

Why use 7.1% chlorhexidine digluconate for umbilical cord care and not some other topical antiseptic?

This brief is intended to answer this question and summarize available evidence around the effectiveness of common antiseptic options currently used for cord care in low- and middle-income countries (LMIC). Antiseptics are antimicrobial substances that are applied to living tissue/skin to reduce the possibility of infection or sepsis.

What topical antiseptics are commonly used for cord care in LMIC?

Rubbing alcohol is a general nonspecific term for either isopropyl alcohol (isopropanol) or ethyl alcohol (ethanol) rubbing alcohol products. The United States Pharmacopeia defines “isopropyl rubbing alcohol” as containing not less than 68% and no more than 72% isopropyl alcohol by volume, and “rubbing alcohol” as containing no less than 68.5% and not more than 71.5% by volume denatured alcohol. In Ireland and the United Kingdom, the comparable preparation is surgical spirit B.P., which the British Pharmacopoeia defines as 95% methylated spirit, 2.5% castor oil, 2% diethyl phthalate, and 0.5% methyl salicylate. Because rubbing alcohol is not as concentrated as pure alcohol, it acts more slowly, which means the alcohol soaks completely into the bacterial cell before coagulation happens, and the bacteria die. Alcohol often produces a burning/painful sensation when applied to open skin wounds.¹ A Cochrane Review² on umbilical cord antiseptics for preventing sepsis and death among newborns found that topical alcohol application was advantageous in the reduction of colonization with *Escherichia coli* compared with dry cord care and triple dye application, and not advantageous in the reduction of colonization with streptococcus.

Methylated spirit (also called denatured alcohol or denatured rectified spirit) is ethanol that has one or more chemical additives to make it toxic, taste, or smell bad for human consumption (i.e., drinking). The main additive has traditionally been 10% methanol. It works as an antiseptic in the same way as rubbing alcohol.

Povidone-iodine, also known as iodopovidone, is a broad-spectrum antiseptic for topical application in the treatment and prevention of wound infection. It contains from 9% to 12% available iodine and works by releasing iodine, which results in the death of a range of microorganisms.

Triple dye contains three ingredients: brilliant green, crystal violet, and proflavine hemisulfate. It is a bactericide effective against both Gram-positive and Gram-negative bacteria. A Cochrane Review¹ on umbilical cord antiseptics for preventing sepsis and death among newborns found that topical triple dye application reduced bacterial colonization with *Staphylococcus aureus* compared to both dry cord care and alcohol application, and that there was no advantage of application of triple dye for reduction of colonization with streptococcus.

Chlorhexidine for umbilical cord care, which is formulated with 7.1% chlorhexidine digluconate aqueous solution or gel delivering 4% chlorhexidine, is an antiseptic with a broad spectrum of activity against Gram-negative and Gram-positive bacteria. Chlorhexidine kills by disrupting the cell membrane. It does not contain alcohol so does not produce a burning/painful sensation when applied to open wounds. Unlike the products described above, topical chlorhexidine has high residual activity because it binds to the proteins present in human tissues like skin. Once it is bound to the proteins, it releases slowly, leading to prolonged activity. The presence of blood does not seriously affect the antimicrobial activity of chlorhexidine.^{3,4} Rare but serious allergic reactions have been reported when some chlorhexidine products have been used, although none of the recent reports are related to use of 7.1% chlorhexidine for umbilical cord care.⁵

What about the comparative efficacy of 7.1% chlorhexidine digluconate and other antiseptics commonly used for cord care in LMIC?

- The application of 7.1% chlorhexidine was most effective in decreasing colonization when compared with 70% alcohol and povidone-iodine in a study among 516 newborns born in an obstetric ward in one hospital in **Turkey**.⁶ In this study, the total bacterial colonization rate of cases with normal skin flora was significantly lower when 7.1% chlorhexidine was used.
- In **India**,⁷ 247 infants born in a hospital and 79 infants born in the community were randomly allocated to 7.1% chlorhexidine, placebo, or dry cord care groups. Results showed that chlorhexidine significantly decreased colonization and density of colonization at 48 hours compared to placebo and dry cord care among infants born both in the hospital and the community.
- In **Sylhet, Bangladesh**,⁸ 5,234 umbilical swabs were collected at home (days 1, 3, and 6 after birth) from 1,923 infants participating in a trial of three cord care regimens (no chlorhexidine, single-day chlorhexidine cleansing, multiple-day chlorhexidine cleansing). Reductions in cord colonization were observed in single- and multiple-day cleansing groups. On days 1, 3, and 6, respectively, multiple cleansing consistently reduced invasive organisms such as *Escherichia coli* (49%, 64%, and 42% lower), *Klebsiella pneumoniae* (46%, 53%, and 33% lower), and *Staphylococcus aureus* (34%, 84%, and 85% lower).

Importantly, the topical application of 7.1% chlorhexidine to the umbilical cord reduces neonatal mortality and omphalitis in high-mortality settings.^{9,10} Data on newborn mortality reduction in LMIC do not exist for the other topical antiseptics discussed above. Further, the 7.1% chlorhexidine formulation is highly bactericidal, thus minimizing the risk of contamination of the product.¹¹

As noted in a review of the evidence¹² on antimicrobial applications for cord care, “specific antiseptics vary in effectiveness depending on their antibacterial properties, the mode or frequency of application, the concentration of the antiseptic used and the degree of contamination in the environment. Chlorhexidine appears to be a favorable choice of antiseptic because of its wide-ranging activity against Gram-positive and Gram-negative bacteria, its residual effect on the skin, and its low toxicity.”

¹ Lachenmeier DW. Safety evaluation of topical applications of ethanol on the skin and inside the oral cavity. *Journal of Occupational Medicine and Toxicology*. 2008;3:26. doi:10.1186/1745-6673-3-26.

² Imdad A, Bautista RM, Senen KA, et al. Umbilical cord antiseptics for preventing sepsis and death among newborns. *Cochrane Database of Systematic Reviews* 2013, Issue 5. Art. No.: CD008635.

³ World Health Organization (WHO). *WHO Guidelines on Hand Hygiene in Health Care*. Geneva: WHO; 2009.

⁴ Crabtree TD, Pelletier SJ, Pruett TL. Chapter 44