive jaundice: head, chest, abdomen, upper arm and forearm, thigh and lower leg  
– Newborns > 1500g with:  
  • Very extensive jaundice: head, chest, abdomen, upper arm and arms, forearm, thigh and lower leg  
  AND  
  • At least one of the following risk factors: ABO or Rh incompatibility, asphyxia, G6PD deficiency, inadequate breastfeeding, infection, hypothermia, asphyxia, cephalohaematoma, maternal diabetes  
– Newborns > 1500g with no risk factors but extreme jaundice affecting also the palms of the hands and soles of the feet |

EXTENSION SCORE OF JAUNDICE

0 ➔ NONE
1 ➔ FACE AND NECK
2 ➔ CHEST AND BACK
3 ➔ ABDOMEN BELOW THE NAVAL AND TILL KNEES
4 ➔ ARMS AND LEGS BELOW THE KNEES
5 ➔ HANDS AND FEET
b. **Treatment based on laboratory**

- It is indicated to start phototherapy when Bilirubin (µmol/l) is > GA in weeks x 10 – 100.

   **Example:**
   - Neonate of 32 weeks of GA.
   - Calculation: 32 x 10 – 100 = 220.
   - Conclusion: For this neonate you should start phototherapy if bilirubin level in blood is higher than 220 µmol/l.

Or

- It is indicated to start phototherapy according to the WHO table 2012 below.

- **PS:** In case an exchange transfusion is indicated, try to refer to a health structure where it is feasible.

*(WHO 2012)*

![Photo of the WHO table 2012](image)

**c. Phototherapy in practice**

- The phototherapy lamp should be at the right distance indicated by the manufacturer for an optimal efficacy. It is important to follow the recommendations written by the manufacturer (often 35-50 cm).

- The maximum of the cutaneous surface of the newborn has to be exposed (small napkins for big neonates and facial mask as diaper for small premature).

- Don’t forget good eye protection during phototherapy *(see the photo below)*. Always cover the eyes of the neonate.

- **Note that phototherapy is not a danger for caregiver and/or health staff in charge of the baby (specifically there is no risk for their eyes).** Specific precautions are not needed for them and the phototherapy lamp should not be switched off during care.
o Maintain good hydration (breastfeeding); if necessary use infant formula or D10% and a gastric tube. Increase daily intakes by 10 to 20ml/kg/day compare to usual need.

o Start treatment for infection, if present.

o Sun exposure is not an effective treatment for severe jaundice. However, if there are no other options, expose the bare newborn to the sun for 10 minutes 4 times a day, in the morning and late afternoon, when the sun is not too strong.

o Always cover the infant’s eyes.

o Do NOT contruct and/or use a “home made” lamp with blue or white light as it is almost not efficient at all and could also be dangerous for the baby.

o Monitor vital signs every 2-3 hours

5 – CAUSAL MANAGEMENT of ABNORMAL JAUNDICE

- It depends on the cause of the jaundice and can be medical, dietary surgical or other.
- Don’t forget antibiotics and/or malaria treatment when they are indicated.

6 – Kernicterus

<table>
<thead>
<tr>
<th></th>
<th>Early stage</th>
<th>Intermediate stage</th>
<th>Advanced stage</th>
</tr>
</thead>
</table>
| **Acute encephalopathy** | Lethargy
Hypotonia
Poor suction
Acute cry, squeak | Stupor
Irritability
Hypertonia | Opisthotonos ; Shriek
Gyro-ocular crisis
Absence of suction
Apnoea; Fever
Coma; Convulsions; Death |
| **Chronic encephalopathy** |                       |                    | Cerebral Motor Handicap (CMH) with not coordinated and/or involuntary movements
Loss of hearing auditory for the high |
OVERHEAD INFANT PHOTOTHERAPY UNIT

EEMDPHOE1-- OVERHEAD INFANT PHOTOTHERAPY UNIT
(ARDO Amelux), 230V
UNITE DE PHOTOTHERAPIE pour NOUVEAU-NE
(ARDO Amelux), 230V
Indicative price/unit: 1255 €
Justification code: PM
Medical device class: IIb

EEMDPHOA001 PHOTOTHERAPY
EYE PROTECTOR
Neonate, single patient

new code: EEMDPHOA002 PHOTOTHERAPY
EYE PROTECTOR
Premature, single patient

Lesions of grey central nuclei
19. MANAGEMENT of a NEWBORN with GASTROINTESTINAL BLEEDING from the UPPER TRACT

1 – DEFINITION

Vomiting of bright red blood or active bleeding from the O/NGT is seen.

2 – QUESTIONS and EXAMS

- What are the vital signs?
- Comprehensive and cautious clinical exam including peripheral perfusion (colour and temperature of hands and feet, CRT), skin and abdominal exam with observation, palpation and auscultation, and anal examination.
- What is the Hb (Hte)?
- Is blood available in the blood bank? Is a transfusion necessary?
- Is there bleeding from other sites that suggests disseminated intravascular coagulation (DIC) or other coagulopathy. If bleeding is coming only from the O/NGT, disorders such as stress ulcer, nasogastric trauma and swallowing of maternal blood are likely causes to consider.
- Age of the newborn infant? Swallowing of maternal blood (1st day of life); pyloric stenosis (3 – 4 weeks of life)…
- Jaundice or not?
- What medications are being given (indomethacin, NSAIDs, corticosteroids…)?
- Was vitamin K1 given at birth? Failure may result in a bleeding disorder, usually at 3 – 4 days of life.

3 – CAUSES of GASTROINTESTINAL BLEEDING from the UPPER TRACT

- Idiopathic: > 50% of cases has no clear diagnosis and usually resolves spontaneously within several days.
- Swallowing of maternal blood: ~ 10% of cases (1st day of life, typically from caesarean delivery). No treatment.
- Ulcers: single stress ulcer and perforation are more common in the duodenum than the stomach in the neonate. Gastric erosions often precede the ulceration.
- Diffuse hemorrhagic or ulcerative esophagitis, gastritis, and duodenal mucosa lesions: can be caused by an increase in gastric acid secretion in neonates and infants.
• Allergic colitis such as formula intolerance after introduction. Milk protein sensitivity is secondary to cow’s milk or soybean formula and can present with upper GI or rectal bleeding usually in the second or third week of life.

• O/NGT trauma: Forceful insertion or too large tube.

• NEC – Refer to the chapter 11 in part IV.

• Coagulopathy: Hemorrhagic disease of the newborn (vitamin K1 was not given at birth) and DIC (bleeding from other sites and background since DIC can occur after severe infection, sepsis and/or meningitis, shock and severe fetal asphyxia) account for ~ 20% of cases. It can be also congenital coagulopathies; most commonly factor VIII deficiency (hemophilia A) or factor IX deficiency (hemophilia B).

• Drug induced bleeding
  o Indomethacin, NSAIDs, corticosteroids, heparin, high-dose dexamethasone…
  o Maternal use of aspirin, cephalothin and Phenobarbital.

• GI bleeding caused by liver disease, cholestatis.

• Pyloric stenosis: at the 3rd or 4th week of life.

• Congenital defect such as gastric volvulus, malrotation with volvulus, hirschprung disease with NEC, intussusception (rare in the neonatal period, more frequent in young infants 3 to 24 months), gastric duplication, and Meckel diverticulitis are rare causes of GI bleeding.

• Rare other causes: gastric teratoma, hemangioma of the stomach…

4 - MANAGEMENT of GASTROINTESTINAL BLEEDING from the UPPER TRACT

• It depends on the cause and severity of the bleeding.

• The initial plan is to address the loss of volume (treatment of hypovolemia) and so to give rapid volume replacement +/- blood transfusion (only when it is indicated) – Refer to the chapters 7 & 8 on “shocks & blood transfusion” in part IV.

• Any other supportive treatment as needed: oxygen…

• Stop the acute episode of GI bleeding if there is a significant bleeding:
  o Gastric lavages 5 ml/kg by O/NGT with ½ tepid sterile water + ½ NS (controversy about which fluid to use so this proposition is the best compromise) until the bleeding has subsided (never use cold-water lavages because they lower the infant’s core temperature too rapidly).
  o Some gastric applications of a solution containing adrenaline might be helpful and can be used (controversial) if tepid lavages do not stop the bleeding. Intra-gastric adrenaline 0.1% (1 ml = 1 mg): 1 vial to be diluted in 100 ml of sterile water (10 ml = 0.1 mg) then 0.5 ml/kg of the dilution x 3 / day in the stomach by the O/NGT (adrenaline is given locally because of its important vaso-constrictive action).

• Gastritis or stress ulcer: PO (10 mg capsules) or slow IV (minimum 5 minutes) omeprazole (curative treatment) 0.7 mg/kg, one single daily morning dose, without stopping enteral feeding when feasible, x 10 days.
<table>
<thead>
<tr>
<th>Weight in kg</th>
<th>Quantity (capsules at 10 mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 5</td>
<td>5 mg x 1/j</td>
</tr>
<tr>
<td>&gt; 5 - 10</td>
<td>10 mg x 1/j</td>
</tr>
</tbody>
</table>

- Ranitidine is not recommended due to the risk in the VLBW babies to have high risk to develop NEC or sepsis, and to the lack of studies in the newborn > 1.5 Kg
- Allergic colitis such as formula intolerance: eliminate the formula and change to maternal milk or protein hydrolysat milk without cow milk protein and without lactose.
- O/NGT trauma: in most of the cases, trauma is mild and requires only observation. If the O/NGT is too large, replacing it with a smaller one may resolve the problem.
- NEC – Refer to the chapter 11 in part IV.
- Coagulopathies:
  - Hemorrhagic disease of the newborn – Refer to the following chapter 19 in part IV.
  - DIC: investigate and treat adequately causes, specifically severe infections, and underlying conditions, plus supportive treatments as needed.
  - Congenital coagulopathies: there are needs for specialized consultation, specific lab testing and care that are generally not possible in MSF settings.
- Drug induced bleeding: stop the responsible drug.
- Gastrointestinal bleeding caused by liver disease, cholestatis: there are needs for specialized consultation, specific lab testing and care that are generally not possible in MSF settings.
- Pyloric stenosis: hydration and surgical pyloromyotomy are necessary and can generally be done in MSF programs or reference hospitals.
- Surgical conditions such as gastric volvulus, malrotation with volvulus, hirschprung disease with NEC, intussusception, gastric duplication, and Meckel diverculitis: these all require immediate surgical evaluation and decision according to contexts, settings...
1 – DEFINITION
A newborn infant has passed a red bloody stool: high or low digestive haemorrhage.

2 – QUESTIONS and EXAMS

• Is it grossly bloody?
• Is the stool otherwise normal in colour but with streaks of blood?
• Is the stool only positive for occult blood?
• Was the infant given vitamin K1 at birth?
• Age of the newborn infant?
• Comprehensive and cautious clinical exam including peripheral perfusion (colour and temperature of hands and feet, CRT), abdominal exam with observation, palpation and auscultation, and anal examination.
• Faecal occult blood testing (hemoccult test), haemoglobin +/- haematocrit and platelets, lab stool exam.

3 – CAUSES of BLOODY STOOL

• Occult blood only, no visible blood
  o Swallowing of maternal blood (accounts for 30% of bleeding) during delivery or breast-feeding (secondary to cracked nipples) may be the cause. Swallowed blood usually appears in the stool on the second or third day of life.
  o O/NGT trauma.
  o NEC – Refer to the chapter 11 in part IV.
  o Formula intolerance. Milk protein sensitivity is secondary to cow’s milk or soybean formula, and symptoms of blood in the stool usually occur in the second or third week of life.
  o Gastritis or stress ulcer (common cause and can be secondary to certain medications). Stress ulcers may occur in the stomach or the duodenum and are associated with prolonged, severe sepsis. Steroid therapy, especially prolonged, is associated with ulcers. Haemorrhagic gastritis can occur from aminophyllin therapy.
  o Unknown cause.
• Streaks of visible blood in the stool
  o Anal fissure.
  o Rectal trauma. This is often secondary to temperature probes.

• Grossly bloody stool
  o NEC – Refer to the chapter 11 in part IV.
  o Hemorrhagic disease of the newborn. Bloody stools typically appear on the second or third day of life. The entity occurs from vitamin K1 deficiency and can be prevented if it is administered at birth. Give IM vitamin K1 – Phytomenadione according to the MSF guidelines (see § 5, Part II). The standard dose is 1 mg IM (vial 2 mg / 0.2 ml, DO NOT USE the 10 mg / 1 ml vials because of manipulations, possible contamination…) at birth.
  o Disseminated intravascular coagulation (DIC). There is usually bleeding from other sites. This can be secondary from a severe infection (sepsis & meningitis).
  o Colitis due to intestinal infections causing bleeding such as Shigella, Salmonella, Campylobacter, Yersinia and enteropathogenic strains of E. Coli or dietary / formula intolerance factors including allergy and dietary protein-induced colitis.
  o Other infections, such as CMV, toxoplasmosis, syphilis, and bacterial sepsis – Refer to these chapters.
  o Bleeding diathesis. Platelet abnormalities and clotting factor deficiencies can cause bloody stools.
  o Surgical diseases such as malrotation with midgut volvulus, Meckel’s diverticulum, Hirschsprung’s enterocolitis, intestinal duplications, incarcerated inguinal hernia, and intussusception (rare in the neonatal period, more frequent in young infants 3 to 24 months).
  o Severe liver disease.

4 - MANAGEMENT of BLOODY STOOL

• It depends on the cause and severity of the bleeding.

• The initial plan is to address the loss of volume (treatment of hypovolemia) and so to give rapid volume replacement +/- blood transfusion (only when it is indicated) – Refer to the chapters 7 & 8 on “shocks & blood transfusion” in part IV.

• Any other supportive treatment as needed: oxygen…

• Anal fissure and rectal trauma: Observation is indicated. Petroleum jelly applied to the anus may promote healing. Avoid taking intra-rectal temperature.

• O/NGT trauma: in most of the cases, trauma is mild and requires only observation. If the O/NGT is too large, replacing it with a smaller one may resolve the problem.

• Gastritis or stress ulcer – Refer to the previous chapter 18 in part IV.

• Allergic colitis such as formula intolerance: Eliminate the formula and change to maternal milk or protein hydrolysate milk without cow milk protein and without lactose.

• Hemorrhagic disease of the newborn:

  To prevent the hemorrhagic disease of the newborn, all the babies must receive vitamin K1 – Refer to paragraph 5 in part II:
In MSF programs newborns are all considered at risk so the IM administration was chosen.

The standard dose is IM 1 mg (vial of 2 mg/0.2ml).

Do not use 10 mg / 1 ml vials at birth because of the difficulty of use and potential risk of errors and/or contamination.

In order to prevent the late onset of the disease between 4 and 6 weeks of age (up to 3 months), neonates less than 3 months who did not receive vitamin K1 at birth (who was born at home) should receive vitamin K1 as soon as possible.

To treat hemorrhagic disease of the newborn that might be very severe:

- Vitamin K1 1 mg slow IV if possible in severe forms in order to have immediate action and also because IM injections are not recommended in these cases.

- Vitamin K1 IM in case IV line cannot be secured rapidly (antero-lateral face of the thigh) (vial 2 mg/0.2 ml) equals 0.1 ml (syringe 1 ml).

- Can be repeated one time slow IV (if IV line is secured) or IM (if no IV line) after 4 to 6 hours according to clinical evaluation.

- Evaluation of vital values and correction of haemorrhagic shock as needed – Refer to chapters 7 & 8 on “Shocks Management” and “Anaemia / Transfusions” in part IV.

- NEC – Refer to the chapter 11 in part IV.

- Intestinal infections, colitis and sepsis, TORCH infections – Refer to these chapters.

- Surgical conditions such as malrotation with midgut volvulus, Meckel’s diverticulum, Hirschsprung’s enterocolitis, intestinal duplications, incarcerated inguinal hernia, and intussusception: these all require immediate surgical evaluation and decision according to contexts, settings...
22. MANAGEMENT of NEONATAL PAIN

Background

Pain is an important factor of stress in newborns, particularly in premature babies. It includes from daily manipulations to invasive medical procedures. Exposure to prolonged or severe pain may increase neonatal morbidity (HBP…) and cause long term impairment of psychobiological development (Attention Deficit Hyperactivity Disorder-ADHD, impaired learning etc…). Furthermore, infants who have experienced pain during the neonatal period will respond differently to subsequent painful events (altered pain memory at long term): Increased anxiety, hyperalgesia etc... Non-pharmacologic, simple to implement interventions can help neonates to cope with pain and to generate an adequate response.

Types and sources of pain in neonates

- Acute pain: Often related to diagnostic and therapeutic procedures such as tape removal, skin breaking procedures (heel lance, venous puncture etc.), minor surgery, suctioning and CPAP manipulation.
- Established pain: For example such as post-operative pain or inflammatory pain.
- Prolonged or disease-related pain: Meningitis, NEC, phlebitis etc.

Acute pain assessment in neonates-premature infants (PIPP Indicators)

- Neonatal Facial Coding System (NFCS):

<table>
<thead>
<tr>
<th>Facial features and characteristics</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brow bulge</td>
<td>0 1</td>
</tr>
<tr>
<td>Eye squeeze</td>
<td>No Yes</td>
</tr>
<tr>
<td>Nasal-labial furrowing</td>
<td>No Yes</td>
</tr>
<tr>
<td>Opening of the mouth</td>
<td>No Yes</td>
</tr>
</tbody>
</table>

Score: > 2 ➔ Pain management is recommended (refer to treatment).

Note: These indicators should not be used in neonates who are neurologically impaired.

- Other physiological indicators of pain include changes in the heart rate, respiratory rate, oxygen saturation and, palm sweating.
Principles for prevention and management of neonatal pain and stress

1. **Above all:** Look at; Listen; Explain to the mother; Be there.

2. **Minimize the number of daily manipulations and / or painful caring procedures** as much as possible.

3. In order to reduce pain from **bedside care procedures** such as tape removal, NGT placement / change, needle insertion, suction, etc… opt for a non-pharmacological approach: Breastfeeding, facilitated touching, tucking (holding the arms and legs in a flexed position), swaddling, maternal skin-to-skin contact (kangaroo method), sugary water, soft music therapy, massage...

4. **Concentrated sugary solutions**
   The analgesic effect on < 2 months old infants is well demonstrated and it is probably related to endogenous endorphins release. There is a synergism if the sugary solution is associated to suction.

   Efficacy is reinforced by other non-pharmacological methods (skin to skin, massage…).

   - **Indication:**
     - Mildly painful procedures: can be used alone or associated to antalgic level 1.
     - Moderate to severe procedures: associated to antalgic level 2-3.

   - **Quantity (sugary solution 25-30%):** (gauze soaked with D25-30% that is given to the child, between his lips for suction – very efficient with infants and young children)
     - Newborn:
       - 0.5 ml if weight < 2.5 kg
       - 1 ml if weight = 2.5 to < 3 kg
       - 2 ml if weight ≥ 3kg
     - Infant: 2 ml

   - **Timing of administration:**
     - Every 3-4 hours for at term newborn
     - Every 6 hours for pre-term babies

   - **Preparation:**
     - Prepare the material for analgesia and painful procedure
     - Place the child in a comfortable position (in the mother’s arms if possible)
     - Place the sugary solution on the tongue of the baby using a syringe or a nipple if available
     - Wait 2 minutes
     - Allow the child to suckle during the procedure
     - If needed, repeat the administration after 5 minutes

   - **Efficacy criteria:**
     - Absence of signs of pain according to the evaluation scale NFCS (Neonatal Facial Coding System).
     - Antalgic effect on children.

5. **PO or IV Paracetamol: 10 mg/kg/6 h**

   Don’t forget that good pain management in neonates allows 10 to 20% mortality reduction.
23. MANAGEMENT of TALIPES CLUB-FOOTED NEWBORNS

1. Early recognition.

2. When neurological exam is normal there are 2 situations:
   - Long, non-rigid and reducible talipes feet: very good prognosis when adequate physiotherapy is started early.
   - Short, rigid and not reducible talipes feet: reserved prognosis despite early adapted physiotherapy. Surgery will be necessary most of the time. It should be done ideally before the infant start walking.

3. Principles of treatment: Immediate daily physiotherapy associating cautious manipulations (we should avoid a possible trauma of the cartilages of the feet that are very fragile at this age) and immobilisation referring to the picture 2 above still few months after the infant is walking.

4. Physiotherapy should be continued few months after the infant is walking.
# 24. SURVEILLANCE & MONITORING FORM FOR SICK NEWBORN UNIT (NCU)

<table>
<thead>
<tr>
<th>NAME / FIRST NAME</th>
<th>SURVEILLANCE FORM CARE FOR SICK NEONATES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td></td>
</tr>
<tr>
<td>VITAL VALUES</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
</tr>
<tr>
<td>Heart Rate (HR)</td>
<td></td>
</tr>
<tr>
<td>CRT (norm &lt; 3 sec)</td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate (RR)</td>
<td></td>
</tr>
<tr>
<td>Chest in drawing</td>
<td></td>
</tr>
<tr>
<td>Apnoea</td>
<td></td>
</tr>
<tr>
<td>SpO₂ under air or oxygen</td>
<td></td>
</tr>
<tr>
<td>Oxygen in Litres/Min / Number of Neonates on the concentrator</td>
<td></td>
</tr>
<tr>
<td>Temperature (T⁰)</td>
<td></td>
</tr>
<tr>
<td>Glycaemia</td>
<td></td>
</tr>
<tr>
<td>Urine</td>
<td></td>
</tr>
<tr>
<td>FEEDING</td>
<td></td>
</tr>
<tr>
<td>Insertion / Change O/NGT</td>
<td></td>
</tr>
<tr>
<td>Insertion / Change IV Catheter</td>
<td></td>
</tr>
<tr>
<td>D10%</td>
<td></td>
</tr>
<tr>
<td>Maternal milk by O/NGT</td>
<td></td>
</tr>
<tr>
<td>Maternal milk with spoon</td>
<td></td>
</tr>
<tr>
<td>Maternal milk by supplemental suckling</td>
<td></td>
</tr>
<tr>
<td>Breastfeeding</td>
<td></td>
</tr>
<tr>
<td>Milk formula</td>
<td></td>
</tr>
<tr>
<td>Gastric aspirates (quantity and colour)</td>
<td></td>
</tr>
<tr>
<td>Vomiting / Stools</td>
<td></td>
</tr>
<tr>
<td>DRUGS</td>
<td></td>
</tr>
<tr>
<td>Caffeine citrate IV / PO</td>
<td></td>
</tr>
<tr>
<td>ATB1 IV / IM</td>
<td></td>
</tr>
<tr>
<td>ATB2 IV / IM</td>
<td></td>
</tr>
<tr>
<td>ATB3 IV / IM</td>
<td></td>
</tr>
<tr>
<td>Artesunate IV / IM</td>
<td></td>
</tr>
<tr>
<td>Phenobarbital IV / IM</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>8</td>
</tr>
<tr>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Temp. °C</td>
<td></td>
</tr>
<tr>
<td>37.5 - 37.9</td>
<td>🟢</td>
</tr>
<tr>
<td>36.1 - 36.4</td>
<td>🟢</td>
</tr>
<tr>
<td>35.1 - 35.9</td>
<td>🟢</td>
</tr>
<tr>
<td>&lt;35</td>
<td>🟢</td>
</tr>
<tr>
<td>Respiration Rate</td>
<td></td>
</tr>
<tr>
<td>31 - 59</td>
<td>🟢</td>
</tr>
<tr>
<td>26 - 30</td>
<td>🟢</td>
</tr>
<tr>
<td>&lt;25</td>
<td>🟢</td>
</tr>
<tr>
<td>Grunting</td>
<td></td>
</tr>
<tr>
<td>≥50</td>
<td>🟢</td>
</tr>
<tr>
<td>40 - 49</td>
<td>🟢</td>
</tr>
<tr>
<td>&lt;40</td>
<td>🟢</td>
</tr>
<tr>
<td>Heart Rate</td>
<td></td>
</tr>
<tr>
<td>≥190</td>
<td>🟢</td>
</tr>
<tr>
<td>150 - 189</td>
<td>🟢</td>
</tr>
<tr>
<td>100 - 149</td>
<td>🟢</td>
</tr>
<tr>
<td>80 - 99</td>
<td>🟢</td>
</tr>
<tr>
<td>&lt;79</td>
<td>🟢</td>
</tr>
<tr>
<td>SpO₂</td>
<td></td>
</tr>
<tr>
<td>≥94% Pink</td>
<td>🟢</td>
</tr>
<tr>
<td>90 - 94%</td>
<td>🟢</td>
</tr>
<tr>
<td>≤90% Dusky</td>
<td>🟢</td>
</tr>
<tr>
<td>Neurology</td>
<td></td>
</tr>
<tr>
<td>Alert - Active - Awake to feed</td>
<td>🟢</td>
</tr>
<tr>
<td>Irritable - Jittery</td>
<td>🟢</td>
</tr>
<tr>
<td>Poor feeding</td>
<td>🟢</td>
</tr>
<tr>
<td>Flappy - Difficult to awaken</td>
<td>🟢</td>
</tr>
<tr>
<td>Seizure</td>
<td>🟢</td>
</tr>
<tr>
<td>Tetanic spasms</td>
<td>🟢</td>
</tr>
<tr>
<td>Glucose &lt;45mg/dl</td>
<td></td>
</tr>
<tr>
<td>Glucose ≥45mg/dl</td>
<td>🟢</td>
</tr>
<tr>
<td>Others:</td>
<td></td>
</tr>
<tr>
<td>Score</td>
<td></td>
</tr>
<tr>
<td>GREEN</td>
<td>🟢</td>
</tr>
<tr>
<td>Orange</td>
<td>🟢</td>
</tr>
<tr>
<td>Red</td>
<td>🟢</td>
</tr>
</tbody>
</table>

All observations in GREEN ZONE continue observations as determined by doctor or midwife.

1 observation in ORANGE ZONE: Contact doctor or midwife. Management plan and review discussed. Repeat observation in 30 - 60 minutes.

≥2 observations in ORANGE ZONE: IMMEDIATELY contact doctor or midwife.

Any observation in the RED ZONE: IMMEDIATELY contact doctor or midwife.
PART V

KANGAROO CARE UNIT
NOT SICK LBW – VLBW – ELBW & IUGR
1. EVALUATION OF GESTATIONAL AGE (GA)

This evaluation will allow you to determine if, in an infant < 1.5 kg, it is necessary to place an oro gastric tube (< 34 weeks) or to initiate caffeine.

Gestational age: Some definitions
- Preterm Infant: < 37 weeks of gestation
- Term Infant: ≥ 37 weeks and < 42 weeks of gestation
- Post Term Infant: ≥ 42 weeks of gestation

<table>
<thead>
<tr>
<th>Gestational Age (GA) in weeks</th>
<th>&lt; 28 weeks</th>
<th>28 – &lt; 32 weeks / 32 – &lt; 37 weeks</th>
<th>37 – &lt; 42 weeks</th>
<th>≥ 42 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Extreme prematurity</td>
<td>Important (very) prematurity / Moderate to late prematurity</td>
<td>Term Newborn</td>
<td>Post Term Newborn</td>
</tr>
<tr>
<td>Normal birth weight depending on GA</td>
<td>600 – 1250g (mean = 925g)</td>
<td>1250 – 1750g (mean = 1500g) / 1750 – 2500g (mean = 2100g)</td>
<td>2500 – 4000g (mean = 3300g)</td>
<td>2500 – 4000g (mean = 3300g)</td>
</tr>
<tr>
<td>Evolving Risk</td>
<td>High or extreme Risk</td>
<td>At Risk</td>
<td>Norm</td>
<td>At Risk</td>
</tr>
</tbody>
</table>

Rapid assessment of gestational age in delivery room
A rapid method to assess gestational age uses 5 physical criteria at delivery (there are no neurological criteria because of possible birth asphyxia that can lead to be mistaken:
1. Creases in the sole of the foot.
2. Size of the breast nodules.
3. Nature of the scalp hair.
4. Cartilaginous development of the ear lobes.
5. External genitalia: Scrotum and testicular descent in males / Protuberance of labia minora and clitoris in females.

Prematurity & Growth Retardation
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>≤ 34 Weeks</th>
<th>35-37 Weeks</th>
<th>38 Weeks &amp; Beyond</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creases in the soles of the feet</td>
<td>1 or 2 transverse creases; posterior ¾ of sole smooth</td>
<td>Multiple creases; anterior 2/3 of heel with creases</td>
<td>Entire sole, including heel, covered with creases</td>
</tr>
<tr>
<td>Size of the breast nodule</td>
<td>Not visible / palpable (&lt; 33 weeks) or 1-2 mm</td>
<td>3-4 mm</td>
<td>5-7 mm</td>
</tr>
<tr>
<td>Nature of the scalp hair</td>
<td>Fine &amp; Wooly; fuzzy</td>
<td>Fine &amp; Wooly; fuzzy</td>
<td>Coarse &amp; silky; each hair single-stranded</td>
</tr>
<tr>
<td>Cartilaginous development of the ear lobes</td>
<td>No cartilage</td>
<td>Moderate amount of cartilage</td>
<td>Stiff ear lobe with thick cartilage</td>
</tr>
<tr>
<td>Males: Scrotum, penis &amp; Testis fully descended or not</td>
<td>Small scrotum and small penis Testis partially descended</td>
<td>Intermediate or variable</td>
<td>Normal size of the scrotum with deep rugae and prominent penis Testis fully descended</td>
</tr>
<tr>
<td>Females: Protuberance of clitoris and labia minora</td>
<td>Clitoris prominent and labia minora not recovered by labia majora</td>
<td>Intermediate or variable</td>
<td>Labia minora and clitoris recovered by labia majora</td>
</tr>
</tbody>
</table>
2. LBW – VLBW – ELBW – IUGR: CAUSES & CONSEQUENCES

Definitions

- LBW = Low Birth Weight:
  - < 2500 g according to the international and WHO definition.
  - < 2000 g according to MSF definition (for practical reasons of functionality).

- VLBW = Very Low Birth Weight: < 1500 g according to the international norms (and MSF definition).

- ELBW = Extremely Low Birth Weight: < 1000 g according to the international norms (and MSF definition).

- IUGR = Intra-Uterine Growth Retardation: < percentile 10th for the weight + the height + the cranial perimeter (CP) according to the international norms (and MSF definition).
  - Harmonious IUGR: BW, H and CP < percentil 10th in the same proportions.
  - Unharmonious IUGR: BW < percentil 10th but normal H and CP or < with different proportions.

<table>
<thead>
<tr>
<th>Birth Weight in g</th>
<th>&lt; 1000g</th>
<th>1000g - &lt; 1500g</th>
<th>1500g - &lt; 2000g</th>
<th>2000g - &lt; 2500g</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Extreme LBW</td>
<td>Very LBW</td>
<td>Low BW</td>
<td></td>
</tr>
<tr>
<td>Normal GA depending on Birth Weight</td>
<td>&lt; 30 weeks</td>
<td>30 – 32 weeks</td>
<td>33 – 34 weeks</td>
<td>34 – 36 weeks</td>
</tr>
<tr>
<td>Evolving Risk</td>
<td>Extreme Risk</td>
<td>High Risk</td>
<td>At Risk</td>
<td></td>
</tr>
</tbody>
</table>

Prematurity & Growth Retardation
**MAJOR EVOLVING RISKS FOR PREMATURE NEONATES AND INTRAUTERINE GROWTH RETARDATION (IUGR) OR SMALL FOR GESTATIONAL AGE**

**Causes of Prematurity**
- Multiple pregnancies
- Teenage pregnancies
- Premature rupture of membranes
- Gestational HBP – Pre-eclampsia – Eclampsia
- Abruptio placentae
- Cervix insufficiency
- Sepsis

**Causes of IUGR or Dysmaturity**

<table>
<thead>
<tr>
<th>Low Income Countries:</th>
<th>High Income Countries:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal undernutrition</td>
<td>Maternal intoxications (smoking…)</td>
</tr>
<tr>
<td>Maternal anaemia</td>
<td>Pre-eclampsia</td>
</tr>
<tr>
<td>Placental malaria</td>
<td>Congenital infections</td>
</tr>
<tr>
<td>HIV – infection</td>
<td>Chromosomal abnormalities</td>
</tr>
</tbody>
</table>

**Premas 10 top problems due to Immaturity**

<table>
<thead>
<tr>
<th>Organs</th>
<th>Problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Brain</td>
<td>Apnoea / PVH &amp; Leucomalacia</td>
</tr>
<tr>
<td>2. Lungs</td>
<td>IRDS / HMD / BPD</td>
</tr>
<tr>
<td>3. Liver</td>
<td>Hypoglycaemia / Jaundice</td>
</tr>
<tr>
<td>4. Gl – tract</td>
<td>Feeding difficulties / NEC</td>
</tr>
<tr>
<td>5. Kidneys</td>
<td>Salt loosing / Acidosis</td>
</tr>
<tr>
<td>6. Immunity</td>
<td>Infections (compromised immunity)</td>
</tr>
<tr>
<td>7. Circulation</td>
<td>Persisting Ductus Botalli / Arteriosus</td>
</tr>
<tr>
<td>8. Bone Marrow</td>
<td>Anaemia</td>
</tr>
<tr>
<td>9. Subcutaneous Fat</td>
<td>Hypothermia</td>
</tr>
<tr>
<td>10. Eyes</td>
<td>Retinopathy</td>
</tr>
</tbody>
</table>

**IUGR top problems**

1. Too thin ➔ Hypothermia
2. No stores ➔ Hypoglycemia
3. Brain ➔ Variable size according to the cause (micro, normal, macro)
4. Small liver ➔ Hypoglycemia
5. Foetal distress ➔ Meconium aspiration syndrome
6. Congenital malformation ➔ Depending on the cause
7. Short term prognosis ➔ OK when no birth asphyxia or hypoglycemia
8. Long term prognosis ➔ OK when no congenital malformations or infections
3. GENERAL PRINCIPLES MANAGING LBW, VLBW & ELBW

Low birth weight indicates prematurity (less than 37 weeks) or intrauterine foetal growth retardation or a combination of the two.

Low birth weight newborns, whether premature or not, are at significant short-term risk of hypothermia, hypoglycaemia, apnoea, respiratory distress, jaundice, infection, anaemia, dehydration and feeding problems, and at significant long-term risk of poor psychomotor development.

Newborns who weigh 1500 to 2500 g, regardless of the term, are managed in the maternity hospital if they are not sick and if they were born in the maternity, according to the recommendations below. If they were born out of a maternity, they should be managed in a neonatal care unit or in pediatrics, neonatal area, in the absence of neonatal unit, according to the recommendations below.

Newborns who are sick or who weigh less than 1500 g should be referred to a neonatal care unit whenever possible or in pediatrics, neonatal area in the absence of neonatal care unit.

Low Birth Weight (LBW) babies require special attention and specific care. In addition of the weight and the clinical examination, a systematic simple evaluation of gestational age (GA) should be done in delivery room and be reported on the neonatal surveillance sheet.

In all cases, LBW are at high risk for hypothermia, hypoglycaemia, apnoea, respiratory distress, jaundice, infection, anaemia, and dehydration, difficulties to feed and, so at high risk for poor neurological development.

Non sick babies < 1500g / < 34 SA should preferably be transferred to a neonatal kangaroo care unit. If it is not possible, in maternity as in kangaroo care unit follow the recommendations as indicated below.

**Management of jaundice** – refer to the chapter 17 in part IV.

Hyperbilirubinemia is a common transitional finding occurring in > 50% of term newborns and > 80% (almost all) of preterm newborns due to liver immaturity.

**Management of apnoea due to prematurity** – refer to the chapter 5 in part V.

Normally apnoea affect pre term babies ≤ 1500g and/or < 34 weeks of gestational age (GA).
4. KANGAROO MOTHER CARE (KMC)

The Kangaroo mother care (KMC) is a method of caring for infants that involves putting them on the mother's chest skin-to-skin, preferably 24 hours a day. This method can be used for all non-sick infant whose birth weight is less than 2500 g (prematurity and/or intrauterine foetal growth retardation).

The bare infant is placed vertically against the mother’s chest; the mouth should always be able to reach the nipple. Use a pagne to hold the infant.

If needed, use a blanket to keep the mother and infant warm.

When the mother is sleeping, her bust should be raised and the infant should be monitored.

Discuss with the team in order to find the right way for introduction when there are barriers due to cultural issues. Majority of failure of this method is due to non qualified medical staff who are most of the time not well informed and not convinced to the great impact of the use of Kangaroo care.

The objectives of the Kangaroo care are:

- To keep the infant warm and to prevent or treat hypothermia.
- To help get breastfeeding started and keep it going.
- To foster the mother-infant bond and reduce the infant’s stress.
- To reduce episodes of apnoea and bradycardia in premature infants (decreased Gastro-Oesophageal Reflux).

Note: the skin-to-skin contact can also be done by the father, another family member or a wet-nurse during periods when the mother is not available.

According to Cochrane Review, kangaroo care (KMC):

- Hypothermia about 80%.
- Nosocomial infections about 60%.
- Mortality post discharge of 40% and improve neuro development and growth.

Limitations to kangaroo care (KC)

- Acute respiratory difficulties (KMC are possible if SpO2 is stable and monitored).
- Hemodynamic unstability.
• Severe infection.
• Active IV infusion (not a contraindication but can make KMC more difficult) or invasive procedure.

Kangaroo Care (KC) in practice

Young infants are very susceptible to hypothermia. Always keep them warm, otherwise they are using all their energy in an attempt to produce heat, and there is none left for growth. The surface area of the head is very large compared with that of the body; therefore it is a major source of heat loss.

Figures 1, 2 & 3: Proper kangaroo care

• Cover the head to decrease heat lost.
• Keep room temperature at a minimal of 25°C.
• Use the kangaroo method:
  o The young infant is placed against the belly of the mother / wet nurse, with direct skin contact.
  o Place the baby in such a way that the breast is always within reach of the young infant’s mouth.
  o Use a cloth – see below the MSF model – to secure the baby and wrap the pair with a cover wrapped around the mother / wet nurse / father.
• Hold the baby vertically against the chest, maintaining skin-to-skin contact.
• Ensure the child is well covered, including head to prevent heat loss.
• Kangaroo Care can be provided equally by both, mother and father to prevent hypothermia of the infant.
• They need an adaptation phase, family solidarity and health staff support.
• At the beginning, Kangaroo Mother Care can be done by periods of time of 2 to 3-4 hours at the minimum in order to respect infant’s sleep and to decrease his stress.
• Info given to the parents is essential. It should a true contract parents – health team since duration of stay might be long so cohabitation is needed with respect of internal rules (hygiene, circulation…).

Figures 4 & 5: Kangaroo care while breastfeeding and sleeping (mother ideally elevated at 30 degrees from the horizontal plan).

Figures 6 & 7: Kangaroo care while breastfeeding and sleeping (mother should normally be elevated at 30 degrees from the horizontal plan).
Figures 8 & 9: Kangaroo care with involvement of both mother and father

**ALGORITHM to HELP DECISION at BIRTH**

- **NN < 2000g & > 1250g / > 31 GA**
  - CLINICAL EVALUATION
  - Install in “skin to skin” for 2 to 3 h and try to start suction / BF or alternate feeding by OGT
  - Apparition of DANGER SIGNS
  - Tests installing “skin to skin” for few hours / days
  - Good condition

- **NN < 2000g & < 1250g / < 31 GA**
  - Or poor GS
  - Or APGAR < 7 at 5’
  - NEONATAL CARE UNIT
  - Breathing well without O₂ (autonomy)
  - Good neuro status
  - Tests installing “skin to skin” for few hours / days

**DISCHARGE CRITERIA**

- Stabilized infants since at least 5 days and routine care were completed
- Autonomy for feeding (adequate suction) since at least 3 to 5 days
- Gaining weight since at least 3 to 5 days and at the minimum > 1500g
- Weaning of caffeine without apnea since at least 3 to 5 days
- Gestational age > 35 weeks
- Educated, committed, autonomous mother regarding her baby’s care, community handover & further consultations for follow-up
5. APNOEAS of the PREMATURITY (< 1500g; < 34 weeks)

GENERALLY BABIES with WEIGHT ≤ 1500g and/or gestational age < 34 weeks of pregnancy ARE AFFECTED.
They should be systematically prevented in these categories of newborns.

DEFINITION

Babies commonly have **periodic breathing** with pauses of 5 to 10 seconds between breaths. It becomes an apnoea if the pause in breathing is accompanied by:

- Bradycardia (< 100 / min)
- Hypoxemia (SpO2 < 90%)
- And lasts > 20 seconds.

Apnoea might occur in term babies but most commonly it is affecting very / extreme premature babies. It is called apnoea of prematurity (linked to the immaturity of cerebral respiratory centres).

Apnoea is due to two main causes:

- Central hypoventilation (apnoea of prematurity)
- Obstructive apnoea (i.e. bad neck position...).

DIFFERENTIAL DIAGNOSIS of apnoea of prematurity = Diagnosis by exclusion

- Other causes of central apnoea: Sepsis, RSV bronchiolitis, vagal stimulation, oro/nasogastric tubes, gastro-oesophageal reflux (GOR).
- Obstructive apnoea (breathing movements but not airflow due to upper airway obstruction): neck flexion, choanal atresia, macroglossia (Down syndrome...), micrognathia (Pierre Robin syndrome), thick neck (obesity), narrow airway (tracheomalacia, laryngeal oedema, laryngospam).
- Other factors: Birth asphyxia, birth trauma, IVH, metabolic disorders (hypoglycaemia, hypocalcemia, hyponatremia, acidosis), thermal disorders (hypo-hyper thermia), any severe sepsis, drugs (maternal opiates, narcotics, sedatives, beta-blockers), GOR, cardiac insufficiency, patent ductus arteriosus (PDA).
- Summary table

<table>
<thead>
<tr>
<th>Causes</th>
<th>At term newborns</th>
<th>Preterm newborns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metabolism</td>
<td>Hypoxia</td>
<td>Hypoxia</td>
</tr>
<tr>
<td></td>
<td>Hypoglycaemia</td>
<td>Hypoglycaemia</td>
</tr>
<tr>
<td>Infections</td>
<td>Septicaemia – Meningitis</td>
<td>Septicaemia – Meningitis</td>
</tr>
<tr>
<td></td>
<td>Necrotizing enterocolitis</td>
<td>Urinary infection</td>
</tr>
<tr>
<td>Circulation</td>
<td></td>
<td>Patent ductus arteriosus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Anaemia</td>
</tr>
<tr>
<td>Digestive track</td>
<td>Gastro-oesophageal reflux</td>
<td>Gastro-oesophageal reflux</td>
</tr>
</tbody>
</table>
CASE MANAGEMENT of apnoea of prematurity

- First, try always some none traumatic manual stimulations.
- Second, bag & mask ventilation with oxygen when necessary.
- Third, systematically eliminate and treat a medical cause such as perinatal asphyxia, neonatal infection, convulsion, hypoglycaemia, anaemia, hypothermia, “aggressive” suction, inappropriate drugs (sedatives, opiate analgesics during labour, and anaesthetics during caesarean section…), etc...

- **Medical treatment for prevention of the apnoeas due to immaturity (idiopathic apnoeas):**
  - MSF ITC catalogue: CAFFEINE CITRATE, 10mg/ml, eq to 5 mg caffeine base, 1ml amp.
  - The caffeine vial can be kept between 2-8°C for max 24h after opening. For most of the newborn Units, 1-2 vials are enough for the total need for a period of 24-48h.
  - Loading dose: 20 mg/kg Caffeine Citrate as single dose Oral or IV.
  - Daily maintenance dose: 5 mg/kg/dose Caffeine Citrate once daily Oral or IV.
  - ALWAYS prefer oral route. IV route is only when there is an oral contraindication (NEC …).
  - If IV route is chosen, always flush the IV line after administration. Use some ml of NaCl 0.9%.
  - **Dosage of CAFFEINE CITRATE, 10mg/ml, eq to 5 mg caffeine base, 1ml amp.**

<table>
<thead>
<tr>
<th>Weight</th>
<th>Caffeine Citrate Loading ORAL OR IV</th>
<th>Caffeine Citrate Daily dose (maintenance) ORAL OR IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.8 Kg</td>
<td>1.6 ml</td>
<td>0.4 ml</td>
</tr>
<tr>
<td>0.9 Kg</td>
<td>1.8 ml</td>
<td>0.5 ml</td>
</tr>
<tr>
<td>1 Kg</td>
<td>2 ml</td>
<td>0.5 ml</td>
</tr>
<tr>
<td>1.1 Kg</td>
<td>2.2 ml</td>
<td>0.6 ml</td>
</tr>
<tr>
<td>1.2 Kg</td>
<td>2.4 ml</td>
<td>0.6 ml</td>
</tr>
<tr>
<td>1.3 Kg</td>
<td>2.6 ml</td>
<td>0.7 ml</td>
</tr>
<tr>
<td>1.4 Kg</td>
<td>2.8 ml</td>
<td>0.7 ml</td>
</tr>
<tr>
<td>1.5 Kg</td>
<td>3 ml</td>
<td>0.8 ml</td>
</tr>
<tr>
<td>1.6 Kg</td>
<td>3.2 ml</td>
<td>0.8 ml</td>
</tr>
<tr>
<td>1.7 Kg</td>
<td>3.4 ml</td>
<td>0.9 ml</td>
</tr>
</tbody>
</table>
- **Surveillance of possible poor tolerance:** Tachycardia, vomiting, irritability (decrease the dosage).

**WEANING of Caffeine Citrate**

- Wait till the newborn reaches a weight of 1500g or 34 Weeks of gestational age (pre + post natal age).
- The baby should meet the following criteria:
  - No disease and/or apnoea / bradycardia since at least 5 days.
  - No anaemia responding to the criteria for blood transfusion ($\leq 7$ g/dl).
  - Stable glycaemia and temperature since at least 5 days.
  - Good weight gain since at least 5 days.
- After the weaning of Caffeine Citrate:
  - Close surveillance of vital values (x 4/d) and oxygen saturation (x 2/d) for 3 days.
  - Avoid discharging before 5 days without Caffeine Citrate and without problems.
6. PHYSIOLOGIC ANAEMIA in LBW, VLBW and ELBW BABIES
DIAGNOSIS – PREVENTION & CORRECTION

1 – CLINICAL DIAGNOSIS

**Definition of anemia**
- Hematocrit (Hct) or [Hemoglobin (Hb)]
  - < - 2 DS comparing with the mean for age
- Consequences of anemia
  - of the oxygen delivered to tissues (depending also of many other factors)
  - At term neonates, anemia if Hct < 45%
- or
  - 0 - 48h = Hb: < 16g/100ml
  - 3rd – 7th day = Hb: < 14g/100ml
  - > 7 days = Hb: < 10g/100ml

**Hypoplastic anemia - Physiologic anemia of the prematurity**
- Variable symptoms according to age, birth weight and severity of anemia
- After 15 days of life but generally around 3 – 6 weeks; more important in LBW / VLBW / ELBW
- Conjunctivae pallor
- Failure to gain weight / thrive
- Apnea with bradycardia
- No appetite and poor suction
- Tachycardia & Tachypnea
- Hypotonia

2 - IRON INTAKE for ELBW and VLBWB BABIES (WHO Universal Recommendations)

<table>
<thead>
<tr>
<th>Low Birth Weight Babies (&lt; 2.5 kg)</th>
<th>Systematic supplementation (WHO Universal Recommendation)</th>
<th>Iron: 2 mg/kg/day</th>
<th>Ideally from one month of life with exception of infants with any evolving suspected or sepsis under treatment for the end of the inpatient time. In any case at the time of the 1st post natal visit and at least for 4 to 6 months when feasible according to the program possibilities.</th>
</tr>
</thead>
</table>

3 – Ferrous Fumarate (MSF Catalogue) contains 45 mg iron/5 ml

**Ferrous fumarate**, 140mg/5ml (eq. iron 45 mg/5 ml) oral solution, fl - **DORAFERS2S**-

Normally any opened small bottle for a child should be given to the mother for her child’s treatment. According to conservation, hygiene, etc... One bottle should only serves one child.

<table>
<thead>
<tr>
<th>&lt; 1 000g</th>
<th>2.0 mg = 0.2 ml x 1/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 000 – 1 300g</td>
<td>2.0 mg = 0.2 ml</td>
</tr>
<tr>
<td>1 400 – 1 600g</td>
<td>2.8 mg = 0.3ml</td>
</tr>
<tr>
<td>Weight Range</td>
<td>mg/ml</td>
</tr>
<tr>
<td>---------------</td>
<td>---------</td>
</tr>
<tr>
<td>1 700 – 1 900g</td>
<td>3.4 mg = 0.3 ml</td>
</tr>
<tr>
<td>2 000 – 2 300g</td>
<td>4.0 mg = 0.4 ml</td>
</tr>
<tr>
<td>2 400 – 2 600g</td>
<td>4.8 mg = 0.5 ml</td>
</tr>
<tr>
<td>2 700 – 2 900g</td>
<td>5.4 mg = 0.5 ml</td>
</tr>
<tr>
<td>3 000 – 3 300g</td>
<td>6.0 mg = 0.6 ml</td>
</tr>
<tr>
<td>&gt; 3 400g</td>
<td>7.0 mg = 0.7 ml</td>
</tr>
</tbody>
</table>

4 – INDICATIONS FOR BLOOD TRANSFUSION IN NEONATES

- Hb $\leq 7$ g/dl +/- signs of poor tolerance (apnea, bradycardia…) (vital prognosis is engaged) in the absence of associated disease.
- $7 >$ Hb $\leq 10$ g/dl in case of existing associated disease (i.e. Hypovolemic or septic shock, NEC, RDS, HMD or severe LRTI).
- $9 >$ Hb $\leq 12$ g/dl in case of congenital cyanotic cardiopathy and only in these cases.

5 – BLOOD TRANSFUSION SHOULD BE DONE AFTER TRANSFER IN A UNIT FOR SICK NEWBORNS OR IN PEDIATRICS

REFER TO CHAPTER 8, PART IV FOR BLOOD TRANSFUSION INDICATION AND PRACTICE.
<table>
<thead>
<tr>
<th>NAME / FIRST NAME</th>
<th>SURVEILLANCE FORM</th>
<th>NEONATAL KANGAROO CARE</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VITAL VALUES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heart Rate (HR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRT (norm &lt; 3 sec)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate (RR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest in drawing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apnoea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\text{SpO}_2) under air</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Temperature ((\text{T}^\circ))</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Glycaemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEEDING</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insertion / Change O/NGT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D10%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal milk by O/NGT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal milk with spoon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maternal milk by supplemental suckling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breastfeeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milk formula</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric aspirates (quantity and colour)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vomiting / Stools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DRUGS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caffeine citrate PO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATB1 IM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATB2 IM</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium fedeate (Iiron) PO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
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<tr>
<td>Other:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fetal-Infant Growth Chart for Preterm Infants

Plot growth in terms of completed weeks of gestation.


Citation: Fenton TR. BMC Pediatr 2003 Dec 16; 3(1): 13

Gestational age (weeks)

Date

Weight (kilograms)

Head Circumference

Length

Weight

Centimeters

Centimeters

Weight (kilograms)
PART VI

FEEDING & INFUSIONS MANAGEMENT
Exclusive breastfeeding (no food or drink other than breast milk) for the first 6 months is the best choice for infants, regardless of the term or birth weight.

For HIV-infected mothers – Refer to section 5, part III.

If the infant is unable to suck effectively or at all:
• Breast milk can be expressed with a breast pump or by hand.
• If the infant has a good swallowing reflex: the milk can then be given by cup, spoon or syringe.
• If the infant cannot swallow effectively or at all: the milk is given with a gastric tube to prevent aspiration and exhausting the infant.

If sucking is ineffective, check for hypoglycaemia and danger signs.

If the child is able to suckle but the quantity of maternal milk is not sufficient, the supplemental suckling technique offers the possibility to feed her/him with infant milk while stimulating milk production.

Always make sure that any medications being taken by the mother are compatible with breastfeeding, and if necessary, adjust the treatment accordingly.

For the Low Birth Weight newborns (< 2500g):

Exclusive breastfeeding is the best choice:
• If sucking is ineffective but the swallowing reflex is present: express the milk manually or using a breast pump and feed the infant using a cup/spoon.
• If sucking is ineffective and the swallowing reflex is poor or absent: express the milk and feed the infant using a gastric tube.
• For the daily amounts required for feeding, refer to the correspondent sections below.
• If mother does not have enough milk:
  o In the first 72 hours of life, make up the required amounts with 10% dextrose PO.
  o After 72 hours of life, make up the amount with infant formula (or if not available, use diluted F 100 milk).
  o At the same time, continue to stimulate the mother’s milk production (breast pump and the “supplementary nursing” technique).

In case of regurgitation:
• Administer each meal very slowly.
• Hold the infant tilted slightly head-up.

In case of vomiting, abdominal distension, blood in the stool or greenish, foul-smelling stool, stop feeding and request a medical opinion.

In all cases, try putting the infant to the breast periodically to test whether he can (or cannot) breastfeed effectively.
For the less than 2500g, same monitoring as for the over 2500g, but also need:
• Daily weighing;
• Temperature every 4 hours;
• Blood glucose test before every meal or every 3 hours until there are 3 consecutive normal results. In case of hypoglycaemia, see chapter 16 “Hypoglycemia”, part IV.

Breastfeeding success factors

The factors for success in breastfeeding are:
• Informing pregnant women about breastfeeding benefits and implementation.
• Putting the infant to the breast early, within an hour of birth.
• Correct and comfortable positioning of mother and infant. Proper latch-on allows effective sucking and reduces complications (cracks): the infant should face the mother’s body, with the chin against her breast, the nose free and the nipple and most of the areola in the mouth.
• For women with inverted or flat nipples: use techniques to help nipple protrude (nipple massage, use of breast pump just before the infant feeds).
• Maintaining exclusive breastfeeding (unless medically contra-indicated).
• Breastfeeding on demand at least 8 times a day (at least every 3 hours).
• Good hydration (at least 3 litres/day) and a caloric intake > 2500 Kcal/day for the mother, as these directly affect the amount of milk produced.
• Nipple care, washing with water before nursing.
• An organisation that allows the mother and infant to stay together 24 hours a day.
• Help with maintaining lactation even if the mother has to be separated from her infant (preventing milk production from stopping due to lack of stimulation).

Do not stop breastfeeding if:
• The infant has diarrhoea: explain to the mother that her milk is not causing the diarrhoea.
• The mother is sick (unless serious condition): explain to the mother that her milk is not of poor quality because she is sick.
Hand expression and storage of breast milk

- Hand expression is an alternative when a breast pump is not available.
- Milk is expressed every 2 to 3 hours.
- Show the mother the technique. Give her a clean cup or container for collecting the milk. The container should be washed, boiled and rinsed with boiled water and air-dried before each use.

- Technique
  - Wash hands, sit comfortably and hold the container under the breast.
  - With the other hand, hold the breast up with four fingers, and place the thumb above the areola.
  - Squeeze the areola between the thumb and the fingers while pressing backward toward the rib cage.
  - Express each breast for at least 5 minutes, alternating, until the milk stops flowing.
  - If the milk fails to flow, check the technique and apply warm compresses to the breasts.
  - Feed the infant immediately after expressing the milk (by cup or gastric tube).
  - If the infant does not take all of the collected milk, it can be stored in a clean container in the refrigerator (2 to 8°C) for a maximum of 24 hours.
  - Warm the milk at 37°C (water bath) to body temperature for the next feeding.
Administering the milk by cup or other utensil

- The milk can be administered using a cup, spoon or syringe.
- Use a clean (washed, boiled or rinsed with boiled water and air-dried) container / utensil for each feeding.

**Technique**

The mother should (with help from a carer):
- Measure out the volume of milk needed according the infant’s age and weight.
- Hold the infant in a half-seated or upright position on her lap.
- Place the cup / spoon gently against the infant’s lower lip and touch the outside of the upper lip with the edge of the cup.
- Tilt the cup / spoon so that the milk just reaches the infant’s lips.
- Let the infant take the milk at his own pace; never pour the milk into the mouth.
- Stop feeding when the infant closes the mouth and is no longer interested in feeding.
Administering the milk by oro/nasogastric tube

- **Indications**
  - Infants < 1500g: poor sucking, limited or no coordination between sucking and swallowing, tire rapidly.
  - Infants with respiratory distress: risk of aspiration, tire rapidly.
  - Infants with poor general condition (asphyxia, meningitis, seizures, etc…): little or no sucking, weak reflexes.
  - Infants with cleft palate, particularly when the cleft is very wide.

- **Placing the tube**
  *See Part VII, Chapter 2.*

- **Feeding by gastric tube**
  - Before each feeding:
    - Check that the abdomen is not distended or painful.
    - Aspirate the gastric contents to verify that the gastric tube is in the correct position and evaluate the gastric residual:

<table>
<thead>
<tr>
<th>Description of gastric aspirates</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric aspirates ≥ 3 ml/kg/meal <strong>and</strong> dirty, bloody, green or greenish and/or fetid</td>
<td>Stop enteral feeding, install O/NGT with the extremity opened, downward sloping in a bag for gastrointestinal drainage. Make a complete clinical exam including the abdominal wall, stools, vital values and discuss a possible infectious cause such as NEC - <em>See the chapter 11 in Part IV.</em></td>
</tr>
</tbody>
</table>
| Gastric aspirates < 3 ml/kg/meal **and** dirty, bloody, green or greenish and/or fetid | Throw gastric aspirates, don’t give the next meal, make a complete clinical exam including the abdominal wall, stools, vital values and discuss a possible infectious cause such as NEC:  
  - Absence of danger sign and/or alarming general condition ➔ Re evaluation just before the next meal in order to decide to restart or not enteral feeding, to install IV line, etc…  
  - Danger sign and/or alarming general condition ➔ stabilize the neonate adequately; start again the management of feeding / infusion according to the cause and the clinical evolution. |
| Gastric aspirates < 3 ml/kg/meal **and** clean with red or black blood in small quantity | Throw gastric aspirates, don’t give the next meal, make a complete clinical exam including the abdominal wall, stools, vital values and discuss a possible infectious cause such as NEC:  
  - Absence of danger sign and/or alarming general condition ➔ Think about acute gastritis due to stress and treat with PO (slow IV) oméprazole 0.7 mg/kg, a single daily morning dose, **without stopping enteral feeding.**  
  - Danger sign and/or alarming general condition ➔ stabilize the neonate adequately; treat with oméprazole, |
<table>
<thead>
<tr>
<th>Gastric aspirates ≥ 3 ml/kg/meal ≥ 2 times successively and clear (or milky)</th>
<th>Start again the management of feeding / infusion according to the cause and the clinical evolution. Reinject gastric aspirates and continue enteral feeding but maintain the quantity planned for the previous meal with deduction of gastric aspirates for the next meal (don’t increase = no change) still gastric aspirates return to the norm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastric aspirates &lt; 3 ml/kg/meal and clear (or milky)</td>
<td>Reinject gastric aspirates and continue enteral feeding with respect to the established program with deduction of gastric aspirates.</td>
</tr>
</tbody>
</table>

**Attention to stop enteral feeding adequately** (critical general condition, abnormal abdominal signs, bloody stools in the absence of anal fissure, bilious / greenish gastric aspirates…) but don’t stop enteral feeding to all neonates with plus or minus clear gastric aspirates when they have a good general condition and normal clinical exam.

- Then, if the problem is rapidly solved, enteral feeding can be restarted at the stage it was interrupted (or a bit less), increasing slowly and progressively of 20 ml/kg/d if every thing is going well.
- Then, if the problem is not rapidly solved, enteral feeding can only be restarted later, after improvement, at the stage of 20 ml/kg/d, increasing slowly and progressively of 20 ml/kg/d if every thing is going well.

**Administering the milk:**

- Take a sterile or clean (washed, rinsed with boiled water and air-dried) syringe, large enough to hold the total amount of the feeding. Remove the plunger and connect the syringe to the conic end of the tube.
- Pour the milk into the syringe, which should be held vertically.
- Ask the mother to hold the syringe 10 cm above the infant and let the milk flow through the tube by gravity.
- Do not use the plunger of the syringe to force the milk down faster.
- Each feeding should last 10 to 15 minutes.
- For the adequate daily quantities of milk, refer to the correspondent sections.
“Supplementary suction” technique

This technique is used to maintain breastfeeding when milk production is less than the daily amount needed by the infant.

It consists of giving the infant formula through a feeding tube while stimulating milk production.

- **Technique**
  - Cut off the end of a CH8 gastric tube (1 cm from the holes) and remove the cap from the other end.
  - Attach the first end to the nipple using adhesive tape. Place the other end in the cup. The infant should have both the nipple and the tube in the mouth as he nurses (Figure 1).
  - The mother should hold the cup 10 cm below breast-level, so that the milk is not sucked up too quickly.
  - The infant may need 2 or 3 days to adjust to the technique. If, for the first few days, the infant does not take all of the milk in the cup, give him the rest with a cup, spoon or syringe.

![Figure 1: “Supplementary suction” technique](image)

Management of feeding problems (summary)

<table>
<thead>
<tr>
<th>Situation</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem with breastfeeding, but breastfeeding seems possible (milk production, sucking and swallowing are all adequate)</td>
<td>- Give mother more advice, build her confidence, always have a member of the medical team present during breastfeeding, recording observations in the infant’s chart</td>
</tr>
</tbody>
</table>
Breastfeeding with inadequate amount of breast milk (amount of milk produced less than infant’s daily requirements)

- Stimulate milk production by frequent breastfeeding (8 x/day).
- Use a breast pump and the “supplementary nursing” technique.

Ineffective sucking but good swallowing reflex

- Express the milk with a breast pump or by hand.
- Administer the milk using a cup, spoon or syringe.

Ineffective sucking and poor or no swallowing reflex

- Express the milk with a breast pump or by hand.
- Feed breast milk via a gastric tube.

**Breastfeeding in HIV-infected women**

- To reduce the risk of HIV transmission, mothers should receive long-term antiretroviral therapy or for as long as they are breastfeeding.
- Exclusive breastfeeding is recommended for the first 6 months of life, with gradual weaning over one month starting at age 6 months. Stopping breastfeeding abruptly is not recommended.
- Breast milk substitutes can be used as an alternative to exclusive breastfeeding only under the following conditions:
  - There is enough infant formula available for exclusive use to age 6 months.
  - The mother (or the person in charge) is able to prepare the formula under good hygiene conditions and frequently enough to limit the risk of diarrhoea or malnutrition.
  - There is access to a health care facility offering a full range of paediatric care.
2. Basic Principles to understand the choice of feeding the newborns (according to weight and health condition)

**Definition of « Days of Life » (DOL):**

- We are using WHO definitions for the first days of life (DOL) so day 0 does not exist.
- Use DOL 1 for the first 24 hours, then DOL 2, DOL 3…
- There is therefore no DOL 0.
- In practice, feeding orders should be written every morning during the medical rounds. Therefore, it is practical to consider the age of an infant in relation to the calendar date of his birth rather than the hours of life. Thus, the duration of DOL feeding prescription will be between 12 and 36 hours depending of the hour of birth within the day. 12 h corresponds for a baby born the day before, just before midnight with new feeding prescription after the ward round, thus around noon. 36 h corresponds for a baby born the day before, just after midnight with new feeding prescription after the ward round, thus around noon.

Example 1: baby born the 10th October at 10 pm. DOL 1 will be from 10 pm the 10th October till the new medical prescription after the ward round around 11 am – 1 pm the 11th October. This newborn receive a DOL 1 feeding for around 14 hours, then will receive DOL 2 feeding (since just after ward round the 11th October which is his second day of life).

Example 2: baby born the 10th October at 1 am. DOL 1 will be from 1 am the 10th October till the new medical prescription after the ward round around 11 am – 1 pm the 11th October. This newborn receive a DOL 1 feeding for around 14 hours, then will receive DOL 2 feeding (since just after ward round the 11th October which is his second day of life).

**Weight to use to calculate the infant’s feeds:**

- Use the maximum weight to date when calculating feeds (this is often the birth weight).

**Frequence of feeds:**

- BW ≥ 1.5 kg, feed at least 8 times daily (every 3 hours).
- BW < 1.5 kg, feed at least 12 times daily (every 2 hours).
- This will also depend on the capabilities of the neonatal unit to ensure such workload.

**Conditions of the neonate:**

- Very sick or VLBW infant: place an IV.
- Neonate who is too weak feed? Use an alternative feeding method (i.e. NG feeds).
- Neonate who is not sick and is capable of breastfeeding: oral feeds (breast feeds).

**Indications for IV placement:**
• Infant with severe neonatal infection*, asphyxia**, NEC, RDS +++***, severe dehydration (remember to first treat with a 10 ml/kg bolus of 0.9% NaCl)****:
  o *If only mildly ill ⇒ Try PO feeds.
  o **Asphyxia ⇒ Decrease the fluid load to 50 ml/kg/day on DOL 1 and then increase by 10 ml/kg/day, see below.
  o ***SDR + ⇒ Try PO (you may use a RR of 60/minute as the cut off for PO feeds).
    SDR ++ ⇒ Try feeding via GT.
    SDR +++ ⇒ IV line.
  o **** ⇒ Skip to DOL 2 if possible (with PO initiation).
• Infants with BW < 1500g (or < 1250g) ⇒ Always IV line for the first days when feasible.
• Infants with BW ≥ 1500g but < 1750g even mildly sick) ⇒ IV line is acceptable.

Indications Gastric Tube (O/NGT):
  o < 1250g after completion of 3 days IV.
  o 1250 à 1500g.
  o Occasionally 1500 à 1750g.
  o RDS ++.
  o Post asphyxia.
  o Cleft palate with inability to feed PO.

Notes:
  o In case of respiratory distress, weight < 1500g or cleft palate opt for an orogastric tube rather than a nasogastric tube. Both nares should be left unobstructed to optimize breathing.

  o IMPORTANT: After the placement of a gastric tube AND before every feed the possession of the tube MUST be verified. This should be done by injecting the tube with air, aspirating gastric contents, AND looking at the positioning mark placed on the tube.

  o ALL THREE CONFIRMATORY METHODS SHOULD BE USED EACH TIME.

  o Replace the tube every 3 days. Alternate nares with each tube change if the tube is naso-gastric or earlier if the tube is blocked and/or very dirty.

  o Prior to replacing the tube, try a PO feed and then consider whether gastric feeds are truly necessary.

    o French 6 (= CH6): < 2500g.
    o French 8 (= CH8): ≥ 2500g.
    o After every feed, rinse the tube with 2 ml 0.9% NaCl, D5%, or sterile water.

Feeding according to weight:
• BW < 1250g:
  o Starting at day of birth, always feed IV with a goal of stopping IV fluids by DOL 7.
• If IV fluids are not possible (no neonatal unit, basic maternity unit): D10% plus EBM oral for a total of 80 ml/kg/day on DOL 1.

• If the infant’s clinical condition is stable, start po on DOL 3 via gastric tube. Start with small quantities 12 x per day (see below). Transition to 8 x per day feeds once the infant has 8 DOL, weighs > 1500g, is taking oral well, and has stable blood sugars.

• Always start caffeine (wean starting at 1500g according to the infants tolerance thereof).

• BW 1250-1500g:

  - IV is usually indicated. Do not hesitate to use IV for at least several days.

  - If IV fluids are not possible (no neonatal unit, basic maternity unit): D10% plus EBM oral (total 80 ml/kg/day on DOL 1).

  - Tube feeds. 12 feeds per day with transition to 8 feeds per day as described above.

  - Caffeine (wean starting at 1500g according to the infants tolerance thereof).

• BW 1500-1750g:

  - Feedings PO 8 times daily using the supplemental suckling technique, tube feeds, or oral feeds from the outset (syringe or spoon) according to infant’s tolerance.

• BW > 1750g:

  - Start PO 8 times daily.

General comments:

  - 12 feeds per day if < 1500g and 8 feeds per day if > 1500g.

  - Regardless of whether it is PO or IV, we increase the fluids by 20 ml/kg/day (except in the case of asphyxia when we increase by 10 ml/kg/day).

  - IV: 80 ml/kg/day on DOL 1 for infants with BW < 1500g and 60 ml/kg/day for infants with BW > 1500g.

  - IV: For the first 2 days (DOL 1 and 2) give D10% only. Starting on DOL 3, give D10% mixed with sodium. Sodium (Na+): Mix 500 ml D10% with 125 ml 0.9% NaCl (this corresponds to 3 mmol/kg/day of Na+).

  - In general, IV fluids should be stopped once the infant receives 2/3 of their total fluid intake orally (in the absence of vomiting, abdominal distension, gastric residuals of > 3-4 ml/kg/feed, etc.). The other method for stopping IV fluids is to use the feeding table where the IV is decreased slightly each day. We recommend the latter method for practical reasons.

  - Ideally, if the infant is on IV fluids only and is passing urine correctly, we should be adding KCl into the perfusions as of DOL 4. However in the MSF contexts, this can be difficult and dangerous. You also should be sure that urine is passing well.
There is a study being conducted (in 2015) to evaluate the safety of using the oral route for infants < 1500g in place of systematic IV fluids. Waiting for better field evidence recommendations are maintained as explained above.

The maximum oral fluid load to be reached without IV fluid: 160 - 180 ml/kg/day (160 ml/kg/day is most of the time enough for term newborn. It is possible to increase to 180 ml/kg/day if not gaining weight correctly)

The maximum IV fluid load to be reached without oral fluid: 150 ml/kg/day

If a VLBW infant is not gaining weight despite an intake of 200 ml/kg/day (or even 220 ml/kg/day), we can supplement the maternal milk (or formula milk) by adding 5 g (= 10 ml = 1 spoon) of formula milk powder to 90 ml of maternal milk (or formula milk). This allows for the increase of calories without increasing the volume taken by the neonate.

**Oral feeds:**

- **Type of oral feed for the first few feeds when the newborn have an increased catabolism (< 2000g, Sick Neonates):**
  - 1<sup>st</sup> feed: Colostrum + D10% PO.
  - 2<sup>nd</sup> feed: Colostrum + D10% PO.
  - 3<sup>rd</sup> feed onward: Expressed breast milk (EBM). If the quantity is insufficient, supplement with D10% or formula milk during DOL 1-3. If EBM continues to be insufficient on DOL 4, supplement with formula milk (F100 diluted as last choice).

- **Term Neonate at DOL 1:**
  - 60 ml/kg/day increased by 20 ml/kg/day each day… However, if the infant is not sick and in maternity: DOL 1 is 20 ml/kg/day and then increase by 20 ml/kg/day each day (very theoretical as the healthy newborn is breastfed and nobody is monitoring the quantities of breast milk taken but the weight).

- **Multiple methods for oral feeding**
  - Express the breast milk (manually or with a pump) with storage of the EBM (maximum 24 hours in the fridge at a temperature between 2-8° C).
  - Give the milk with a small cup or other utensil.
  - Administration of milk via NG or OG tube.
  - « Double suckling technique ».

The indications for each feeding method are unique. Please see corresponding chapters.

The breast pump has advantages over manual breast milk expression. Manual breast milk expression does not stimulate breast milk production and thus there is a risk of decreased breast milk production after several days of using this technique. The use of breast pumps is therefore preferred (with regard for proper hygiene).
Metoclopramide: Minimally effective in increasing breast milk production and runs the risk of extra pyramidal effects. Therefore this medication is not recommended even if the mothers have poor milk production.

**Measure blood sugar**

- When there is a risk of hypoglycemia including when there are signs of hypoglycemia – *Refer to this chapter* 
  ➜ Follow the protocol on risk of hypoglycemia (verify the blood sugar prior to each feed until you have three consecutive normal values).

- Every time you decrease the IV fluid rate (ideally, you should check before each feeds until three consecutive normal values are obtained, but practically, one normal value after decreasing the rate should suffice.)

- After stopping IV fluids (ideally, you should check before each feeds until three consecutive normal values are obtained, but practically, one normal value after decreasing the rate should suffice.)

- Once daily in all infants weighing < 1500g (ideally at 6 AM).

**Fluid and caloric intake for the mother**

- The mother should drink at least 2-3 liters per day

- In addition, give one additional cup per breastfeed.

- If needed, give the mother PPN to ensure a minimum maternal caloric intake of 2500 Kcal/day (ideally 3200 Kcal/day).

**Summary**

<table>
<thead>
<tr>
<th>Birth weight</th>
<th>Total fluid intakes at DOL1</th>
<th>Daily increase of the quantity</th>
<th>Total maximum daily fluid intakes</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1250 g</td>
<td>80 ml/kg/d</td>
<td>10-20 ml/kg/d</td>
<td>200-220 ml/kg/d</td>
</tr>
<tr>
<td>1250 g - &lt; 1500 g</td>
<td>80 ml/kg/d</td>
<td>10-20 ml/kg/d</td>
<td>180 ml/kg/d</td>
</tr>
<tr>
<td>≥ 1500 g</td>
<td>60 ml/kg/d</td>
<td>20 ml/kg/d</td>
<td>160 ml/kg/d</td>
</tr>
</tbody>
</table>
### 2.1 Daily amounts required for the enteral feeding ONLY

#### Birth weight > 3 500 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/day)</th>
<th>Breast milk or, if not available, milk formula or diluted F-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>40-45</td>
<td>8 x 20 ml</td>
</tr>
<tr>
<td>D2</td>
<td>60-70</td>
<td>8 x 30 ml</td>
</tr>
<tr>
<td>D3</td>
<td>80-90</td>
<td>8 x 40 ml</td>
</tr>
<tr>
<td>D4</td>
<td>100-115</td>
<td>8 x 50 ml</td>
</tr>
<tr>
<td>D5</td>
<td>120-140</td>
<td>8 x 60 ml</td>
</tr>
<tr>
<td>D6</td>
<td>140-160</td>
<td>8 x 70 ml</td>
</tr>
<tr>
<td>D7 and greater</td>
<td>160-180</td>
<td>8 x 70-90 ml</td>
</tr>
</tbody>
</table>

#### Birth weight 3 000 g - < 3 500 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/day)</th>
<th>Breast milk or, if not available, milk formula or diluted F-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>45-50</td>
<td>8 x 20 ml</td>
</tr>
<tr>
<td>D2</td>
<td>70-80</td>
<td>8 x 30 ml</td>
</tr>
<tr>
<td>D3</td>
<td>90-100</td>
<td>8 x 40 ml</td>
</tr>
<tr>
<td>D4</td>
<td>110-130</td>
<td>8 x 50 ml</td>
</tr>
<tr>
<td>D5</td>
<td>125-145</td>
<td>8 x 55 ml</td>
</tr>
<tr>
<td>D6</td>
<td>140-160</td>
<td>8 x 60 ml</td>
</tr>
<tr>
<td>D7 and greater</td>
<td>160-180</td>
<td>8 x 60-75 ml</td>
</tr>
</tbody>
</table>

#### Birth weight 2 500 g – < 3 000 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/day)</th>
<th>Breast milk or, if not available, milk formula or diluted F-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>40-50</td>
<td>8 x 15 ml</td>
</tr>
<tr>
<td>D2</td>
<td>65-80</td>
<td>8 x 25 ml</td>
</tr>
<tr>
<td>D3</td>
<td>80-95</td>
<td>8 x 30 ml</td>
</tr>
<tr>
<td>D4</td>
<td>95-110</td>
<td>8 x 35 ml</td>
</tr>
<tr>
<td>D5</td>
<td>105-130</td>
<td>8 x 40 ml</td>
</tr>
<tr>
<td>D6</td>
<td>120-145</td>
<td>8 x 45 ml</td>
</tr>
<tr>
<td>D7</td>
<td>135-160</td>
<td>8 x 50 ml</td>
</tr>
<tr>
<td>D8</td>
<td>160-180</td>
<td>8 x 50-65 ml</td>
</tr>
</tbody>
</table>

#### Birth weight 2 000 g – < 2 500 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/day)</th>
<th>Breast milk or, if not available, milk formula or diluted F-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>30-40</td>
<td>8 x 10 ml</td>
</tr>
<tr>
<td>D2</td>
<td>50-60</td>
<td>8 x 15 ml</td>
</tr>
<tr>
<td>D3</td>
<td>65-80</td>
<td>8 x 20 ml</td>
</tr>
<tr>
<td>D4</td>
<td>80-100</td>
<td>8 x 25 ml</td>
</tr>
</tbody>
</table>
Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol "risk of hypoglycaemia".

### Birth weight 1 750 g – < 2 000 g

<table>
<thead>
<tr>
<th>Total (ml/kg/j)</th>
<th>Breast milk or, if not available, milk formula or diluted F-100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td></td>
</tr>
<tr>
<td>35-45</td>
<td></td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td></td>
</tr>
<tr>
<td>55-65</td>
<td></td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td></td>
</tr>
<tr>
<td>70-85</td>
<td></td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td></td>
</tr>
<tr>
<td>90-110</td>
<td></td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td></td>
</tr>
<tr>
<td>110-120</td>
<td></td>
</tr>
<tr>
<td><strong>D6 and greater</strong></td>
<td></td>
</tr>
<tr>
<td>140-160</td>
<td></td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol "risk of hypoglycaemia".

### Birth weight 1 500 g – < 1 750 g

<table>
<thead>
<tr>
<th>Total (ml/kg/j)</th>
<th>Breast milk or, if not available, milk formula or diluted F-100</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td></td>
</tr>
<tr>
<td>40-45</td>
<td></td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td></td>
</tr>
<tr>
<td>60-70</td>
<td></td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td></td>
</tr>
<tr>
<td>80-95</td>
<td></td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td></td>
</tr>
<tr>
<td>100-110</td>
<td></td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td></td>
</tr>
<tr>
<td>120-130</td>
<td></td>
</tr>
<tr>
<td><strong>D6 and greater</strong></td>
<td></td>
</tr>
<tr>
<td>160-170</td>
<td></td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol "risk of hypoglycaemia".

### Birth weight 1 250 g – < 1 500 g

<table>
<thead>
<tr>
<th>Total (ml/kg/j)</th>
<th>Maternal milk</th>
<th>Dextrose 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td>40-50</td>
<td>12 x 3 ml</td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td>65-75</td>
<td>12 x 5 ml</td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td>80-95</td>
<td>12 x 7 ml</td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td>95-115</td>
<td>12 x 10 ml</td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td>110-135</td>
<td>12 x 12 ml</td>
</tr>
<tr>
<td><strong>D6</strong></td>
<td>120-145</td>
<td>12 x 15 ml</td>
</tr>
<tr>
<td><strong>D7</strong></td>
<td>135-160</td>
<td>12 x 17 ml</td>
</tr>
<tr>
<td><strong>D8</strong></td>
<td>160-190</td>
<td>12 x 20 ml</td>
</tr>
<tr>
<td><strong>D9 and greater</strong></td>
<td>180</td>
<td>12 x 20-23 ml</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol...
“risk of hypoglycaemia”.

**Birth weight 1 000 g – < 1 250 g**

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>Maternal milk</th>
<th>Dextrose 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>40-50</td>
<td>12 x 3 ml</td>
<td>12 x 1 ml</td>
</tr>
<tr>
<td>D2</td>
<td>65-95</td>
<td>12 x 5 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D3</td>
<td>85-110</td>
<td>12 x 7 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D4</td>
<td>105-130</td>
<td>12 x 9 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D5</td>
<td>115-145</td>
<td>12 x 11 ml</td>
<td>12 x 1 ml</td>
</tr>
<tr>
<td>D6</td>
<td>125-155</td>
<td>12 x 13 ml</td>
<td>--</td>
</tr>
<tr>
<td>D7</td>
<td>135-170</td>
<td>12 x 14 ml</td>
<td>--</td>
</tr>
<tr>
<td>D8</td>
<td>145-180</td>
<td>12 x 15 ml</td>
<td>--</td>
</tr>
<tr>
<td>D9</td>
<td>155-190</td>
<td>12 x 16 ml</td>
<td>--</td>
</tr>
<tr>
<td>D10</td>
<td>165-200</td>
<td>12 x 17 ml</td>
<td>--</td>
</tr>
<tr>
<td>D11 and greater</td>
<td>190-200</td>
<td>12 x 17-20 ml</td>
<td>--</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

**Birth weight 850 g – < 1 000 g**

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>Maternal milk</th>
<th>Dextrose 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>35-40</td>
<td>12 x 2 ml</td>
<td>12 x 1 ml</td>
</tr>
<tr>
<td>D2</td>
<td>60-70</td>
<td>12 x 3 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D3</td>
<td>85-100</td>
<td>12 x 5 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D4</td>
<td>110-125</td>
<td>12 x 7 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D5</td>
<td>120-140</td>
<td>12 x 9 ml</td>
<td>12 x 1 ml</td>
</tr>
<tr>
<td>D6</td>
<td>120-140</td>
<td>12 x 10 ml</td>
<td>--</td>
</tr>
<tr>
<td>D7</td>
<td>130-155</td>
<td>12 x 11 ml</td>
<td>--</td>
</tr>
<tr>
<td>D8</td>
<td>145-170</td>
<td>12 x 12 ml</td>
<td>--</td>
</tr>
<tr>
<td>D9</td>
<td>155-185</td>
<td>12 x 13 ml</td>
<td>--</td>
</tr>
<tr>
<td>D10</td>
<td>170-200</td>
<td>12 x 14 ml</td>
<td>--</td>
</tr>
<tr>
<td>D11 and greater</td>
<td>200</td>
<td>12 x 14-16 ml</td>
<td>--</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

**Birth weight < 850 g**

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>Maternal milk</th>
<th>Dextrose 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>40-50</td>
<td>12 x 2 ml</td>
<td>12 x 1 ml</td>
</tr>
<tr>
<td>D2</td>
<td>70-80</td>
<td>12 x 3 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D3</td>
<td>100-120</td>
<td>12 x 4 ml</td>
<td>12 x 3 ml</td>
</tr>
<tr>
<td>D4</td>
<td>115-130</td>
<td>12 x 5 ml</td>
<td>12 x 3 ml</td>
</tr>
<tr>
<td>D5</td>
<td>125-150</td>
<td>12 x 6 ml</td>
<td>12 x 3 ml</td>
</tr>
<tr>
<td>D6</td>
<td>125-150</td>
<td>12 x 7 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D7</td>
<td>140-170</td>
<td>12 x 8 ml</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D8</td>
<td>155-190</td>
<td>12 x 10 ml</td>
<td>12 x 1 ml</td>
</tr>
<tr>
<td>D9</td>
<td>155-190</td>
<td>12 x 11 ml</td>
<td>--</td>
</tr>
<tr>
<td>D10</td>
<td>170-200</td>
<td>12 x 12 ml</td>
<td>--</td>
</tr>
<tr>
<td>D11 and greater</td>
<td>200</td>
<td>12 x 12-14 ml</td>
<td>--</td>
</tr>
</tbody>
</table>
Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).
Test blood glucose in the first hour of life for infants < 2500g and then according to the protocol "risk of hypoglycaemia".

**General Comments**

The tables above are mainly used when the mother is unable to directly breastfeed. If she directly breastfeeds, amount of breast milk received by the baby will not be known. We recommend to always quantify the quantity of breast milk given for the < 1800g (thus with the mother using a breast pump) because of the frequent insufficient gain of weight for that group of newborn.

**Standard fluid needs for infants as of day 6 of life (and the following weeks) is estimated to be at 160ml/kg/day.** It is possible to administer up to 200ml/kg/day if needed for infant growth/weight gain for the < 1500g. It is important to adjust quantities according to maximum weight (birth weight is to be used in the first days of life until it has been regained). Newborns generally lose weight over the first days of life and during this time birth weight is to be used for fluid calculations until the infant has regained birth weight.

Fluid intake on average for a well breastfed newborn in the first 24 hours of life is at 20ml/kg/day with an increase of 20ml/kg/day over the following days. A sick newborn requires more energy and thus an increased volume of fluids due to an increased catabolic rate.

**Breast milk** is the preferred choice for enteral feeding and if not available or insufficient, infants can be supplemented with **infant formula** or if not available, with **F-100 diluted**.

If the neonate is installed on a warming mattress / table with lamp or under a phototherapy lamp, increase the global volume of daily fluids (infusion + enteral volume) of 10 ml/kg/d because of the losses due to sudation.
2.2 Daily amounts required for IV and enteral feeding

<table>
<thead>
<tr>
<th>Birth weight &gt; 3500 g</th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td>60</td>
<td>216 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td>85</td>
<td>216 ml D10%</td>
<td>8 x 10 ml</td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td>100</td>
<td>192 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 20 ml</td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td>120</td>
<td>192 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 30 ml</td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td>130</td>
<td>144 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 40 ml</td>
</tr>
<tr>
<td><strong>D6</strong></td>
<td>135</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 50 ml</td>
</tr>
<tr>
<td><strong>D7</strong></td>
<td>140</td>
<td>0</td>
<td>8 x 60 ml</td>
</tr>
<tr>
<td><strong>D8 and greater</strong></td>
<td>160-180</td>
<td>0</td>
<td>8 x 70-90 ml</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Birth weight 3000 g - &lt; 3500 g</th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td>55-65</td>
<td>192 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td>70-80</td>
<td>168 ml D10%</td>
<td>8 x 10 ml</td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td>95-110</td>
<td>168 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 20 ml</td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td>110-130</td>
<td>144 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 30 ml</td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td>120-140</td>
<td>96 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 40 ml</td>
</tr>
<tr>
<td><strong>D6</strong></td>
<td>130-150</td>
<td>48 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 50 ml</td>
</tr>
<tr>
<td><strong>D7</strong></td>
<td>140-160</td>
<td>0</td>
<td>8 x 60 ml</td>
</tr>
<tr>
<td><strong>D8 and greater</strong></td>
<td>160-180</td>
<td>0</td>
<td>8 x 60-80 ml</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Birth weight 2500 g – &lt; 3000 g</th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td>55-65</td>
<td>168 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td>70-80</td>
<td>168 ml D10%</td>
<td>8 x 5 ml</td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td>85-100</td>
<td>168 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 10 ml</td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td>105-125</td>
<td>168 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 18 ml</td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td>120-145</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 30 ml</td>
</tr>
<tr>
<td><strong>D6</strong></td>
<td>125-150</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 38 ml</td>
</tr>
<tr>
<td><strong>D7</strong></td>
<td>120-145</td>
<td>0</td>
<td>8 x 45 ml</td>
</tr>
<tr>
<td><strong>D8</strong></td>
<td>135-160</td>
<td>0</td>
<td>8 x 50 ml</td>
</tr>
<tr>
<td><strong>D9</strong></td>
<td>160-180</td>
<td>0</td>
<td>8 x 50-65 ml</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Birth weight 2000 g – &lt; 2500 g</th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td>60-70</td>
<td>144 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td>75-90</td>
<td>144 ml D10%</td>
<td>8 x 5 ml</td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td>90-110</td>
<td>144 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 10 ml</td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td>105-130</td>
<td>144 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>8 x 15 ml</td>
</tr>
</tbody>
</table>
Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

### Birth weight 1 750 g – < 2 000 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>65-70</td>
<td>96 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D2</td>
<td>80-95</td>
<td>120 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D3</td>
<td>100-110</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 3 ml</td>
</tr>
<tr>
<td>D4</td>
<td>120-130</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 5 ml</td>
</tr>
<tr>
<td>D5</td>
<td>130-150</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 7 ml</td>
</tr>
<tr>
<td>D6</td>
<td>150-160</td>
<td>96 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 10 ml</td>
</tr>
<tr>
<td>D7</td>
<td>160-170</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 12 ml</td>
</tr>
<tr>
<td>D8</td>
<td>150-180</td>
<td>48 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 15 ml</td>
</tr>
<tr>
<td>D9</td>
<td>130-160</td>
<td>0</td>
<td>12 x 17 ml</td>
</tr>
<tr>
<td>D10</td>
<td>160-170</td>
<td>0</td>
<td>12 x 20 ml</td>
</tr>
<tr>
<td>D11</td>
<td>180</td>
<td>0</td>
<td>12 x 20-23 ml</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

### Birth weight 1 500 g – < 1 750 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>65-75</td>
<td>96 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D2</td>
<td>80-95</td>
<td>120 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D3</td>
<td>105-125</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 3 ml</td>
</tr>
<tr>
<td>D4</td>
<td>120-145</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 5 ml</td>
</tr>
<tr>
<td>D5</td>
<td>135-160</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 7 ml</td>
</tr>
<tr>
<td>D6</td>
<td>145-170</td>
<td>96 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 10 ml</td>
</tr>
<tr>
<td>D7</td>
<td>145-170</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 12 ml</td>
</tr>
<tr>
<td>D8</td>
<td>150-180</td>
<td>48 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 15 ml</td>
</tr>
<tr>
<td>D9</td>
<td>135-165</td>
<td>0</td>
<td>12 x 17 ml</td>
</tr>
<tr>
<td>D10</td>
<td>160-190</td>
<td>0</td>
<td>12 x 20 ml</td>
</tr>
<tr>
<td>D11</td>
<td>180-200</td>
<td>0</td>
<td>12 x 20-23 ml</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

### Birth weight 1 250 g – < 1 500 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>65-75</td>
<td>96 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D2</td>
<td>80-95</td>
<td>120 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D3</td>
<td>105-125</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 3 ml</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

### Birth weight 1 250 g – < 1 500 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>65-75</td>
<td>96 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D2</td>
<td>80-95</td>
<td>120 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D3</td>
<td>105-125</td>
<td>120 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 3 ml</td>
</tr>
</tbody>
</table>
Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).
Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

### Birth weight 1 000 g – < 1 250 g

<table>
<thead>
<tr>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td>60-70</td>
<td>72 ml D10%</td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td>75-95</td>
<td>96 ml D10%</td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td>95-120</td>
<td>96 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td>115-145</td>
<td>96 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td>115-145</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D6</strong></td>
<td>135-170</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D7</strong></td>
<td>155-190</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D8</strong></td>
<td>155-190</td>
<td>48 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D9</strong></td>
<td>135-170</td>
<td>0</td>
</tr>
<tr>
<td><strong>D10</strong></td>
<td>155-190</td>
<td>0</td>
</tr>
<tr>
<td><strong>D11</strong></td>
<td>165-205</td>
<td>0</td>
</tr>
<tr>
<td><strong>D12 and greater</strong></td>
<td>200</td>
<td>0</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).
Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

### Birth weight 850 g – < 1 000 g

<table>
<thead>
<tr>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>D1</strong></td>
<td>70-85</td>
<td>72 ml D10%</td>
</tr>
<tr>
<td><strong>D2</strong></td>
<td>95-110</td>
<td>96 ml D10%</td>
</tr>
<tr>
<td><strong>D3</strong></td>
<td>95-110</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D4</strong></td>
<td>110-125</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D5</strong></td>
<td>120-140</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D6</strong></td>
<td>145-170</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D7</strong></td>
<td>155-185</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D8</strong></td>
<td>155-185</td>
<td>48 ml D10% + NaCl 10% (ou 0.9%)</td>
</tr>
<tr>
<td><strong>D9</strong></td>
<td>130-155</td>
<td>0</td>
</tr>
<tr>
<td><strong>D10</strong></td>
<td>145-170</td>
<td>0</td>
</tr>
<tr>
<td><strong>D11</strong></td>
<td>155-185</td>
<td>0</td>
</tr>
<tr>
<td><strong>D12</strong></td>
<td>170-200</td>
<td>0</td>
</tr>
<tr>
<td><strong>D13 and greater</strong></td>
<td>200</td>
<td>0</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).
Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocol “risk of hypoglycaemia”.

189
### Birth weight < 850 g

<table>
<thead>
<tr>
<th></th>
<th>Total (ml/kg/j)</th>
<th>IV (ml/day)</th>
<th>Breast Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>85-100</td>
<td>72 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D2</td>
<td>85-100</td>
<td>72 ml D10%</td>
<td>0</td>
</tr>
<tr>
<td>D3</td>
<td>110-130</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 2 ml</td>
</tr>
<tr>
<td>D4</td>
<td>125-150</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 3 ml</td>
</tr>
<tr>
<td>D5</td>
<td>140-170</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 4 ml</td>
</tr>
<tr>
<td>D6</td>
<td>155-180</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 5 ml</td>
</tr>
<tr>
<td>D7</td>
<td>170-200</td>
<td>72 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 6 ml</td>
</tr>
<tr>
<td>D8</td>
<td>155-180</td>
<td>48 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 7 ml</td>
</tr>
<tr>
<td>D9</td>
<td>170-200</td>
<td>48 ml D10% + NaCl 10% (ou 0.9%)</td>
<td>12 x 8 ml</td>
</tr>
<tr>
<td>D10</td>
<td>140-170</td>
<td>0</td>
<td>12 x 10 ml</td>
</tr>
<tr>
<td>D11</td>
<td>155-180</td>
<td>0</td>
<td>12 x 11 ml</td>
</tr>
<tr>
<td>D12</td>
<td>170-200</td>
<td>0</td>
<td>12 x 12 ml</td>
</tr>
<tr>
<td>D13 and greater</td>
<td>200</td>
<td>0</td>
<td>12 x 13-14 ml</td>
</tr>
</tbody>
</table>

Quantify the quantity of milk given to the newborn < 1800 g (use breast pump).

Test blood glucose in the first hour of life for infants < 2 500g and then according to the protocole “risk of hypoglycaemia”.

**Notes**

- If the neonate is installed under a heating lamp or a phototherapy lamp increase the total volume of daily fluid intakes (infusion + enteral volume) of 10 to 20 ml/kg/d because of losses due to sudation.

- **Solutions for infusion:**
  - **At D1 and D2:** D10%
  - **From D3:** D10% + NaCl 10% 3 mEq/kg/d (if possible)
    - If NaCl 10% unavailable: 4/5 D10% + 1/5 NaCl 0.9% (NaCl 10%: 1 ml = 1.7 mEq).

**General Comments**

The tables above are used to estimate the quantity of fluids needed by the newborn arriving in the newborn unit at DOL 1. For any late arrival (> DOL 1) or for any modification of intake (example: stopping the oral intake), an adaptation of the total feeding/fluid intake should be done (with respect of the total daily intake received by the newborn).

The “breast milk” column of the tables above is mainly used when the mother is unable to directly breastfeed. If she directly breastfeeds, amount of breast milk received by the baby will not be known. We recommend to always quantify the quantity of breast milk given for the < 1800g (thus with the mother using a breast pump) because of the frequent insufficient gain of weight for that group of newborn.

**Standard fluid needs for infants as of day 6 of life (and the following weeks) is estimated to be at 160ml/kg/day.** It is possible to administer up to 200ml/kg/day if needed for infant growth/weight gain for the < 1500g. It is important to adjust quantities according to maximum weight (birth weight is to be used in the first days of life until it has been regained). Newborns generally lose weight over the first days of life and during this time birth weight is to be used for fluid calculations until the infant has regained birth weight.
Please fill the infusion set each 6 hours. This will avoid a fluid overload which often happens while filling the infusion set each 24 hours and the infusion running too fast.

If a newborn > 6 days old, need to have ONLY IV fluid for several days, give max 160ml/kg/day and do not increase more as sometimes seen for oral feeding. Also consider to give KCL IV in the infusion after D4 (but with high cautious) – *See General Notes in the chapter 2 of this part.*

**Breast milk** is the preferred choice for enteral feeding and if not available or insufficient, infants can be supplemented with **infant formula** or if not available, with **diluted F-100.**

### INFUSION FOR MAINTENANCE

The IV solution (1/5 0.9% NaCl + 4/5 D10) is ideal and practical for providing the adequate amount of dextrose and sodium for the neonate. However, the sodium load can be too high when an infant is receiving a fluid load of > 100 ml/kg/day all per IV (an infant who is NPO). Therefore, you should modify the composition to (1/10 0.9%NaCl + 9/10 D10 %) if you need to have the infant on this solution for multiple days.

If the baby is installed on a warming mattress / table with lamp or under a warming or phototherapy lamp, increase daily quantity (enteral + IV) by 10-20 ml/kg/day compare to usual need.

<table>
<thead>
<tr>
<th>Practical reminder 1:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pediatric infusion set: 1 ml = 60 drops of liquid solution.</td>
</tr>
<tr>
<td>Pediatric blood transfusion set: 1 ml = 15 to 20 drops of blood according to the manufacturer (please read with attention the notice of the manufacturer).</td>
</tr>
<tr>
<td>Do not use adult infusion set in neonatology.</td>
</tr>
<tr>
<td>AVOID ANARCHIC MANAGEMENT of INFUSIONS that means INTERMITTENT INFUSIONS WITH EXCEPTION OF EMERGENCY TREATMENT of SHOCK or SEVERE DEHYDRATION.</td>
</tr>
</tbody>
</table>

In this case the protocol is very clear: 10 ml/kg over 30 minutes x 1, 2 or 3 ACCORDING TO VITAL VALUES.

<table>
<thead>
<tr>
<th>Practical reminder 2:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change infusion set and bag / bottle each day (maximum 24 hours), even if the bag / bottle is not empty because of the high risk of nosocomial infection.</td>
</tr>
<tr>
<td>Replace O/NGT every 3 to 5 days (according to the conditions) and for each replacement, change the nostril (in case of NGT) or the corner of the mouth (OGT) for the introduction of the new tube. Use a bit of Vaseline to decrease the trauma and the pain.</td>
</tr>
<tr>
<td>Change IV catheter every 3 days (maximum 5 days depending of settings, hygienic maintenance, workload, staff and clinical condition of the infant). Only “active / used” catheter should remain in place while “preventive / not used” catheters should be removed.</td>
</tr>
</tbody>
</table>
3. PLACING an Oro/NasoGastric Tube (OGT/NGT)

Gastric tubes must always be used with great caution. There is a risk of aspiration if the tube is used incorrectly.

If possible, use the orogastric route rather than the nasogastric route in cases of respiratory distress or weight below 1500 g. Both nostrils must remain unobstructed for effective breathing.

3.1 Technique

- Choose a CH6 or CH8 tube, depending on the size of the infant’s nostrils. The tube must not completely block the opening of the nostril.
- Measure the distance from the mouth (oro) or bridge of the nose (naso) to the tragus of the ear, and then the distance from the tragus of the ear to the xyphoid process of the sternum. Mark this insertion length on the tube with a pen.
- Lubricate the tube with water. Hold the infant’s head firmly to prevent injury. Insert the tube in a continuous motion to the pen mark.
- Secure the tube with adhesive tape.
- Check for correct tube placement:
  1. Aspirate the stomach contents
  AND
  2. Inject 2 ml of air into the stomach via the tube. Place a stethoscope on the abdomen to listen for the noise of the air in the stomach.

If there is any doubt about the tube position, withdraw the tube and start over.
Intrapulmonary administration of the liquid contents can be fatal.

- To feed, connect a 20-ml syringe, without its plunger, to the tube (tulip) and allow the milk in the syringe to flow by gravity. See chapter 1, part VI.
- Rinse the tube with a few ml of 0.9% sodium chloride after each use.

3.2 Monitoring

The tube position should always be checked before administering any liquid or medication; check the position of the reference mark, check that aspiration brings up gastric liquid, and inject air into the stomach.

If not correctly positioned, re-insert the tube and verify that it is correctly positioned.

Replace the tube every 3-5 days, switching nostrils (NGT) or the corner of the mouth (OGT) with each new tube, or sooner if the tube becomes clogged. Evaluate if tube is still necessary before replacing.
4. SURVEILLANCE

4.1 Surveillance & Monitoring of a newborn with infusion

- **Inspection of the entry point:**
  - Verify the absence of redness and/or subcutaneous oedema / swelling at the entry point of the catheter. Oedema and swelling can occur when the catheter is not into the vein so the fluid is extravasating into the soft tissues.
  - In case of redness or oedema, at any moment, stop the infusion, remove the catheter and, if needed set up a new IV line.
  - Verify the volume and flow of the infusion and compare with the prescribed amount.
  - Note all observations in the file of the infant.
  - Dextrose solutions > 15% can cause +/- important necrosis of the soft tissues. So, surveillance should be very cautious and dextrose should not extravasate. **Be careful** regarding surveillance and monitoring and don’t use any solution > 15%.

- **Control glycemia** one hour after starting the infusion and then any 6 hours:
  - If hypoglycaemia, treat adequately – Refer to the chapter 16 in part IV.
  - If glycemia ≥ 180 mg/dl or ≥ 10 mmol/l 2 times consecutively (transient hyperglycemia with risk of glucose in the urine), replace initial solution with Dextrose 5% over only few hours, time to stabilize glycemia.

- **Control hydration** status of the infant 2 times daily:
  - The infant is moderately dehydrated ➔ increase the volume of the infusion of 10 ml/kg/d according to the weight of reference = weight before dehydration.
  - The infant is severely dehydrated ➔ make a bolus of NS (NaCl 0.9%) / RL (10 ml/kg/30 min) and then increase the volume of the infusion of 10 ml/kg/d according to the weight of reference = weight before dehydration.
  - The infant has signs of shock ( HR, CRT > 2 sec, cold extremities, weak pulses), make a bolus of NS / RL (10 ml/kg/30 min) – Then refer to the chapter 7 in part IV.
  - The infant is overhydrated ➔ decrease the volume of the infusion by 50% over 12 to 24 hours but **Pay attention to hypoglycemia** – Refer to the chapter 16 in part IV.

- Carefully note in the file each time the infant is passing urine (ask to the mother / bag to collect urine).

- If there is not background of birth asphyxia, no urine in 24 hours (or very small quantity) ➔ To increase the total volume of the infusion of 10 ml/kg/d.

- Control weight once daily. If there is a weight loss > 5% in 24 hours ➔ To increase the total volume of the infusion of 10 ml/kg/d according to the weight of reference = weight before weight loss over 24 hours in order to compensate inadequate intake and to restaurue normal hydration and hemodynamics.

4.2 Surveillance & Monitoring of a newborn with enteral feeding
Before each meal

- Weight for any neonate < 1500g without infusion.
- Check the O/NGT is in the right position.
- Regurgitations, vomiting, careful exam of the abdomen, stools (aspect, color, quantity, bile, blood...).
- Gastric aspirates (milk and liquid staying in the stomach since the previous meal) and assess their quantity and quality – *See the table above.*

**Attention to stop enteral feeding adequately** (critical general condition, abnormal abdominal signs, bloody stools in the absence of anal fissure, bilious / greenish gastric aspirates...) but don’t stop enteral feeding to all neonates with plus or minus clear gastric aspirates when they have a good general condition and normal clinical exam.

Any abnormal sign, even non specific one, can be a feature of sepsis: temperature instability, slight jaundice, apnoea, bradycardia, lethargy, peripheral hypo perfusion (cold hands and feet and increased CRT)… – interruption of the enteral feeding and make a complete clinical exam including the abdominal wall, stools, vital values and discuss a possible infectious cause such as NEC – *Refer to the chapter 11 in part IV.*

After each meal

- Weight for any neonate < 1500g without infusion.
- Install the infant in proclive position 30 to 40 degrees over at least 30 minutes in order to avoid regurgitations and/or inhalation.

**Weight, temperature and glycemia**

- Weigh the infant once daily at the minimum (ideally twice a day).
- Regularly control temperature: Every 4 hours and treat accordingly – *See below.*
- Regularly control glycemia and treat accordingly – *See below.*
- Don’t forget that adequate caloric intake is necessary to maintain general homeostasis, particularly body temperature.
- Glycemia should remain stable if the number of meals is adequately chosen according to the weight of the infant.

**Maternal breastfeeding – Refer to chapter 1 in par VI**

**How to detect hypoglycemia**

- Regularly control glycemia: before each meal or in the absence of enteral feeding, at least every 3 hours still glycemia remain stable > 45 mg/dl or > 2.5 mmol/l at least 2 times consecutively.
- In addition, control glycemia 2 times after any decrease or after stopping the infusion.
- Treat adequately a possible (IV D10% 2 ml/kg x 1 or 2 or PO / O/NGT D10% 5 ml/kg x 1 or 2 or sublingual D50% 1 ml/kg x 1 or 2 if O/NGT is not possible). Don’t forget that hypoglycaemia can be due not only to PPN but also to neonatal infections. Call a MD for systematic investigation +/- treatment according to the results – *Refer to the chapter 10 in part IV.*

**How to detect hypothermia**

- Control temperature every 4 hours.
• Treat a possible hypothermia – *Refer to the chapter 15 in part IV.*

• Systematically apply Kangaroo care (skin to skin) to maintain body temperature including during night.

• Put also a nightcap (surgical jersey), shocks surgical jersey), mitten (surgical jersey) and a good blanket…

• If severe and/or resistant hypothermia to the above measures and/or convulsions and/or apnea ➔ immediately check glycemia, call a MD and investigate +/- treatment for neonatal sepsis according to the results – *Refer to the chapter 10 in part IV.*
5.1 Ten steps to successful breastfeeding

- Have a written breastfeeding policy that is routinely communicated to all health care staff.
- Train all health care staff in skills necessary to implement this policy.
- Inform all pregnant women about the benefits and management of breastfeeding.
- Help mothers initiate breastfeeding within one half-hour of birth (maximum within 1 hour of birth).
- Show mothers how to breastfeed and maintain lactation, even if they should be separated from their infants.
- Give newborn infants no food or drink other than breast milk, unless medically indicated.
- Practice rooming in - that is, allow mothers and infants to remain together 24 hours a day.
- Encourage breastfeeding on demand.
- Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants.
- Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

5.2 Breastfeeding in practice
- Ensure friendly environment, encouragement to the mother, self-confidence, a minimum of privacy…
- Start breastfeeding as soon as possible according to clinical status and gestational age, normally within one half-hour of birth (maximum 1 hour).
- If necessary taught the mother on the way, manually or with a pump, to express her breast to obtain breast milk in a cup.
- Thereafter use cup and spoon or the “supplemental suckling” method.
In case there is not enough maternal milk:
- Give D10% as complement to available maternal milk following the recommendations of the tables in the chapter 5, part VI.
- If there is still no enough maternal milk after 3 to 5 days complement with infant formula with respect to specific conditions below. In severe maternal conditions or total absence of maternal milk, don’t hesitate to think about infant formula more rapidly.
- Stimulate maternal milk production in order to ensure adequate exclusive breastfeeding. It is crucial to well explain her role and the importance of breastfeeding to the mother. The mother should be self-confident in her capacities to perform a good breastfeeding. The quality of psycho-social support is a key issue.
- Before stimulation verify general (importance of rest, no stress…), nutritional (≥ 2500 kcal/d) and hydration (≥ 3l/d) status of the mother. Well explain to the mother the relationship between nutrition, hydration, and rest, breast stimulation putting the infant to the breast and quality / quantity of maternal milk.
- Before each breast feed give a cup of clean water to the mother (500 ml).
- Encourage breastfeeding on demand as frequently as possible / needed for better stimulation, at east every 3 hours, over 20 minutes (10 min on each breast) and always prior giving milk formula supplementation (when there is no other solution) (about 30 to 60 minutes before).

Most often insufficient quantity of maternal milk is due to insufficient stimulation from the young infant.
- Verify the good position of baby during breastfeeding – See pictures above.
- Verify the nipples have no lesions and treat possible redness, fissure or cracks applying thick coat of Vaseline. Nipples should be washed with clean water before each breast feed.

<table>
<thead>
<tr>
<th>What to do</th>
<th>What to explain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maintain breastfeeding in any circumstances ⇒ Continue breastfeeding even in case the infant has diarrhoea. ⇒ Continue breastfeeding even in case the mother is sick (with exception of very severe condition).</td>
<td></td>
</tr>
<tr>
<td>2. Stimulation milk production: ⇒ Be sure milk production will not stop because of lack of stimulation / breast feed.</td>
<td></td>
</tr>
<tr>
<td>✓ Breastfeed on demand / frequently.</td>
<td></td>
</tr>
<tr>
<td>✓ Ensure enough maternal drink (≥ 3l/d). Be cautious on mother hydration because of its impact on milk production.</td>
<td></td>
</tr>
<tr>
<td>✓ Ensure maternal meals (≥ 2500 kcal/d). Be cautious on mother nutritional status because of its impact on milk production.</td>
<td></td>
</tr>
<tr>
<td>3. Adequately treat any disease ⇒ Be sure the mother is not thinking that the quality of her milk is poor or that it quantity is insufficient when it is wrong.</td>
<td></td>
</tr>
</tbody>
</table>
When all the above conditions are fully completed, in case a supplementation is necessary, specific formula milk for neonates (or when indicated special therapeutic milk formula without lactose and without cow milk proteins) will be prescribed by the MD in charge.

- **Before prescribing a specific formula milk for neonates be sure the prescribed formula milk will be available and all specific conditions below will be met for the entire duration of the use:**
  - Safe water and sanitation
  - **And** sufficient infant formula milk to support normal growth and development of the infant can be provided.
  - **And** the mother or caregiver can prepare it cleanly and frequently enough so that is safe and carries a low risk of diarrhea and malnutrition.
  - **And** the mother or caregiver can exclusively give infant formula milk in the first 6 months.
  - **And** the family is supportive of this practice.
  - **And** the mother or caregiver can access health care that offers comprehensive child health services.

- Daily increase of the milk quantity according to the tables *in the chapter 5, part VI*.
- Calculate the quantity of formula milk based on the available quantity of maternal milk.
- If the baby is losing more than 10% of his weight in 48 hours, re-check the weight, and then based on vital values and clinical signs, evaluate needs for rehydration with a bolus of 10 ml/kg/30 to 60 minutes x 1 or 2. The bolus can be done a third time if it is necessary – *Refer to the paragraph 1 in the chapter 7, part IV*. After rehydration, go back to the normal nutritional recommended scheme – *Refer to the table in chapter 5, part VI*.

### 5.3 Conservation of maternal milk according to current scientific knowledge

<table>
<thead>
<tr>
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</tr>
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</tr>
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<tr>
<td>In a 3 star-freezer part of a fridge</td>
<td>3 to 4 months</td>
</tr>
<tr>
<td>In a separate freezer (-18°)</td>
<td>&gt; 6 months</td>
</tr>
</tbody>
</table>
6. MEDICAL SPECIALIZED FORMULA for NEONATES

ONLY current available infant milk for Newborn in MSF ITC Catalogue:

NFOSMILI1P9: MILK, INFANT, powder, 1st age, 900 g tin

Also available in MSF Catalogue:

- MILK INFANT, powder, 1st age, 400 g tin.
- MILK, INFANT, powder, 2nd age, 900 g tin.

INDICATIONS

⚠️ IN THE ABSENCE OF MATERNAL MILK (NO POSSIBILITY TO BREASTFEED)

1. Re-feeding diarrhoea due to probable secondary intolerance to Lactose or Cow-Milk Proteins (typically explosive liquid stools directly after each attempt to eat, especially with milk formula and/or after an acute diarrheal episode).

2. Re-feeding persistent diarrhoea in neonates / infants less than 4 months.

3. Re-feeding NEC in premature babies, in newborns with severe jaundice, in newborns with short small intestine or other severe congenital disease.

RECOMMENDED MILK: PROTEIN HYDROLYSATE FORMULA WITHOUT COW-MILK PROTEINS AND LACTOSE-FREE

- Quantities to be given are based the age and the weight of the infant – see recommendations for usual reconstitution on the notice written by the manufacturer in each box and also in the protocols of this clinical and management guideline – normally 1 level spoon of powder in 30 ml of boiled water.

- When the problem is solved (diarrhoea has totally disappeared for at least 4 weeks) but never before 3 months (minimum) to 6 months (necessary time for cicatrisation and reconstitution of villosities) of treatment, the reintrooduction of another milk and other food can be started very cautiously and progressively, starting by changing a meal in 24 hours for few days, then changing 2 meals in 24 hours for few more days and then changing progressively all meals).
PROTEIN HYDROLYSATE FORMULA OF THE MARKET & MAIN CHARACTERISTICS OF COMPOSITION

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>LABORATORY</th>
<th>NATURE OF HYDROLYSATE</th>
<th>PRESENCE OF LACTOSE*</th>
<th>PRESENCE OF MILD CHAIN TRIGLYCERIDS (&gt; 40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfaré (Powder)</td>
<td>Nestlé Clinical Nutrition</td>
<td>Bovin lactoserum</td>
<td>No</td>
<td>Yes (48%)</td>
</tr>
<tr>
<td>Galliagène Progress (Powder)</td>
<td>Gallia</td>
<td>Bovin caseine</td>
<td>No</td>
<td>Yes (40%)</td>
</tr>
<tr>
<td>Neocate (Powder)</td>
<td>SHS International</td>
<td>Free amino acids</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Nutramigen (Powder)</td>
<td>Mead-Johnson</td>
<td>Bovin caseine</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pepti-Junior (Powder)</td>
<td>Nutricia</td>
<td>Bovin lactoserum</td>
<td>No</td>
<td>Yes (49%)</td>
</tr>
<tr>
<td>Prégomine (Powder)</td>
<td>Diele Distripharma</td>
<td>Pork collagene and soj isolate</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>

PRACTICAL ADVICES ON THE WAY TO USE PROTEIN HYDROLYSATE FORMULA

- DIGESTION / ABSORPTION DISEASES (neonatal NEC, neonates with severe jaundice, neonates with short small intestine)
  Or
- PERSISTENT DIARRHEA in neonates and/or infants less than 4 months / POSSIBLE SECONDARY INTOLERANCE TO LACTOSE OR COW-MILK PROTEINS WITH SEVERE ACUTE MALNUTRITION
  - It is recommended to use one of the three hydrolysates containing mild chain tryglycerids in variable quantity (40 to 50%) since their absorption is independent of bilio-pancreatic secretions: Alfaré, Galliagène Progress and Pepti-Junior.

- PERSISTENT DIARRHEA in neonates and/or infants less than 4 months / POSSIBLE SECONDARY INTOLERANCE TO LACTOSE OR COW-MILK PROTEINS WITHOUT SEVERE ACUTE MALNUTRITION
  - It is theoretically possible to use one of the five available hydrolysates: Alfaré, Galliagène Progress, Nutramigen, Pepti-Junior or Prégomine.
PART VII

NEONATAL PROCEDURES & VITAL NORMS
1. OXYGEN THERAPY

O₂: Oxygen  
CO₂: Carbon dioxide  
SpO₂: Hemoglobin saturation in oxygen

A pulse oximeter is the best tool to guide oxygen therapy in children of all ages. Oxygen should be administered to a newborn that has oxygen saturation:
- Neonate at term (≥ 37 weeks of GA): < 90% on room air.  
- Preterm baby (< 37 weeks of GA): < 90% on room air.

Excessive or inappropriate oxygen supplementation (too high oxygen flow and/or too high SpO2) can cause direct lung injury and has also been associated with retinopathy of prematurity in newborns.

When oxygen is being administered, the oxygen flow rate should be adjusted to provide the minimum flow rate which still provides oxygen saturation between:
- Neonate at term (≥ 37 weeks of GA) & Preterm baby (< 37 weeks of GA): between 90% to 95%.

If an infant being administered oxygen therapy has oxygen saturation ≥ 95% (at term and preterm baby), the oxygen flow rate should gradually be decreased.
Once an infant’s oxygen saturation is ≥ 95% on room air (preterm baby and at term baby), the oxygen may be discontinued.

If a pulse oximeter is unavailable, oxygen therapy should be given to infants with any of the following:
- Central cyanosis.  
- Permanent grunting.  
- Severe lower chest in drawing and/or thoracic recession.  
- Severe nasal flaring.

INDICATIONS
1. Severe RDS / LRTI with patent Respiratory Distress Syndrome (RDS) even if the SpO₂ is kept up since the baby will be exhausted by the respiratory distress and the oxygen will decrease the effort and delay the exhaustion.
2. Severe RDS / LRTI with low SpO₂ (SpO₂ < 90% (preterm & at term); if possible systematic measure of SpO₂ for severe LRTI).  
3. Systematically and early for all STATES OF SHOCK (oxygen debt +++).  
4. BIRTH ASPHYXIA with cyanosis and/or low SpO₂.  
5. Severe or prolonged CONVULSIONS with cyanosis and/or low SpO₂.

ADMINISTRATION
• In all MSF contexts and in any circumstances, opt for nasal prongs rather than other means. The only exception is for aerosol therapy but the goal in this circumstance is very different.

- Better hygiene and easy change of the prongs.
- Better elimination of \( \text{CO}_2 \) (flows that are usually used in paediatrics don’t allow a correct elimination of carbon dioxide under the mask). Under the mask, children are inhaling their own \( \text{CO}_2 \) and progressively get asphyxiated with severe headache, sleep inducing, bradypnea, apnoeas and respiratory arrest.
- When indicated and the child is in good conditions, allow reinitiating oral feeding under oxygen.
- Allow a progressive weaning: Stop the oxygen during rest periods and maintain it during the efforts (meals).

• It is strongly recommended to use a FLOW SPLITTER ped.Sureflow EEMDCONE407 (\( \text{O}_2 \) repartition) as soon as several children are connected on the same concentrator (4 at the maximum). In these cases, put the maximal flow that is recommended by the manufacturer for the concentrator that is used (always refer to the technical manuals and sheets done by the biomed). In these cases, after connection of the flow splitter, look at the optimal flow for each flow regulator based on the desired \( \text{SpO}_2 \) for each infant, in a range of 0.5 to 2l/min maximum.

• In paediatrics, it is better to moderately raise the \( \text{O}_2 \) concentrators from the floor on small support or others, at the level of the beds (not more) to maintain a better cleaning up of the floor and for tubes and connectors to be over the floor (tubes and connectors on the floor are major vectors of nosocomial respiratory infections and deaths). Be sure never to block the ventilation holes on the bottom of the oxygen concentrator or it will overheat.

• Tubes and connectors should always be over the floor, particularly connectors, and should be as short as possible (normally maximum 1 meter) to allow good sterilisation and hygiene before reusing. Longer tubes don’t allow good sterilisation. If needed, you can use 1 m with the nasal prong + 1 m after the connection. Ensure also the length is enough to avoid accidental disconnection when the child is moving in the bed or when the mother is taking him.

• Keep the tubes over the floor and well routed in order to avoid plucking and to allow easy control.

• The cleanliness and permeability of nasal oxygen prongs / tubes should be checked regularly and several time daily.
- Nasal tubes should be changed at least every 3 days, more if needed.
- Tubes should be changed immediately if they are dirty or if they were on the floor.

WEANING
1. Disappearance of clinical signs of severity or clear improvement.
2. Normal SpO\textsubscript{2} with oxygen three times with 8 hour-intervals.
3. First of all weaning during rest periods, with oxygen maintained during meals x 24 hours.
4. Complete weaning after 24 hours if everything is going well and monitor SpO\textsubscript{2} one time during a meal (it should be \geq 95\% for both a premature and at term infant).
5. No change the phase / ward immediately after complete weaning. Wait 24 hours.

NB
Note that for each order of one oxygen concentrator, some options will be systematically proposed, of which:
1. Oxygen concentrator EEMDCONE4-- CONCENTRATOR O2 (De Vilbiss 525KS) 220V + accessories (or the 10 l/min EHOEZFR0664).
2. 1 FLOW SPLITTER ped. Sureflow EEMDCONE407 (conc. De Vilbiss 515KS/AKS/525KS)
3. 1x kit humidifier: EHOEZFR0587 (Pediatric distributeur, SUREFLOW) HUMIDIFIERS KIT
4. 1 Pulse oxymeter (SpO\textsubscript{2}) EEMDPOXE4-- OXYMETER, PULSE (Masimo RAD-5) + accessories
5. Different O\textsubscript{2} nasal prongs for pediatrics programs.
2. ORO / NASO GASTRIC TUBE (OGT / NGT) INSERTION

Indications

- If possible, breastfeeding should always be encouraged and there is no contraindication.
- Feeding by O/NGT allows to exactly know the exact quantity of milk (or other) we are providing, to avoid wrong ways (meal inhalation) or neonatal exhaustion.
- O/NGT is generally indicated for all newborns with functional problem (lack of breathing /swallowing coordination, lack of reflexes, respiratory distress) or anatomical problem (cleft palate) such as:
  - Premature babies < 1500g (or GA ≤ 33 weeks) – limited or absent coordination, weak suction, rapid exhaustion, immature reflexes.
  - Newborns with respiratory distress (tachypnea, chest indrawing, oxygen) – rapid exhaustion and risk of meal inhalation.
  - Newborns with acute birth asphyxia or any other illness responsible for poor general status – weak or absent suction, decreased coordination / reflexes, convulsions or equivalences.
  - Newborns with cleft palate, particularly when they are large.
- O/NGT is also indicated in case of stomach distension (bag mask resuscitation…), abdominal distension (ileus, NEC…), any severe intestinal suffering. In these cases, the tube should be in declivity. The lowest extremity should be open in a bag / bottle for stomach / gun drainage.
- Always prefer oro-gastric tube in neonates with respiratory distress and/or in very / extremely LBW (< 1500g) at risk for apneas since they need to have free nostrils for better breathing. Note that newborns cannot breathe efficiently by their mouth so, in case nostrils are obstructed including by NGT, they can worsen their respiratory condition and/or make apneas.

Use CH 6 or 8.

Proper Measurement of Oro / Naso Gastric Tube Insertion Length

The length of the inserted tube is approximated by measuring the distance from the mouth (oro) / bridge of the nose (naso), to the ear tragus and then adding the distance from the ear tragus to the sternum xyphoid (see pictures below: oro-gastric tube).
Once the tube is inserted, to verify the position attach a syringe and suction the gastric contents. The correct position of the oro / naso gastric tube can also be verified by a syringe and a stethoscope injecting 5 to 10 ml of air in the stomach via the tube. When the air is arriving into the stomach, the stomach is rumbling and you can hear this sounds with the stethoscope. The oro / naso gastric should be correctly taped in place.

Bag-mask ventilation can be administered with the oro / naso gastric tube in place. During resuscitation, remove the syringe and leave the end of the tube open to ventilate the stomach.

Securing oral (figures below) / nasal gastric tube in place
Feeding with breast milk by an Oro or Naso Gastric Tube – « Tulip» or by gravity (see photos below)

- Ensure that the mother can properly express breast milk.
- Insert an oro-gastric or naso-gastric tube if one is not already in place (see above).
- Confirm that the tube is properly positioned before each feeding.
- Determine the required volume of milk for the feed according to the baby’s age and weight.
- Remove the plunger of a high-level disinfected or sterile syringe (of a size large enough to hold the required volume of milk) and connect the barrel of the syringe to the end of the gastric tube.
- If a high-level disinfected or sterile syringe is not available, use a clean (washed, boiled or rinsed with boiled water, and air-dried) syringe.
- Put the required volume of milk for the feed into the syringe with the “tip” of the syringe pointed downward.
- Have the mother hold the syringe 5 to 10 cm above the baby or suspend the tube above the baby and allow the milk to run down the tube by gravity (see the photos above).
- Do not force milk through the tube using the plunger of the syringe.
- Using this method, each feeding should take 10 to 15 minutes.
- Replace the gastric tube with another new gastric tube after 3 days changing the nostril for the insertion. Replace it earlier if it is pulled out or becomes blocked, and throw the old one into the dustbin.

Conservation of maternal milk according to current scientific knowledge

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3. INTRA OSSEOUS INFUSION (IO)

Medical technique strictly reserved for experienced medical doctors thoroughly trained in this procedure.

Indications: Emergency vascular access (and so temporary) in a child in a state of vital distress (e.g. accidental, traumatic, respiratory, hemodynamic, infectious, neurological…) when venous access cannot be secured immediately. The IOI must absolutely avoid using umbilical cord catheterization and must be relayed by a venous access as soon as possible.

- All isotonic solutes can be used with IO: D5%, Ringer Lactate and normal saline.
- Likewise for blood, blood products and injectable medicines that can be given through the IO.

Required supplies

- Intravenous (IV) needle 19G (gauge) – Newborns ≤ 5 kg.
- Intraosseous (IO) needle 18G (gauge) – Child > 5 kg and ≤ 10 kg (Reference MSF medical catalogue volume 2 – Part A SINSNEIO18)
- Clamp
- Local anaesthetic
- Povidone iodine (dermal aqueous solution 10%)
- 4 x 4 sterile compresses
- Sterile gloves
- Infusion in emergency (2 ml x 2 D10% + Ringer Lactate and/or NS 0.9%) ready to be connected to the intra-osseous + 3 way tap.
- Sterile syringes 5 x 1 and 10 ml x 1
- Adhesive tape
Implementation procedure

- Preferred site in a child = Proximal tibia (distal tibia and distal femur can also be used).
- Immobilize the limb, if possible with knee bent at 45 degrees (sand bag or cushion under the knee).
- Refer to the figure below for anatomical pointers (site for median puncture 1 to 3 cm below the anterior tibial tuberosity).
- Apply a local anesthetic to the insertion zone (only if the child is conscious).
- Wash carefully your hands (universal precautions) or put on sterile gloves.
- Clean the puncture area carefully with Povidone iodine (dermal aqueous solution 10%).
- Hold the IO needle firmly between index and forefinger and the thumb of the right hand and stabilize the proximal tibia with the left hand (which at this point is no longer sterile).
- Introduce the IO needle at a right angle (nearly 90 degrees) to the tibia but with the bevel pointed towards the feet and by aiming for the feet (more a downwards insertion than upwards).
- With slow, firm but well controlled movements of (twisting or drilling) supported screwing, to the right and then to the left, penetrate the medullar intra-osseous space (at the precise moment that resistance stops, stop all pressure).
- Pull out the central trocard.
- Aspire with a sterile 5 ml syringe to check correct positioning in the intra-osseous space (0.5 to 1 ml of bone marrow suffices – it looks like blood).
- Take a second sterile 10 ml syringe filled with 0.9% sodium chloride and push rapidly (flush) to check the solution passes properly and there is no resistance.
- Set up the perfusion you already prepared on the IO needle and open it rapidly to start with. The perfusion solute should flow without any resistance if the needle is correctly positioned.
- Then select the desired flow.
- In the event of resistance, try and reposition the needle by pushing it lightly and re-attempting an aspiration.
- Secure the IO needle by fixing it carefully once all checks have been carried out.
- Check the absence of subcutaneous infiltration. In the event of infiltration, extract the IO needle and try the other leg.

Complications

- Extravasations of solutes and/or medicines
- Hematoma
- Compartmental syndrome
- Infection, subcutaneous abscess, osteomyelitis
- Epiphysis lesion, fracture
- Fat embolism

Surveillance

- Local pain, color, pulse, parenthesis, paralysis (compartmental syndrome)
- Liquid diffusion in the subcutaneous tissues
- Loco-regional inflammation
- Breathing: RR and SAT
- Circulation: HR, CRT, color and temperature of hands and feet, pulses
INTRA-OSSEOUS INFUSION SYSTEM
(Normally not for neonates)

- SINSNEIOKN1 (EZ-IO) KIT, INTRAOSSEOUS NEEDLE, paediatric, ref 9018
- SINSNEIOK1- (EZ-IO) DRILL, sealed battery operated, ref 9050
- SINSNEIOK11 (EZ-IO) TRANSPORT BAG for EZ-IO kit, ref 9027
- SINSNEIOK12 (EZ-IO) DRESSING, adhesive, stabilizing, ref 9066
4. LUMBAR PUNCTURE (LP)

Medical technique strictly reserved for experienced medical doctors thoroughly trained in this procedure.

**Indications:** Any suspicion of meningitis.

LP should be an « easy » procedure in pediatrics. It should not be delayed and, should not delay the antibiotic treatment in the context of meningitis with signs of severity.

**Sitting position**

**Lying position**

**Site of lumbar puncture**

**Contra-indications**

- ICHT
- Major abnormalities of the haemostasis
Required supplies

- Big needle or short big catheter (18G or 20G)
- Local anaesthetic
- Povidone iodine (dermal aqueous solution 10%)
- 4 x 4 sterile compresses
- Sterile gloves
- Infusion in emergency (2 ml x 2 D10% + Ringer Lactate and/or NS 0.9%) and ready to be connected to the intra-osseous + 3 way tap.
- Sterile syringes 10 ml x 2
- Adhesive tape

Implementation procedure

- With respect to some exceptions, in children, LP is done in a sitting down position, round back with a maximal lumbar flexion and a pillow between the arms. The child should have the head on the knees (genu pectorale position) and be strongly maintained by a third person while a nurse is helping the medical doctor.
- Apply a local anaesthetic to the puncture zone (only if the child is conscious).
- Wash carefully your hands (universal precautions) or put on sterile gloves.
- Clean the puncture area carefully with Povidone iodine (dermal aqueous solution 10%).
- Firm and regularly progressive puncture, perpendicular to the dorsal wall, on the median line, at the level of the L4 – L5 interval (line doing the junction between the two posterior iliac combs). The puncture should be at the superior side of the inferior vertebra with a slightly ascending direction. You should stop as soon as the small resistance is felt (passing through the yellow ligament and the sub-arachnoids membrane); more rarely it is also possible at the L3 – L4 level.
- Pull out the central trocard.
- Leave the SCF flow down spontaneously in a sterile tube (10 drops are enough).
- Note the pressure of the flow, the colour / aspect of the liquid (transparent, clear, yellow, bloody…).
- Put back the central trocard and pull out the needle.
- Compression of the puncture area and immediately install the child in lateral decubitus.
- Carefully remove the iodine, which was applied initially.
- Small protective dressing.
- Maintain the child 1 to 3 hours in decubitus in order to avoid headache.

Complications

- Head aches.
- Post-LB painful syndrome, very rare in infants and small children.
- No other complications if the rare contraindications are respected (infections, cerebellar amygdales hernia).

Surveillance

- Decubitus 1 to 3 hours.
- Head aches.
- Neurological status.
5. TAKING CAPILLARY BLOOD SAMPLE (HEEL PRICK) – From WHO MANAGING NEWBORN PROBLEMS

Required supplies

- Clean examination gloves.
- Swab or cotton-wool ball soaked in antiseptic solution (4% Chlorhexidine or 2.5% Iodine Povidone (skin preparation or scrub).
- Dry cotton-wool ball.
- Sterile lancet (if a lancet is not available, use a 24G needle).
- Capillary tubes or other appropriate glass collection tubes.

Procedure

- **Pain prevention** *(no pharmacological methods – Refer to this chapter)*.
- Gather necessary supplies.
- Follow principles of infection prevention.
- Wash hands, and put on clean examination gloves.
- Well warm up the heel of the neonate avoiding burns by putting it in a cupule with very tepid water that allow increasing 7 times the blood flow.
- Prepare the skin of the heel using a swab or cotton-wool ball soaked in antiseptic solution, and allow drying.
- Flex the foot up towards the leg and hold it in this position with one hand.
- Squeeze the heel firmly enough to make it flush red (but not so much that it turns white).
- Puncture the skin (about 1 to 2 mm deep) firmly with a lancet (or a 24G needle):
  - Aim towards the lateral or medial side of the heel *(refer to the left figure below)*.
  - Avoid the heel pad because of the risk of infection.
  - Avoid using previously used sites, if possible.
Site for heel prick

- Squeeze the heel gently and intermittently to enhance blood flow. Avoid excessive squeezing and rubbing of the heel, as this will cause bruising and dilution of blood with tissue fluid, giving an inaccurate and/or non-reliable result.

- During the blood sampling, insert a finger between the leg and the top of the foot in order to avoid the foot to be crushed against the leg *(right photo above)*.

| A tiny jab is more unpleasant for the baby because it will take longer to collect the blood and requires prolonged squeezing of the heel; in some cases, a second heel stick may be required. Excessively deep heel sticks, however, can cause cuts, infections, and scarring. |

- Collect blood into the tube, taking enough blood to perform all necessary laboratory investigations.

- After blood is collected, have an assistant apply gentle pressure to the puncture site with a dry cotton-wool ball for several minutes to prevent bruising.

- Record the volume of blood taken.

**Risks**

- Pain +++.

- Necrotizing osteochondritis because of the penetration of the lancet inside the calcaneum during the capillary blood sampling on the heel; ligamentous stretching during the blood sampling on the heel.

- Abcess; hematoma: increased risk in neonates and preterm infants because of the capillary fragility.

- Decrease sensitiveness because of the thickening of the epiderm; Burns in case of skin contact with too hot water. Control the water temperature by maintaining the extremity of your hand inside the water.
6. Making an IM INJECTION in neonates and premature babies

Intra muscle injection (IM)

The intra muscle injection (IM) consist in the under pressure introduction of a drug (antibiotic, vaccine, analgesic, sedative drug…) in a muscle located immediately under the subcutaneous tissue.

Indications

- Administration of a drug.
- Administration of a vaccine.
- Need for more rapid absorption and action of a drug than by oral route; resorption is done more rapidly because of the important vascularisation of the muscles.

Contraindications

- Skin abnormality on the area of injection (inflammation, scratching lesions, nodule, scar…).
- Lymph oedema.
- Newborns with coagulation disease.
- Poorly developed buttock muscle (superior external quarter).
- Deltoid muscle still about the age of 36 months.

Complications

- Abscess: it happens when asepsis rules were not respected. One time an abscess is existing, change the site of injection and inform the medical doctor.
• Great sciatic nerve paralysis (only for injections into the buttocks): it occurs when an injection is done in the buttock muscle but not strictly in the superior external quarter (injection of the product very close to the nerve). Among children, particularly the smallest one, great sciatic nerve trajectory is variable that is increasing the risk to reach it.
• Pain during the injection.
• Lesions of the muscle: fibrosis, deformation.
• Hematoma.
• Weakness.
• Immediate reaction to the injected product: anaphylactic shock, extreme medical emergency.
• Late reaction to the injected product: (hours and/or following days): inflammation of the area, indurations, abscesses…
• Under or over penetration of the muscle because of poor ad equation of the length of the needle or because of a bad technique of injection.
• Premature babies have not or very few muscular mass. It is crucial to pay a great attention to the area of injection and to the quantity of fluid to be injected. It should fit more with the child’s weight rather than with his age.

Prevention of complications – Cautions

• Choose the area of injection and the length of the needle according to the weight, the importance of the muscular and fat mass, the volume and type of product to be injected as well as the planned frequency of injections.
• In neonates, recommended areas of injection are the two thighs (external vast muscles).
• In case of long term treatment, change the areas of injections. Indurations can occur at the injection sites. It is important to avoid new injections into these indurations.

Injection areas in neonates: external vast muscles of the two thighs:

Maximum quantity to be injected:
- 1 ml in premature babies.
- 1 ml in neonates < 2500g.
- 2 ml in neonates ≥ 2500g.

⚠️ Other muscles strongly not recommended

Devices

• Clean tray.
• Hydro-alcoholic solution for the hands.
• Skin cleaning:
  o If administration of a treatment: antiseptic (4% chlorhexidine).
  o If administration of a vaccine: clean water.
• Cotton.
• Collector for sharp or cutting material and needles.
• Product to be injected.
• Needle to prepare / sampling of the product to be injected.
• Material for injection: sterile syringe + 23G (blue) needle or auto block syringe for vaccination.

Procedure
• Prepare the procedure by actions that aim at pain and discomfort limitation (presence of parents, sugared water…).
• Check the medical prescription.
• Check the name, the dosage and the administration route of the product.
• Prepare the material and the product to be injected on the tray.
• Install the baby and his relatives comfortable.
• Wash the hands or make disinfection with a hydro-alcoholic solution.
• Look at the area of injection.
• Clean the area of injection.
• Stretch the skin; maintain the muscle between the thumb and the index.
• Give the injection at 90° without hesitation and without rebound.
• Control the right position of the needle; slow sucking up in order to be sure that the needle is not in a vessel. In case there is a blood reflux, change a little bit the position of the needle and suck up again.
• Slowly inject the product. In order to limit pain during the injection of some products (benzathin benzylpenicillin, etc...), share the global quantity of product to make two injections, half global dose in each area.
• Take off the needle and slightly compress at the same time the site of injection with cotton with disinfectant.
• Don’t recap the needle and remove it immediately in the collector for sharp or cutting material and needles.
• With dry cotton, make a small massage on the site of injection in order to facilitate the diffusion of the product.
• Remove wastes.
• Wash your hands or disinfect them with the hydro-alcoholic solution.
• Write the procedure in the care file of the infant.
Nasal Continuous Positive Airway Pressure (NCPAP) is an effective treatment for respiratory distress syndrome (RDS).
It should be done by well trained staff that has a good understanding of the system, in neonatal units, in hospitals levels II (it allows to decrease the number of transfers to hospitals level III) and levels III.
Clear policy and guidelines on the use of NCPAP should exist in the unit in order to ensure safe and effective application.
Delivering NCPAP required a functional system. So, pay attention to details and work done.

Procedure
The application of continuous positive airway pressure (CPAP) to neonates and infants by nasal prongs (NCPAP) is the only one recommended in MSF programs.
It should be administered with a commercially available circuit used in conjunction with a continuous flow source, infant ventilator, or a suitably equipped multipurpose ventilator.

Description / Definition
Continuous positive airway pressure (CPAP) is the application of positive pressure to the airways of the spontaneously breathing infant throughout the respiratory cycle.
For the most part, neonates are preferential nose breathers that easily facilitate the application of nasal CPAP. This is accomplished by affixing nasal prongs to the infant.
The NCPAP delivery system consists of three components:
• The circuit for continuous flow of inspired gases.
• The interface connecting the CPAP circuit to the infant’s airway.
• A method for creating positive pressure in the CPAP circuit.
The device provides heated and humidified continuous or variable flow from a circuit connected to a continuous gas source, mechanical ventilator designed for neonates, or a suitably equipped multipurpose ventilator, set in the CPAP mode.
CPAP maintains inspiratory and expiratory pressures above ambient pressure, which should result in an increase in Functional Residual Capacity (FRC) and improvement in static lung compliance and decreased airway resistance in the infant with unstable lung mechanics with subsequent reduction in the work of breathing.

Indications
• Abnormalities on physical examination – the presence of increased work of breathing as indicated by an increase in respiratory rate of more than 30% of normal, substernal and suprasternal retractions, grunting, and nasal flaring; and/or the presence of pale or cyanotic skin color and agitation.
• Inadequate SpO\textsubscript{2} despite optimal oxygen therapy – Refer to the chapter 1 in Part VII.
• The presence of poorly expanded and/or infiltrated lung fields on chest radiograph.
The presence of a condition (listed below) thought to be responsive to NCPAP if associated with one or more of the clinical presentations described above:
- Respiratory Distress Syndrome (RDS) / Hyaline Membrane Disease (HMD)
- Severe and/or repeated apnea / bradycardia / cyanosis of prematurity
- Severe Transient Tachypnea of the Newborn (TTN) with important oxygen requirement
- Chest X-Ray consistent with RDS / Atelectasis / Pulmonary edema.

Contraindications
- Birth weight less than 1000g (relative contraindication in hospitals level II)
- GA < 31 weeks (relative contraindication in hospitals level II)
- Insufficient medical or nursing resources
- Insufficient equipment
- Apnea in babies more than 1500g and/or 34 weeks of GA since they have rarely uncomplicated apnea of prematurity as a reason to require NCPAP (in these case look for birth asphyxia with HIE, sepsis...).

Hazards / Complications
- Pneumothorax (more likely at the acute phase of the RDS and NOT a contraindication to continue)
- Nasal obstruction (secretions or improper position of the NCPAP / Prongs)
- Nasal septal erosion or necrosis
- Gastric distension
- Sepsis
- Agitation not relieved by simple measures (comforting, paracetamol)
- Continued deterioration.

All of the above require immediate consultation with the Neonatologist / Pediatrician / MD in charge to discuss further management and retrieval.

Assessment of Outcome
CPAP is initiated at levels of 4-5 cm H$_2$O and may be gradually increased up to 10 cm H$_2$O to provide the following:
- Stabilization of oxygen requirement with SpO$_2$ matching with expected results – Refer to the chapter 1 on oxygen therapy in Part VII.
- Reduction in the work of breathing as indicated by a decrease in respiratory rate by 30-40% and a decrease in the severity of retractions, grunting, and nasal flaring.
- Improvement in lung volumes and appearance of lung as indicated by chest radiograph.
- Improvement in infant comfort as assessed by bedside caregiver.
- Clinically significant reduction in apnea, bradycardia, and cyanosis episodes.
The Diamedica Baby CPAP provides controllable, safe CPAP with minimal running costs for preterm babies, neonates and infants. No need for compressed gases.

The Diamedica baby CPAP has a bubble pressure controller. The pressure in the system is controlled by selecting the required setting on the top of the bubble container:

- Maximum gas flow is 16 l/min
- Variable oxygen concentration 21% - 95%
- No compressed gases required
- No need for an oxygen analyser (see chart overleaf)
- Additional humidifier
- Maximum pressure in the circuit is set by the bubble controller (see detail)

The Diamedica Baby CPAP is reliable, safe and economical:

- Gives maximum reliability, and is simple to use
- The running costs are very low
- Requires minimal power, the equivalent of running four 100w light bulbs
- The inspiratory and expiratory tubing is adjustable
- Includes velcro fixings straps and a chin strap
- Neonate bonnets are included
- It is robust and able to withstand extremes of temperature and humidity, making it suitable for use in the most challenging of environments

The Baby CPAP kit contains:

- Oxygen concentrator, twin flowmeter for 8 l/min O₂ and 8 l/min air
- Bubble pressure controller 1cm H₂O - 10cm H₂O
- Adjustable inspiratory and expiratory tubing (2 sets included)
- Silicone nasal prongs (7 sizes available - 4 included as standard)
- Neonate bonnets (two sizes included)
- Velcro fixing straps and chin strap
- Gas sample port and connector

continued
Training and Support

Diamedica’s commitment to our customers is:

- To provide, free of charge to all customers, ongoing after sales support via email or telephone for as long as the customer has their equipment.
- To provide training for medical and technical personnel to enable them to maximise the potential of the equipment safely and economically.

**Oxygen / Air Mixing Chart**

<table>
<thead>
<tr>
<th>Oxygen Flowmeter (lt/min)</th>
<th>Air Flowmeter (lt/min)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>95.0</td>
<td>57.5</td>
<td>45.0</td>
<td>38.8</td>
<td>35.0</td>
<td>32.5</td>
<td>30.7</td>
<td>29.4</td>
<td>28.3</td>
</tr>
<tr>
<td>2</td>
<td>95.0</td>
<td>70.0</td>
<td>57.5</td>
<td>50.0</td>
<td>45.0</td>
<td>41.4</td>
<td>38.8</td>
<td>36.7</td>
<td>35.0</td>
</tr>
<tr>
<td>3</td>
<td>95.0</td>
<td>76.3</td>
<td>65.0</td>
<td>57.5</td>
<td>52.1</td>
<td>48.1</td>
<td>45.0</td>
<td>42.5</td>
<td>40.5</td>
</tr>
<tr>
<td>4</td>
<td>95.0</td>
<td>80.0</td>
<td>70.0</td>
<td>62.9</td>
<td>57.5</td>
<td>53.3</td>
<td>50.0</td>
<td>47.3</td>
<td>45.0</td>
</tr>
<tr>
<td>5</td>
<td>95.0</td>
<td>82.5</td>
<td>73.6</td>
<td>66.9</td>
<td>61.7</td>
<td>57.5</td>
<td>54.1</td>
<td>51.3</td>
<td>48.8</td>
</tr>
<tr>
<td>6</td>
<td>95.0</td>
<td>84.3</td>
<td>76.3</td>
<td>70.0</td>
<td>65.0</td>
<td>60.9</td>
<td>57.5</td>
<td>54.6</td>
<td>52.1</td>
</tr>
<tr>
<td>7</td>
<td>95.0</td>
<td>85.6</td>
<td>78.3</td>
<td>72.5</td>
<td>67.7</td>
<td>63.8</td>
<td>60.4</td>
<td>57.5</td>
<td>55.0</td>
</tr>
<tr>
<td>8</td>
<td>95.0</td>
<td>86.7</td>
<td>80.0</td>
<td>74.5</td>
<td>70.0</td>
<td>66.2</td>
<td>62.9</td>
<td>60.0</td>
<td>57.5</td>
</tr>
</tbody>
</table>

*Assuming an oxygen concentrator output of 95% oxygen.*
8. ELECTRIC INFUSION PUMP in NEONATES

EEMDSYPE1-- SYRINGE PUMP (Perfusor® compact), single syringe

Gross weight / unit: 2.66 kg
Volume/unit: 14.76 dm³
Indicative price/unit: 839.62 €

Justification code: PM
Medical device class: IIb

Maintenance

Must be cleaned and disinfected with Surfanios® 0.25 % detergent-disinfectant solution (i.e. 20 ml = 1 sachet = 1 stroke of dosing pump for 8 litres water).

Do not rinse (contact time must be 15 minutes minimum and the product is not corrosive).
9. CLEANING OF INCUBATORS (when you are obliged to have some because of donation…)

**Surfanios**

**DDISSURF+++**  
DDISSURF2S- → Detergent / Disinfectant for surfaces, 20 ml, monodose sachet  
DDISSURF5B- → Detergent / Disinfectant for surfaces, 5 l tin + dosing pump

**Definition**  
Detergent-disinfectant used for the cleaning and the disinfection of surfaces: floors, walls and medical equipment: like Mayo table, operation table, operating lamp...

Replaces *Cresol* and *Chlorine* for these indications.

Trade name: *Surfanios®*

**Specifications**
- Contains
  - detergent active principles
  - antimicrobial active principles: amino-acids and quaternary ammonium
- Meets the European standards:
  - active on BK, HIV-1, HBV, HBC, salmonella, staph metiR,  
  - Acinetobacter baumanni, Candida albicans, Aspergillus niger, Mycobacterium terrae
- acts within 15 minutes (except Mycobacterium terrae and HBV: 30 minutes)
- Non corrosive, compatible with any kind of covering/flooring

**Packaging**
- Monodose sachet of 20ml
- Tin of 5 litres with 20 ml dosing pump

**Instructions for use**
- Concentrated solution TO BE DILUTED at 0.25% before use (i.e. 20 ml – 1 sachet – 1 stroke of dosing pump for 8 litres water).
- Apply according to instructions for use on a visually clean and dry surface.
- **Do not rinse** (contact time must be 15 minutes minimum).
- Clean regularly the surfaces with an ammoniated detergent (e.g. Ajax) to remove the fat layer which forms during the successive applications of Surfanios® (minimum once a month or more if the layer is visible).
- Do not use to clean sanitary surfaces.

**Precautions for use**
- Very irritating product when undiluted
- Avoid contact with skin and eyes: wear household gloves and safety goggles
- In case of contact, rinse immediately with plenty of clear water
- Do not use for the skin disinfection

**Storage**
- Between 5 and 35°C, in a dry and ventilated area
- Shelf life:
  - closed tins: 3 years
  - monodose sachets: 18 months
- Do not prepare the solutions in advance
- Discard the diluted solutions after use
## 10. LABORATORY REFERENCE VALUES

### Blood – Term infants (age of life)

<table>
<thead>
<tr>
<th>Value</th>
<th>Cord</th>
<th>1-12 hour</th>
<th>12-24 hour</th>
<th>24-48 hour</th>
<th>48-72 hour</th>
<th>3-10 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (g/dL)</td>
<td>16.8</td>
<td>18.4</td>
<td>17.8</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>53</td>
<td>58</td>
<td>55</td>
<td>54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCV</td>
<td>107</td>
<td>108</td>
<td>99</td>
<td>98</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reticulocytes (%)</td>
<td>3-7</td>
<td>3-7</td>
<td>1-3</td>
<td>0-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WCC $\times 10^9$/L</td>
<td>18.1 (9-30)</td>
<td>22.8 (13-38)</td>
<td>18.9 (9.4-34)</td>
<td></td>
<td>12.2 (5-21)</td>
<td></td>
</tr>
<tr>
<td>Neutro $\times 10^9$/L</td>
<td>11.1 (6-26)</td>
<td>15.5 (6-28)</td>
<td>11.5 (5-21)</td>
<td></td>
<td>5.5 (1.5-10)</td>
<td></td>
</tr>
<tr>
<td>CRT</td>
<td>&lt; 3 seconds</td>
<td>&lt; 3 seconds</td>
<td>&lt; 3 seconds</td>
<td>&lt; 3 seconds</td>
<td>&lt; 3 seconds</td>
<td></td>
</tr>
<tr>
<td>CRP (mg/L)</td>
<td>&lt; 7 &lt; 7 &lt; 7 &lt; 7 &lt; 7</td>
<td>&lt; 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Albumin (g/L)</td>
<td>28-43</td>
<td>28-43</td>
<td>28-43</td>
<td>28-43</td>
<td>30-43</td>
<td></td>
</tr>
<tr>
<td>Na (mEq/L)</td>
<td>147 (126-166)</td>
<td>143 (124-156)</td>
<td>145 (132-159)</td>
<td>148 (134-160)</td>
<td>149 (139-162)</td>
<td></td>
</tr>
<tr>
<td>K (mEq/L)</td>
<td>7.8 (5.6-12)</td>
<td>6.4 (5.3-7.3)</td>
<td>6.3 (5.3-8.9)</td>
<td>6.0 (5.2-7.3)</td>
<td>5.9 (5.0-7.7)</td>
<td></td>
</tr>
<tr>
<td>Ca (Ionised) (millimol/L)</td>
<td>1.05-1.37</td>
<td>1.05-1.37</td>
<td>1.05-1.37</td>
<td>1.10-1.44</td>
<td>1.20-1.48</td>
<td></td>
</tr>
</tbody>
</table>
Blood – Preterm infants

Hb at birth (g/dl) = 14 (at 24 weeks of GA); 14.5 (at 28 weeks of GA); 15 (at 34 weeks of GA).

CSF – Term and Preterm infants (by age of life)

<table>
<thead>
<tr>
<th>Value</th>
<th>Term &lt; 7 d</th>
<th>Term &gt; 7 d</th>
<th>Preterm &lt; 7 d</th>
<th>Preterm &gt; 7 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCC (mm³)</td>
<td>5 (0-30)</td>
<td>3 (0-10)</td>
<td>9 (0-30)</td>
<td>12 (2-70)</td>
</tr>
<tr>
<td>RCC (mm³)</td>
<td>9 (0-50)</td>
<td>&lt; 10</td>
<td>30 (0-333)</td>
<td>30</td>
</tr>
<tr>
<td>Protein (g/L)</td>
<td>0.6 (0.3-2.5)</td>
<td>0.5 (0.2-0.8)</td>
<td>1 (0.5-2.9)</td>
<td>0.9 (0.5-2.6)</td>
</tr>
<tr>
<td>Glucose (millimol/L)</td>
<td>3 (1.5-5.5)</td>
<td>3 (1.5-5.5)</td>
<td>3 (1.5-5.5)</td>
<td>3 (1.5-5.5)</td>
</tr>
</tbody>
</table>

Urine – Term and Preterm infants (by age of life)

<table>
<thead>
<tr>
<th>Value</th>
<th>Term &lt; 7 d</th>
<th>Term &gt; 7 d</th>
<th>Preterm &lt; 7 d</th>
<th>Preterm &gt; 7 d</th>
</tr>
</thead>
<tbody>
<tr>
<td>WCC (per HPF)</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>RCC (per HPF)</td>
<td>0-2</td>
<td>0-2</td>
<td>0-2</td>
<td>0-2</td>
</tr>
<tr>
<td>Squames (per HPF)</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>Organisms</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>

HPF = “HIGH POWER FIELD”
# PART VIII

## CASE DEFINITIONS for the DATABASE

| Neonatal Period | Case definition recommended by APLS (International Standards):  
All newborns from birth (Day 0) to Day 28 or 30 – 31.  

Case definition recommended by WHO:  
All newborns from birth (Day 0) to 2 months (because of physiological / physiopathological particularities and common specific risks in poor resource settings).  

Case definition recommended by MSF:  
APLS or WHO case definition to be discussed with the operations context by context based on needs, other health actors activities / possibilities and MSF capacity |
|---|---|
| Gestational Age | Case definition recommended by WHO / APLS  
- Preterm Infant: < 37 weeks of gestation.  
- Term Infant: ≥ 37 weeks and < 42 weeks of gestation.  
- Post Term Infant: ≥ 42 weeks of gestation. |
| LBW  
VLBW  
ELBW  
IUGR | Case definition recommended by WHO / APLS  

**Confirmed cases:**  
- LBW = Low Birth Weight:  
  - < 2500 g according to APLS (International standards) and WHO.  
  - < 2000 g according to MSF (because of practical and functional reasons).  
- VLBW = Very Low Birth Weight: < 1500 g according to APLS (International standards) and MSF. |
<table>
<thead>
<tr>
<th>Neonatal bacterial sepsis &amp; other neonatal severe infections with exception of neonatal meningitis</th>
<th>Recommended case definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>* Neonatal signs of danger:</td>
<td></td>
</tr>
<tr>
<td>▪ Reduced feeding or unable to breastfeed.</td>
<td></td>
</tr>
<tr>
<td>▪ Irritability, high-pitched cry, convulsions.</td>
<td></td>
</tr>
<tr>
<td>▪ Drowsy, lethargic or unconscious.</td>
<td></td>
</tr>
<tr>
<td>▪ Respiratory rate less than 20 / min or apnoea (cessation of breathing for &gt; 15 sec).</td>
<td></td>
</tr>
<tr>
<td>▪ Respiratory rate greater than 60 / min.</td>
<td></td>
</tr>
<tr>
<td>▪ Grunting.</td>
<td></td>
</tr>
<tr>
<td>▪ Severe chest depression (respiratory distress).</td>
<td></td>
</tr>
<tr>
<td>▪ Central cyanosis.</td>
<td></td>
</tr>
</tbody>
</table>

**Clinical description**

Neonatal bacterial sepsis is characterized by acute onset of fever (usually > 38.5° C rectal or 38.0° C axillary) or hypothermia or any signs of danger* or high risk factors such as maternal fever (T° > 37.9° C before delivery or during labour), membranes ruptured > 24 hours before delivery, foul smelling amniotic fluid, deep jaundice, severe abdominal distension, local signs such as many or severe skin pustules, umbilical redness extending to the peri umbilical skin or umbilicus draining pus, painful joints, joint swelling, reduced movement, and irritability if these parts are handled.

**Laboratory criteria for diagnosis**

Neonatal bacterial sepsis can be confirmed by two methods.

(1) Culture method: isolation of a bacterial pathogen from a normally sterile clinical specimen such as blood.

(2) Gram stain results.

**Case classification**

**Suspected:**

▪ Any neonate with sudden onset of fever (> 38.5° C rectal or 38.0° C axillary) or hypothermia or two signs of danger*.

   Or

▪ Any neonate with 1 high risk factor = alarming background such as maternal fever (T° > 37.9° C before delivery or during labour), membranes ruptured > 24 hours before delivery, foul smelling amniotic fluid, deep jaundice, severe abdominal distension, local signs such as many or severe skin pustules, umbilical redness extending to the peri umbilical skin or umbilicus draining pus, painful joints, joint swelling, reduced movement, and irritability if these parts are handled.

**Confirmed:**

▪ A case that is laboratory-confirmed by growing (i.e. culturing) or identifying (i.e. by Gram stain) a bacterial pathogen from the blood in a neonate with a clinical syndrome consistent with bacterial sepsis.
**Note:** Any neonates with a bacterium isolated from blood may be reported as confirmed cases of sepsis if their clinical syndrome was sepsis (i.e. culture from normally sterile fluids is the gold standard). Culture of bacteria from a non-sterile site does not confirm a case of disease, since the bacteria can grow in these other areas without causing disease.
Neonatal bacterial meningitis

* Neonatal signs of danger:
  - Reduced feeding or unable to breastfeed.
  - Irritability, high-pitched cry, convulsions.
  - Drowsy, lethargic or unconscious.
  - Respiratory rate less than 20 / min or apnoea (cessation of breathing for > 15 sec).
  - Respiratory rate greater than 60 / min.
  - Grunting.
  - Severe chest depression (respiratory distress).
  - Central cyanosis.

WHO recommended case definition

Clinical description
Neonatal bacterial meningitis is characterized by acute onset of fever (usually > 38.5° C rectal or 38.0° C axillary) or hypothermia associated with at least two general signs such as drowsy, lethargic or unconscious, reduced feeding, irritability, high-pitched cry, apnoeic episodes, and any signs of danger. Two other signs are more specific but they appear lately (advanced cases) and consequently should not be considered as necessary for the clinical diagnosis: Convulsions and bulging fontanel. Nevertheless, when they are existing, hyper or hypothermia + one of these two specific sign is equivalent to clinical meningitis.

Laboratory criteria for diagnosis
Neonatal bacterial meningitis can be confirmed by three methods. (1) Culture method: isolation of a bacterial pathogen from a normally sterile clinical specimen such as CSF or blood. (2) Antigen detection methods: identification of a bacterial antigen in normally sterile fluids (i.e. CSF or blood) by such methods as latex agglutination or counter immunoelectrophoresis (CIE). (3) Gram stain results.

Case classification
Suspected:
Any neonate with sudden onset of fever (usually > 38.5° C rectal or 38.0° C axillary) or hypothermia and two of the following signs: drowsy, lethargic or unconscious, reduced feeding, irritability, high-pitched cry, apnoeic episodes, and any signs of danger.
  Or
Any neonate with sudden onset of fever (> 38.5 °C rectal or 38.0 °C axillary) or hypothermia and one of the following signs: Convulsions and bulging fontanelle.

Probable:
A suspected case with CSF examination showing at least one of the following:
- Turbid appearance;
- Leukocytosis (> 100 cells/mm3);
- Leukocytosis (10-100 cells/mm3) AND either an elevated protein (> 100 mg/dl) or decreased glucose (< 40 mg/dl).

Confirmed:
A case that is laboratory-confirmed by growing (i.e. culturing) or identifying (i.e. by Gram stain or antigen detection methods) a bacterial pathogen in the CSF or from the blood in a neonate with a clinical syndrome consistent with bacterial
meningitis.

*Note:* Any neonates with a bacterium isolated from CSF or blood may be reported as confirmed cases of meningitis if their clinical syndrome was meningitis (i.e. culture from normally sterile fluids is the gold standard). Culture of bacteria from a non-sterile site does not confirm a case of disease, since the bacteria can grow in these other areas without causing disease.

<table>
<thead>
<tr>
<th>Necrotizing enterocolitis (NEC)</th>
<th>WHO recommended case definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical case definition and case classification</strong></td>
<td><strong>Suspected case:</strong></td>
</tr>
<tr>
<td></td>
<td>Any neonates, particularly if very low birth weight (&lt; 1.75 kg), after 1 week of age, with feeding intolerance, abdominal distension + features of sepsis: temperature instability, jaundice, apnoea, bradycardia, lethargy, peripheral hypoperfusion, shock.</td>
</tr>
<tr>
<td></td>
<td>Or</td>
</tr>
<tr>
<td></td>
<td>Any neonates, particularly if very low birth weight (&lt; 1.75 kg), after 1 week of age, with at least one of the 3 major symptoms: Bilious aspirates / vomiting or bloody stools or abdominal distension and tenderness + features of sepsis: temperature instability, jaundice, apnoea, bradycardia, lethargy, peripheral hypoperfusion, shock.</td>
</tr>
<tr>
<td><strong>Confirmed case:</strong></td>
<td>Any neonates, particularly if very low birth weight (&lt; 1.75 kg), after 1 week of age, with the 3 major symptoms: Bilious aspirates / vomiting, bloody stools, major abdominal distension and tenderness or perforation / peritonitis (paralytic ileus, abdominal wall oedema and discoloration) + features of sepsis: temperature instability, jaundice, apnoea, bradycardia, lethargy, peripheral hypoperfusion, shock.</td>
</tr>
</tbody>
</table>

*Note:* The basis for case classification is entirely clinical and does not depend on laboratory confirmation. NEC cases reported by physicians are considered to be confirmed. However, investigators should examine NEC case records during annual hospital record reviews.

<table>
<thead>
<tr>
<th>Perinatal asphyxia (neonatal convulsions due to perinatal asphyxia) or Hypoxic Ischaemic Encephalopathy (HIE)</th>
<th>WHO recommended case definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Clinical case definition and case classification</strong></td>
<td><strong>Suspected case:</strong></td>
</tr>
<tr>
<td></td>
<td>Any stillbirth in which the cause of death is unknown.</td>
</tr>
<tr>
<td></td>
<td>Any neonatal death between 0 and 2 days of age inclusive in which the cause of death is unknown.</td>
</tr>
<tr>
<td>Neonatal Tetanus (NT)</td>
<td>WHO recommended case definition</td>
</tr>
<tr>
<td>-----------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td><strong>Clinical case definition and case classification</strong></td>
<td><strong>Suspected case:</strong> Any neonatal death between 3 and 28 days of age inclusive in which the cause of death is unknown. Or Any neonate reported as having suffered from neonatal tetanus between 3 and 28 days of age and not investigated. <strong>Confirmed case:</strong> Any neonate with normal ability to suck and cry during the first 2 days of life and - Who, between 3 and 28 days of age, cannot suck normally and - Becomes stiff or has spasms (i.e. jerking of the muscles).</td>
</tr>
</tbody>
</table>

*Note:* The basis for case classification is entirely clinical and does not depend on laboratory confirmation. NT cases reported by physicians are considered to be confirmed. However, investigators should examine NT case records during annual hospital record reviews.
<table>
<thead>
<tr>
<th>Pathological neonatal jaundice</th>
<th>WHO recommended case definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Clinical description</strong></td>
</tr>
<tr>
<td></td>
<td>&gt; 50% of normal newborns and &gt; 80% of preterm newborns have some jaundice, which is considered as normal jaundice (physiological) when skin and eyes are yellow but none of the bellow:</td>
</tr>
<tr>
<td></td>
<td>Jaundice started on the 1st day of life.</td>
</tr>
<tr>
<td></td>
<td>Jaundice lasting longer than 14 days in term or 21 days in preterm infants.</td>
</tr>
<tr>
<td></td>
<td>Jaundice with fever.</td>
</tr>
<tr>
<td></td>
<td>Deep jaundice: palms and soles of the baby deep yellow.</td>
</tr>
</tbody>
</table>

**Suspected case (abnormal or pathological jaundice):**
Jaundice started on the 1st day of life.
Or
Jaundice lasting longer than 14 days in term or 21 days in preterm infants.
Or
Jaundice with fever.
Or
Deep jaundice: palms and soles of the baby deep yellow.

**Confirmed case (abnormal or pathological jaundice):**
Any suspected case when the cause was diagnosed and confirmed by the laboratory: Serious bacterial infection (growing - i.e. culturing - or identifying - i.e. by Gram stain - a bacterial pathogen from the blood in a neonate with a clinical syndrome consistent with bacterial sepsis); Haemolytic disease due to blood group incompatibility or G6PD deficiency (haemoglobin or PCV, full blood count, blood type of baby and mother, and coombs test, G6PD screen); Congenital syphilis (syphilis serology such as VDRL tests) or other intrauterine infection; Liver disease such as hepatitis (hepatitis serology) or biliary atresia (liver ultrasound scanner); Hypothyroidism (thyroid function).

| Others / Unspecified | According to the diagnosis, please refer to the different chapters of the MSF NEONATAL GUIDELINE. |
### NEONATAL DRUGS, PRODUCTS AND MATERIAL CHECKLIST / CHECKLIST DES MÉDICAMENTS, PRODUITS ET MATÉRIEL NÉONATAUX
(FROM NEONATAL MEDICAL ORDER TOOL/DE L’OUTILS DE COMMANDE MEDICAL EN NEONATOLOGIE)

#### DRUGS AND PRODUCTS / MEDICAMENTS ET PRODUITS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDISSURF2S-</td>
<td>DETERGENT/DISINFECTANT for surfaces, 20 ml, monodose sachet</td>
<td>DETERGENT/DISINFECTANT de surface, 20 ml, sachet monodose (Surfanios)</td>
</tr>
<tr>
<td>DDISSURF5B-</td>
<td>DETERGENT/DISINFECTANT for surfaces, 5 l tin + dosing pump</td>
<td>DETERGENT/DISINFECTANT de surface, bidon 5 l + Pompe doseuse (Surfanios)</td>
</tr>
<tr>
<td>DDISMHEX5B-</td>
<td>DETERGENT/DISINFECTANT for med. equip., 5l tin + dosing pump</td>
<td>DETERGENT/DISINFECTANT pr mat. méd., bidon 5l + Pompe dos.</td>
</tr>
<tr>
<td>DEXTALCO5S-</td>
<td>ALCOHOL-BASED HAND RUB, solution, 500 ml, bottle</td>
<td>HYDRO-ALCOOLIQUE, solution, 500 ml, flacon</td>
</tr>
<tr>
<td>DEXTZFR0060</td>
<td>AQUEOUS CHLORHEXIDINE 0,2%, sterile solution, 5ml, unid.</td>
<td>CHLORHEXIDINE AQUEUSE 0,2%, solution sterile, 5ml, unid.</td>
</tr>
<tr>
<td>DEXTIODP1S2</td>
<td>POLYVIDONE IODINE, 10%, solution, 200 ml, dropper bot.</td>
<td>POLYVIDONE IODEE, 10%, solution, 200 ml, fl. verseur</td>
</tr>
<tr>
<td>DEXOACIV3T4</td>
<td>ACICLOVIR, 3%, eye ointment, sterile, 4.5 g, tube</td>
<td>ACICLOVIR, 3%, pommade ophtalmique, stérile, 4,5 g, tube</td>
</tr>
<tr>
<td>DEXOTETR1O5</td>
<td>TETRACYCLINE hydrochloride, 1%, eye ointment, ster, 5g, tube</td>
<td>TETRACYCLINE chlorhydrate, 1%, pommade opht., stér, 5g, tube</td>
</tr>
<tr>
<td>DEXTYINO1O1</td>
<td>ZINC OXIDE, 10%, ointment, 100 g, tube</td>
<td>OXYDE DE ZINC, 10%, pommade, 100 g, tube</td>
</tr>
<tr>
<td>DEXTMICO2C3</td>
<td>MICONAZOL nitrate, 2%, cream, 30 g, tube</td>
<td>MICONAZOLE nitrate, 2%, crème, 30 g tube</td>
</tr>
<tr>
<td>DINJLIDO1V1</td>
<td>LIDOCAINE, 1%, 10 ml, vial</td>
<td>LIDOCAINE, 1%, 10 ml, fl.</td>
</tr>
<tr>
<td>DINJAMPI5V-</td>
<td>AMpicillin, 500 mg, powder, vial</td>
<td>AMPICILLINE, 500 mg, poudre, fl.</td>
</tr>
<tr>
<td>DINJGENT8A-</td>
<td>GENTAMICIN sulfate, 40 mg/ml, 2 ml, amp.</td>
<td>GENTAMICINE sulfate, 40 mg/ml, 2 ml, amp.</td>
</tr>
<tr>
<td>DINJCLOX5V-</td>
<td>CLOxacillin, 500 mg, powder, vial</td>
<td>CLOXACILLINE, 500 mg, poudre, fl.</td>
</tr>
<tr>
<td>DINJCEF05V-</td>
<td>CEFOTAXIME sodium, eq. 500 mg base, vial</td>
<td>CEFOTAXIME sodique, éq. 500 mg base, fl.</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
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<tr>
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<td>-----------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>DINJMETN5V-</td>
<td>METRONIDAZOLE, 5 mg/ml, 100 ml, plastic bt. for infusion</td>
<td></td>
</tr>
<tr>
<td>DINJCLIN3A-</td>
<td>CLINDAMYCIN, 150 mg/ml, 2 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJCEFT2V-</td>
<td>CEFTRIAXONE, 250 mg, powder, vial</td>
<td></td>
</tr>
<tr>
<td>DINJPENB1V-</td>
<td>BENZATHINE BENZYL PENICILLIN, 1.2 M IU, powder, vial</td>
<td></td>
</tr>
<tr>
<td>DINJPENG1V-</td>
<td>BENZYL PENICILLIN (peni G, crystal peni), 1 MIU, powder, vial</td>
<td></td>
</tr>
<tr>
<td>DINJPENP4V-</td>
<td>PENICILLIN PROCAINE 3 MIU / PENI G 1 MIU, (PPF) powder, vial</td>
<td></td>
</tr>
<tr>
<td>DINJAMIK5A-</td>
<td>AMIKACIN sulfate, eq. 250 mg/ml base, 2 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJACIV2V-</td>
<td>ACICLOVIR sodium, 250 mg, powder, vial</td>
<td></td>
</tr>
<tr>
<td>DINJARTS6V-</td>
<td>ARTESUNATE 60 mg, powder, vial + NaHCO3 5% 1 ml + NaCl 0.9% 5 ml</td>
<td></td>
</tr>
<tr>
<td>DINJARTE2A-</td>
<td>ARTEMETHER, 20 mg/ml, 1 ml, amp.</td>
<td></td>
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<tr>
<td>DINJEPIN1AM</td>
<td>EPINEPHRINE (adrenaline) tartrate, eq. 1 mg/ml base, 1 ml amp IM</td>
<td></td>
</tr>
<tr>
<td>DINJEPIN1AV</td>
<td>EPINEPHRINE (adrenaline) tartrate, eq. 1 mg/ml base, 1 ml amp IM</td>
<td></td>
</tr>
<tr>
<td>DINJZFR0156</td>
<td>PHENOBARBITAL sodium, 200 mg/ml, 1 ml, amp.</td>
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</tr>
<tr>
<td>DINJPHEY2V-</td>
<td>PHENYTOIN sodium, 50 mg/ml, 5 ml, vial</td>
<td></td>
</tr>
<tr>
<td>DINJDIAZ1A-</td>
<td>DIAZEPAM, 5 mg/ml, 2 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJPHYT2AN</td>
<td>PHYTOMENADIONE (vitamin K1), 10 mg/ml, 2 mg/0.2 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJOMEP4V-</td>
<td>OMEPRAZOLE, 40 mg, powder, vial, for infusion</td>
<td></td>
</tr>
<tr>
<td>DINJCAFC1A-</td>
<td>CAFFEINE CITRATE, 10 mg/ml, eq to 5 mg caffeine base, 1 ml amp</td>
<td></td>
</tr>
<tr>
<td>DINJMORP1A-</td>
<td>MORPHINE hydrochloride, 10 mg/ml, 1 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJNALO4A-</td>
<td>NALOXONE, 0.4 mg/ml, 1 ml, amp.</td>
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</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
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<tr>
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<td>-----------------------------------------------------------------------------</td>
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<tr>
<td>DINJZFR0167</td>
<td>Flumazenil, 0.1mg/ml, 10 ml, amp. Flumazenil, 0,1mg/1 ml, 10 ml, amp.</td>
<td></td>
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<tr>
<td>DINJDEXA4A-</td>
<td>DEXAMETHASONE phosphate, 4 mg/ml, 1 ml, amp.</td>
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<tr>
<td>DINJDEXA4A-</td>
<td>DEXAMETHASONE phosphate, 4 mg/ml, 1 ml, amp.</td>
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<tr>
<td>DINJFURO2A-</td>
<td>FUROSEMIDE, 10 mg/ml, 2 ml, amp.</td>
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<tr>
<td>DINJFURO2A-</td>
<td>FUROSEMIDE, 10 mg/ml, 2 ml, amp.</td>
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<tr>
<td>DINJSODC9A-</td>
<td>SODIUM chloride, 0.9%, 5 ml, amp.</td>
<td></td>
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<tr>
<td>DINJSODC9A-</td>
<td>SODIUM chlorure, 0,9%, 5 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINFSODC9N0</td>
<td>SODIUM chloride, 0.9%, 100 ml, plastic pouch</td>
<td></td>
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<tr>
<td>DINFSODC9N0</td>
<td>SODIUM chlorure, 0,9%, 100 ml, poche plastique</td>
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<tr>
<td>DINFSODC9N2</td>
<td>SODIUM chloride, 0.9%, 250 ml, plastic pouch</td>
<td></td>
</tr>
<tr>
<td>DINFSODC9N2</td>
<td>SODIUM chlorure, 0,9%, 250 ml, poche plastique</td>
<td></td>
</tr>
<tr>
<td>DINJGLUC1A1</td>
<td>GLUCOSE HYPERTONIC, 10%, 10 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJGLUC1A1</td>
<td>GLUCOSE HYPERTONIQUE, 10%, 10 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJGLUC5V5</td>
<td>GLUCOSE HYPERTONIC, 50%, 50 ml, vial</td>
<td></td>
</tr>
<tr>
<td>DINJGLUC5V5</td>
<td>GLUCOSE HYPERTONIQUE, 50%, 50 ml, fl.</td>
<td></td>
</tr>
<tr>
<td>DINFDEXT1N5</td>
<td>DEXTROSE (GLUCOSE) 10%, 500 ml, plastic pouch</td>
<td></td>
</tr>
<tr>
<td>DINFDEXT1N5</td>
<td>DEXTROSE, 10%, 500 ml, poche plastique</td>
<td></td>
</tr>
<tr>
<td>DINJWATE1A-</td>
<td>WATER for injection, 10 ml, plastic amp.</td>
<td></td>
</tr>
<tr>
<td>DINJWATE1A-</td>
<td>EAU pour injection, 10 ml, amp. plastique</td>
<td></td>
</tr>
<tr>
<td>DINJPOTC1A-</td>
<td>POTASSIUM chloride, 10%, 100 mg/ml, 10 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJPOTC1A-</td>
<td>POTASSIUM chlorure, 10 %, 100 mg/ml, 10 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJCALG1A-</td>
<td>CALCIUM GLUCONATE, 100 mg/ml, 10 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DINJCALG1A-</td>
<td>CALCIUM GLUCONATE, 100 mg/ml, 10 ml, amp.</td>
<td></td>
</tr>
<tr>
<td>DORANYST1S-</td>
<td>NYSTATIN, 100,000 IU/ml, oral suspension</td>
<td></td>
</tr>
<tr>
<td>DORANYST1S-</td>
<td>NYSTATINE, 100.000 UI/ml, susp. buvable</td>
<td></td>
</tr>
<tr>
<td>DORAFLUC1S-</td>
<td>FLUCONAZOLE, 50 mg/5 ml, oral solution, bottle (35ml)</td>
<td></td>
</tr>
<tr>
<td>DORAFLUC1S-</td>
<td>FLUCONAZOLE, 50 mg/5 ml, solution buvable, flacon (35ml)</td>
<td></td>
</tr>
<tr>
<td>DORAERYT1S1</td>
<td>ERYTHROMYCIN, 125 mg/5ml, powder for oral susp. 100 ml, bot.</td>
<td></td>
</tr>
<tr>
<td>DORAERYT1S1</td>
<td>ERYTHROMYCINE, 125 mg/5 ml, poudre pour susp. buv. 100 ml, fl.</td>
<td></td>
</tr>
<tr>
<td>DORAACLIN3C-</td>
<td>CLINDAMYCIN, 300 mg, géluie</td>
<td></td>
</tr>
<tr>
<td>DORAACLIN3C-</td>
<td>CLINDAMYCINE, 300 mg, caps</td>
<td></td>
</tr>
<tr>
<td>DORASUDI5T-</td>
<td>SULFADIAZINE, 500 mg, tab.</td>
<td></td>
</tr>
<tr>
<td>DORASUDI5T-</td>
<td>SULFADIAZINE, 500 mg, comp.</td>
<td></td>
</tr>
<tr>
<td>DORAPYRM2T-</td>
<td>PYRIMETHAMINE, 25 mg, tab.</td>
<td></td>
</tr>
<tr>
<td>DORAPYRM2T-</td>
<td>PYRIMETHAMINE, 25 mg, comp.</td>
<td></td>
</tr>
<tr>
<td>DORAARAC01-</td>
<td>ARTESLUNATE 25mg / AMODIAQUINE eq.67.5mg base, 2-11 mo, 3 tab</td>
<td></td>
</tr>
<tr>
<td>DORAARAC01-</td>
<td>ARTESLUNATE 25mg / AMODIAQUINE eq.67,5mg base, 2-11 m, 3 comp</td>
<td></td>
</tr>
<tr>
<td>DEXTARTS5RC</td>
<td>ARTESLUNATE, 50 mg rectal caps.</td>
<td></td>
</tr>
<tr>
<td>DEXTARTS5RC</td>
<td>ARTESLUNATE, 50 mg, suppositoire</td>
<td></td>
</tr>
<tr>
<td>DORANEVI5TD</td>
<td>NEVIRAPINE (NVP), 50 mg, disp. tab.</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Product Description</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>DORAYIDO1S-</td>
<td>NEVIRAPINE (NVP), 50 mg, comp. disp.</td>
<td></td>
</tr>
<tr>
<td>ZIDOVOUDINE, (AZT), 50mg/5ml, oral solution, 100ml bot.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZIDOVOUDINE, (AZT), 50mg/5ml, solution buvable, 100ml fl.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORAISON5S-</td>
<td>ISONIAZID (H), 50 mg/5ml, syrup, 500 ml, bottle.</td>
<td></td>
</tr>
<tr>
<td>ISONIAZIDE (H), 50 mg/5ml, sirop, 500 ml, flacon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORAPARA1S-</td>
<td>PARACETAMOL (acetaminophen), syrup, 120 mg/5ml, bot.</td>
<td></td>
</tr>
<tr>
<td>PARACETAMOL (acétaminophène), sirop, 120 mg/5 ml, fl.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORAPHEN1S-</td>
<td>PHENOBARBITAL, 5.4%, 1 mg/drop, oral solution, 30 ml, bot</td>
<td></td>
</tr>
<tr>
<td>PHENOBARBITAL, 5.4%, 1 mg/goutte, solution orale, 30 ml, fl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORAPRED5T-</td>
<td>PREDNISOLONE, 5 mg, tab.</td>
<td></td>
</tr>
<tr>
<td>PREDNISOLONE, 5 mg, comp.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORAYINS2T-</td>
<td>ZINC sulfate, eq. to 20 mg zinc mineral, dispersible tab.</td>
<td></td>
</tr>
<tr>
<td>ZINC sulfate, éq. à 20 mg de zinc minéral, comp. dispers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORAFERS2S-</td>
<td>FERROUS fumarate, 140mg/5ml (eq iron 45 mg/5 ml) oral sol.bt</td>
<td></td>
</tr>
<tr>
<td>FER fumarate, 140mg/5ml (eq. fer 45 mg/5 ml) sol. buv., fl.</td>
<td></td>
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<tr>
<td>DORACALC1C-</td>
<td>CALCIUM CARBONATE, 1.25 g (= 500mg calcium), chewing tab</td>
<td></td>
</tr>
<tr>
<td>CALCIUM CARBONATE, 1,25 g (éq à 500 mg calcium), comp. à croq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DORACOLC1S1</td>
<td>COLECALCIFEROL (vit.D3) 10,000 IU/ml, sol., 10 ml, bot.</td>
<td></td>
</tr>
<tr>
<td>COLECALCIFEROL (vit. D3) 10 000 UI/ml, sol., 10 ml, fl.</td>
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<tr>
<td>DORAPYR1ST-</td>
<td>PYRIDOXINE hydrochloride (vitamin B6), 50 mg, tab</td>
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</tr>
<tr>
<td>PYRIDOXINE chlorhydrate (vitamine B6), 50 mg, cp.</td>
<td></td>
<td></td>
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<tr>
<td>DORAORS2S-</td>
<td>ORAL REHYDRATION SALTS (ORS) low osmol., sachet 20.5 g/11</td>
<td></td>
</tr>
<tr>
<td>SELS REHYDRATATION ORALE (SRO) basse osmol. sachet 20,5 g/11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVACATET2S-</td>
<td>IMMUNOGLOBULIN, HUMAN, ANTITETANUS, 250 IU/ml, syr.</td>
<td></td>
</tr>
<tr>
<td>IMMUNOGLOBULINE HUM. ANTITETANIQUE, 250 UI/ml, sering.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVACVBCG3VD</td>
<td>VACCINE BCG, 1 dose, multidose vial, 0.05 ml/dose</td>
<td></td>
</tr>
<tr>
<td>VACCIN BCG, 1 dose, fl. multidose, 0.05 ml/dose</td>
<td></td>
<td></td>
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<tr>
<td>DVACVBCG3SD</td>
<td>(vaccine BCG) SOLVENT, 1 dose, multidose vial</td>
<td></td>
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<tr>
<td>(vaccin BCG) SOLVANT, 1 dose, multidose fl.</td>
<td></td>
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<tr>
<td>DVACVHEB3VD</td>
<td>VACCINE HEPATITIS B, 1 children dose, multidose vial (oder done in dose and not in vial)</td>
<td></td>
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<tr>
<td>VACCIN HEPATITE B, 1 dose enfant, fl. Multidose (commande se fait en dose et non pas en flacon)</td>
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<tr>
<td>DVACVPOL2DDD</td>
<td>VACCINE ORAL POLIOMYELITIS, 1 dose, multidose vial +dropper</td>
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<tr>
<td>VACCIN POLIO ORAL, 1 dose, fl. multidose +compte-gouttes</td>
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<tr>
<td>NFOSMILI1P9</td>
<td>MILK, INFANT, powder, 1st age, 900 g tin</td>
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</tr>
<tr>
<td>LAIT NOURRISSON, poudre, 1er âge, 900 g bte</td>
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<td></td>
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<tr>
<td>NFOSRUSFSUP</td>
<td>READY TO USE SUPPL. FOOD, paste, 500 kcal, 92 g sachet</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
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<tr>
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</tr>
<tr>
<td>ELAEGLC2S-</td>
<td>(glucomètre Nova StatStrip) STRIP (gluomètre Nova StatStrip) BANDELETTE</td>
<td></td>
</tr>
<tr>
<td>SLASGLC201</td>
<td>(glucomètre Nova StatStrip) CONTROL SOLUTION low, 4ml vial (glucomètre Nova StatStrip) SOLUTION DE CONTROLE bas 4ml fl.</td>
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</tr>
<tr>
<td>SLASGLC203</td>
<td>(glucomètre Nova StatStrip) CONTROL SOLUTION high, 4ml vial (glucomètre Nova StatStrip) SOLUTION DE CONTROLE haut 4ml fl.</td>
<td></td>
</tr>
<tr>
<td>ELEHAEM3C-</td>
<td>(HemoCue Hb 301) MICROCUVETTES, s.u. (HemoCue Hb 301) MICROCUVETTES, u.u.</td>
<td></td>
</tr>
<tr>
<td>ELELANC1D-</td>
<td>LANCET, s.u., sterile, standard point LANCETTE, u.u., stérile, pointe normale</td>
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</tr>
<tr>
<td>ELELANC2H-</td>
<td>LANCET, HEEL, for infants LANCETTE POUR TALON, pour nourrissons</td>
<td></td>
</tr>
<tr>
<td>SCTDCANN2N-</td>
<td>CANNULA, NASAL, OXYGEN, 2 prongs + tube, neonate LUNETTES A OXYGENE, 2 embouts + tube, nouveau-né</td>
<td></td>
</tr>
<tr>
<td>SCTDCANN2PL</td>
<td>CANNULA, NASAL, OXYGEN, 2 prongs + tube, premature low flow LUNETTES A OXYGENE, 2 embouts + tube, prématuré débit min.</td>
<td></td>
</tr>
<tr>
<td>SCTDBRCF1N-</td>
<td>FILTER, BREATHING CIRCUIT, 15M/15F, neonate, s.u. FILTRE CIRCUIT RESPIRATOIRE, 15M/15F, nouveau-né, u.u.</td>
<td></td>
</tr>
<tr>
<td>EANEAIRG00-</td>
<td>AIRWAY, GUEDEL, reusable n°00, neonate CANULE DE GUEDEL, reutilisable n00, neo-natal</td>
<td></td>
</tr>
<tr>
<td>SCTDTUGL06-</td>
<td>TUBE, GASTRIC, Luer tip, s.u., 40 cm, CH06 SONDE GASTRIQUE, embout Luer, u.u., 40 cm, CH06</td>
<td></td>
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<tr>
<td>SCTDTUGL08-</td>
<td>TUBE, GASTRIC, Luer tip, s.u., 40 cm, CH08 SONDE GASTRIQUE, embout Luer, u.u., 40 cm, CH08</td>
<td></td>
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<tr>
<td>SCTDTUSU08-</td>
<td>TUBE, SUCTION, conical tip, 50 cm, single use, CH8 SONDE ASPIRATION, embout conique, 50 cm, u.u., CH8</td>
<td></td>
</tr>
<tr>
<td>SCTDTUSU10-</td>
<td>TUBE, SUCTION, conical tip, 50 cm, single use, CH10 SONDE ASPIRATION, embout conique, 50 cm, u.u., CH10</td>
<td></td>
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<tr>
<td>SCTDTUSU14-</td>
<td>TUBE, SUCTION, conical tip, 50 cm, single use, CH14 SONDE ASPIRATION, embout conique, 50 cm, u.u., CH14</td>
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<tr>
<td>SCTDTUSU16-</td>
<td>TUBE, SUCTION, conical tip, 50 cm, single use, CH16 SONDE GASTRIQUE, embout Luer, u.u., 60 cm, CH10</td>
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</tr>
<tr>
<td>SINSIVPP22-</td>
<td>IV CATHETER, injection port, s.u. 22 G (0.8 x 25 mm), blue CATHETER IV, site d’injection, u.u. 22 G (0.8 x 25 mm) bleu</td>
<td></td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
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<tr>
<td>SINSIVPP24-</td>
<td>IV CATHETER, injection port, s.u. 24 G (0.7 x 19 mm) yellow</td>
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<tr>
<td>SINSIVPPSTO</td>
<td>(IV catheter) STOPPER, male Luer lock, s.u.</td>
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<tr>
<td>SINSNEED21-</td>
<td>NEEDLE, s.u., Luer, 21 G (0.8 x 40 mm) green, IM</td>
<td></td>
</tr>
<tr>
<td>SINSNEED23-</td>
<td>NEEDLE, s.u., Luer, 23 G (0.6 x 30mm) blue, SC, IM child</td>
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<tr>
<td>SINSNEED26-</td>
<td>NEEDLE, s.u., Luer, 26 G (0.45 x 13 mm), brown, ID</td>
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<tr>
<td>SINSNEIO18-</td>
<td>NEEDLE, INTRA-OSSEOUS, s.u., 18G</td>
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<tr>
<td>SINSNESD22-</td>
<td>NEEDLE, SPINAL L.P., s.u., 22 G (0.7 x 40 mm)</td>
<td></td>
</tr>
<tr>
<td>SINSSCAV21-</td>
<td>SCALP VEIN INFUSION SET, s.u., 21G (0.8 x 19 mm), green</td>
<td></td>
</tr>
<tr>
<td>SINSSCAV25-</td>
<td>SCALP VEIN INFUSION SET, s.u., 25G (0.5 x 19 mm), orange</td>
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</tr>
<tr>
<td>S InSEXTS53--</td>
<td>EXTENSION TUBING + STOPCOCK, 3-WAY</td>
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<tr>
<td>SINSSETP150</td>
<td>SET, INFUSION, paediatric, precision, sterile, s.u.</td>
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</tr>
<tr>
<td>SINSSYDI01-</td>
<td>SYRINGE, s.u., Luer, 1 ml, graduated 1/100</td>
<td></td>
</tr>
<tr>
<td>SINSSYDL02-</td>
<td>SYRINGE, s.u., Luer, 2 ml</td>
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<tr>
<td>SINSSYDL05-</td>
<td>SYRINGE, s.u., Luer, 5 ml</td>
<td></td>
</tr>
<tr>
<td>SINSSYDL10-</td>
<td>SYRINGE, s.u., Luer, 10 ml</td>
<td></td>
</tr>
<tr>
<td>SINSSYDL20-</td>
<td>SYRINGE, s.u., Luer, 20 ml</td>
<td></td>
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<tr>
<td>SINSSYDF60L</td>
<td>SYRINGE, s.u., 60 ml, feeding, Luer</td>
<td></td>
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<tr>
<td>SINSSYAI05B</td>
<td>SYRINGE, AUTO-DISABLE with needle, s.u., BCG imm., 0.05 ml</td>
<td></td>
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<tr>
<td>SINSSYLL50-</td>
<td>(syringe pump) SYRINGE, s.u., Luer lock, 50 ml</td>
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<tr>
<td>SINSSETI3L-</td>
<td>(syringe pump) INFUSION LINE, s.u., PVC, 200 cm</td>
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</tr>
<tr>
<td>SDREUMBC2--</td>
<td>UMBILICAL CORD CLAMP, sterile, s.u.</td>
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<tr>
<td>Code</td>
<td>Description</td>
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<tr>
<td>SMSURAZO1D-</td>
<td>RAZOR, disposable RASOIR, jetable</td>
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<tr>
<td>SMSUGLOE1S-</td>
<td>GANT D'EXAMEN, latex, u.u. non stérile, petit GLOVE, EXAMINATION, latex, s.u. non sterile, small</td>
<td></td>
</tr>
<tr>
<td>SMSUGLOE1M-</td>
<td>GANT D'EXAMEN, latex, u.u. non stérile, moyen GLOVE, EXAMINATION, latex, s.u. non sterile, medium</td>
<td></td>
</tr>
<tr>
<td>SMSUGLOE1L-</td>
<td>GANT D'EXAMEN, latex, u.u. non stérile, grand GLOVE, EXAMINATION, latex, s.u. non sterile, large</td>
<td></td>
</tr>
<tr>
<td>ELINMASS3--</td>
<td>MASK, SURGICAL, IIR type, s.u. MASQUE CHIRURGICAL, type IIR, u.u.</td>
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<tr>
<td>SMSUDEPT1W-</td>
<td>DEPRESSOR, TONGUE, wooden ABAISSE LANGUE, bois</td>
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<tr>
<td>SDRECOTW5R-</td>
<td>COTTON WOOL, hydrophilic, roll, 500 g COTON hydrophile, rouleau, 500 g</td>
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</tr>
<tr>
<td>SDRECOMP1P-</td>
<td>COMPRESS, GAUZE, paraffin, 10 cm x 10 cm, sterile COMPRESSE, TULLE, gras, 10 cm x 10 cm, stérile</td>
<td></td>
</tr>
<tr>
<td>SDRECOMN7N-</td>
<td>COMPRESS, NON WOVEN, 7.5 cm, 4 plies, non sterile (50 to 100 Units) COMPRESSE, NON TISSEE, 7.5 cm, 4 plis, non stérile</td>
<td></td>
</tr>
<tr>
<td>SDREBANE06N</td>
<td>BANDAGE, EXTENSIBLE, non adhesive, 6 cm x 4 m BANDE EXTENSIBLE, non adhésive, 6 cm x 4 m</td>
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</tr>
<tr>
<td>SDREBANT1T2</td>
<td>BANDAGE, JERSEY, TUBULAR, 10 cm x 25 m BANDE JERSEY, TUBULAIRE, 10 cm x 25 m</td>
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<tr>
<td>SDRETAPA025</td>
<td>TAPE, ADHESIVE, roll, 2 cm x 5 m ( pour VVP ) SPARADRAP, rouleau, 2 cm x 5 m</td>
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<tr>
<td>SDRETAPA100</td>
<td>TAPE, ADHESIVE, roll, extensible, nonwoven, 10 cm x 10 m BANDE ADHESIVE, rouleau, extensible, non-tissé, 10 cm x 10 m</td>
<td></td>
</tr>
<tr>
<td>ELINDRSS01-</td>
<td>DRAPE, STERILE, nonwoven, s.u., 45 x 75 cm CHAMP STERILE, non-tissé, u.u., 45 x 75 cm</td>
<td></td>
</tr>
<tr>
<td>ELINDRAW6D-</td>
<td>DRAWSHEET, disposable, plastified, absorbable, 60 x 60 cm ALEZE, u.u., plastifiée, absorbante, 60 x 60 cm</td>
<td></td>
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<tr>
<td>SMSUBLAN1--</td>
<td>BLANKET, SURVIVAL, 220 x 140 cm, thickness 12 microns COUVERTURE DE SURVIE, 220 x 140 cm, épaisseur 12 microns</td>
<td></td>
</tr>
<tr>
<td>ELINGOWI1--</td>
<td>GOWN, PROTECTION, non woven, single use BLOUSE DE PROTECTION, non tissée, u.u..</td>
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<tr>
<td>SMSTCARI01E</td>
<td>CARD, IMMUNIZATION, French/English, A5, recto/verso CARTE DE VACCINATION, français/anglais, A5, recto/verso</td>
<td></td>
</tr>
<tr>
<td>DEXTSOAP1B2</td>
<td>SOAP, 200 g, bar SAVON, 200 g, barre</td>
<td></td>
</tr>
</tbody>
</table>

**WARD MATERIAL/MATÉRIEL POUR LE SERVICE**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLUCOMETER, blood glucose monitor (Nova StatStrip) + strips (200)</td>
<td></td>
</tr>
<tr>
<td>ELAEGLUC2--</td>
<td>GLUCOMETRE, lecteur glycémie (Nova StatStrip) + bandelettes</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
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<tr>
<td>----------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Glucomètre, lecteur glycémie (Nova StatStrip) + bandelettes</td>
<td></td>
</tr>
<tr>
<td>ELAEHAEM3--</td>
<td><strong>HAEMOGLOBIN PHOTOMETER</strong> (HemoCue Hb 301) tropicalized <strong>PHOTOMETRE HEMOGLOBINE</strong> (HemoCue Hb 301), tropicalisé</td>
</tr>
<tr>
<td>ELAEHAEM2CL</td>
<td>(HemoCue Hb 201+/301) <strong>CLEANER</strong>, box of 5 (HemoCue Hb 201+/301) <strong>NETTOYANT</strong>, boîte de 5</td>
</tr>
<tr>
<td>EANEOXYM4--</td>
<td><strong>OXYMETER, PULSE</strong> (Masimo RAD-5) + accessories <strong>OXYMETRE DE POULS</strong> (Masimo RAD-5) + accessoires</td>
</tr>
<tr>
<td>PELEBATTO6</td>
<td>BATTERY, rechargeable, NiMH, 1.2 V, R6 (AA), set of 4 <strong>PILE, rechargeable</strong>, NiMH, 1.2 V, R6 (AA), jeu de 4</td>
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<tr>
<td>EHOECONC4--</td>
<td><strong>CONCENTRATOR O2</strong> (De Vilbiss 525KS) 220V + access. <strong>EXTRACTEUR O2</strong> (De Vilbiss 525KS) 220V + access.</td>
</tr>
<tr>
<td>EANTSCAL1B-</td>
<td><strong>SCALE</strong> (Seca 725), beam mechanical, baby, 0-15 kg, grad. 10 g <strong>BALANCE</strong> (Seca 725), mécan. à curseurs, bébé, 0-15 kg, grad. 10g</td>
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<tr>
<td>EANTSCAL6--</td>
<td><strong>INFANT SCALE</strong> (Seca 354), electronic, 0-20 kg <strong>PESE-BEBE</strong> (Seca 354), électronique, 0-20 kg</td>
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<tr>
<td>EHOEPUMS1B-</td>
<td><strong>PUMP, SUCTION, MECHANICAL</strong> (Twin Pump) + collection bottles <strong>ASPIRATEUR MECANIQUE</strong> (Twin Pump) + bocaux collecteurs</td>
</tr>
<tr>
<td>EANEPUMS3--</td>
<td><strong>PUMP, SUCTION, ELECTRICAL</strong> (DeVilbiss VacuAide) <strong>ASPIRATEUR ELECTRIQUE</strong> (DeVilbiss VacuAide)</td>
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<tr>
<td>EHOESYRP1--</td>
<td><strong>SYRINGE PUMP</strong> (Perfusor® compact), single syringe <strong>SERINGUE ELECTRIQUE</strong> (Perfusor compact), monoviole</td>
</tr>
<tr>
<td>EHOEHEAP650</td>
<td><strong>WARMING MATTRESS (=HEATING PAD, electrical)</strong>, neonatology, small model, AMECOSY NC3 = 650 x 330 x 40 mm <strong>MATELAS CHAUFFANT (= COUSSIN CHAUFFANT électrique)</strong>, néonatologie, petit modèle, AMECOSY NC3 = 650 x 330x 40mm</td>
</tr>
<tr>
<td>EHOEHEAP765</td>
<td><strong>WARMING MATTRESS</strong>, neonatology, big model, AMECOSY NC1, 765 x 600 x 40 mm <strong>MATELAS CHAUFFANT</strong>, néonatologie, grand modèle, AMECOSY NC1, 765 x 600x 40mm</td>
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<tr>
<td>EHOEWARI1M-</td>
<td><strong>WARMER FOR INFANTS</strong> (Ceratherm 600-2), mobile <strong>RAMPE CHAUFFANTE POUR BEBES</strong> (Ceratherm 600-2), mobile</td>
</tr>
<tr>
<td>EHOEPHOT1--</td>
<td><strong>OVERHEAD INFANT PHOTOTHERAPY UNIT</strong> (ARDO Amelux), 230V <strong>UNITE DE PHOTOTHERAPIE pour NOUVEAU-NE</strong> (ARDO Amelux), 230V</td>
</tr>
<tr>
<td>EHOEPHOT101</td>
<td>(Ardo Amelux) <strong>LAMP FLUORESCENT WHITE</strong> (CFL) 18W950 (Ardo, Amelux) <strong>LAMPE FLUORESCENTE BLANCHE</strong> (CFL) 18W950</td>
</tr>
<tr>
<td>EHOEPHOT104</td>
<td>(Ardo Amelux) <strong>LAMP FLUORESCENT BLUE</strong> (CFL) 18W950</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
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<tr>
<td>EHOEPHOT102</td>
<td>(Ardo, Amelux) LAMPE FLUORESCENT BLEUE (CFL) 18W71</td>
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<tr>
<td>EHOEPHOT001</td>
<td>(Ardo Amelux) FUSE T2.5A</td>
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<tr>
<td>EHOEPHOT002</td>
<td>(Ardo, Amelux) FUSIBLE T2.5A</td>
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<tr>
<td>SMSUTHER1D-</td>
<td>THERMOMETER, ELECTRONIC, accuracy 0.1º C + case</td>
</tr>
<tr>
<td>AFURCLOC1W-</td>
<td>WALL CLOCK, with second hand</td>
</tr>
<tr>
<td>EMEQPUMB1P-</td>
<td>BREAST PUMP, manual, plastic</td>
</tr>
<tr>
<td>EMEQSPAC2--</td>
<td>SPACER, 155 ml, with masks(2 sizes)+ mouthpiece</td>
</tr>
<tr>
<td>EMEQSTET4--</td>
<td>STETHOSCOPE, double cup, infant (Littmann Classic II)</td>
</tr>
<tr>
<td>ETMANRES2--</td>
<td>MANNEQUIN, NEWBORN, resuscitation, dark, basic (NeoNatalie)</td>
</tr>
<tr>
<td>ETMANRES2L-</td>
<td>MANNEQUIN, NEWBORN, resuscitation, light, basic (NeoNatalie)</td>
</tr>
<tr>
<td>ETMANRES201</td>
<td>(newborn mannequin NeoNatalie) SUCTION BULB</td>
</tr>
<tr>
<td>ETMANRES202</td>
<td>(mannequin nouveau-ne NeoNatalie) POIRE ASPIRATION</td>
</tr>
<tr>
<td>EHOESTAI2--</td>
<td>STAND, INFUSION, 2 hooks, on castors</td>
</tr>
<tr>
<td>EANTTAPM1--</td>
<td>TAPE, MEASURE, 1.5 m, fiber glass</td>
</tr>
<tr>
<td>EMEQTRAD3--</td>
<td>TRAY, DRESSING, 30 x 20 x 3 cm, stainless steel</td>
</tr>
<tr>
<td>ESURSCOP4SB</td>
<td>SCISSORS, blunt/blunt, straight, DRESSING, 14.5 cm 03-02-14</td>
</tr>
<tr>
<td>EMEQTOUT1--</td>
<td>TOURNIQUET, elastic, 100 x 1.8 cm</td>
</tr>
<tr>
<td>PHYGTOWE5--</td>
<td>TOWEL, 50 x 70 cm, 100% cotton</td>
</tr>
<tr>
<td>ELINSHEB1W-</td>
<td>SHEET, BED, woven, 180 x 290 cm</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>ELINTUNS1WL</td>
<td>TUNIC, SURGICAL, woven, large</td>
</tr>
<tr>
<td></td>
<td>TUNIQUE CHIRURGICALE, tissé, large</td>
</tr>
<tr>
<td>ELINTUNS1WM</td>
<td>TUNIC, SURGICAL, woven, medium</td>
</tr>
<tr>
<td></td>
<td>TUNIQUE CHIRURGICALE, tissé, moyen</td>
</tr>
<tr>
<td>ELINTUNS1WS</td>
<td>TUNIC, SURGICAL, woven, small</td>
</tr>
<tr>
<td></td>
<td>TUNIQUE CHIRURGICALE, tissé, petit</td>
</tr>
<tr>
<td>ELINCOAW1L-</td>
<td>COAT, MEDICAL, white, large</td>
</tr>
<tr>
<td></td>
<td>BLOUSE MEDICALE, blanche, large</td>
</tr>
<tr>
<td>ELINCOAW1M-</td>
<td>COAT, MEDICAL, white, medium</td>
</tr>
<tr>
<td></td>
<td>BLOUSE MEDICALE, blanche, moyen</td>
</tr>
<tr>
<td>ELINCOAW1S-</td>
<td>COAT, MEDICAL, white, small</td>
</tr>
<tr>
<td></td>
<td>BLOUSE MEDICALE, blanche, petit</td>
</tr>
<tr>
<td>SINSCONT1R-</td>
<td>REUSABLE SHARPS CONTAINER (RSC), 1.2 litre</td>
</tr>
<tr>
<td></td>
<td>CONTAINER REUTILISABLE POUR OBJETS TRANCHANTS, 1.2 litre</td>
</tr>
<tr>
<td>SCONT5C-</td>
<td>CONTAINER, needles/syringes, 5 l, cardboard for incineration</td>
</tr>
<tr>
<td></td>
<td>CONTAINER, aiguilles/seringues, 5 l, carton pour incinération</td>
</tr>
</tbody>
</table>
CONCLUSION

The utilisation of Dopamine perfusion, Potassium bolus, Bicarbonates, Magnesium, Hydrocortisone etc cannot be justified in MSF's working conditions.

Calcium Gluconate and Epinephrine have LIMITED INDICATIONS in this protocol, which should never be exceeded.

Ventilation by Ambu bag with air / oxygen and chest compression should only be done in acute situations for cases that should recover or improve fast or to newly arrived neonates before initiating any care.

In all cases, PLEASE, no excessive therapeutic efforts for sick babies under 1000g since brain damages are likely to happen quickly and because mid / long term prognosis is poor in such situations.

Always think about palliative care for the baby to be “comfortable” and psycho-social support to the mothers and families.

Please keep in mind that neonatal mortality will never be reduced to zero because of all situations we cannot face in the contexts MSF is working. Medical Doctors are not “Gods” who are expected to produce miracles, but human beings trying to reduce mortality and morbidity with the available means.

Do the best you can, and as quick as you can, but offer the same thoroughness and quality of care as if you were in your home country.

Start by the essential neonatal care to be implemented and then comprehensive according to your settings, means, the objectives and PoA, staff capacity and available supports in term of drugs, medical supplies and equipments.

Once you have done everything you can, and done it properly, tell yourself that you have done a good job, even if the final result is fatal.

While mortality statistics are essential, they have no value without an analysis of why and how...

Many thanks for your attention and action. We are looking forward to meet you in the field.

We hope this tool was useful. For the future, all your feedbacks, comments, suggestions and questions are welcomed and will be source of progress.

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REFERENCES


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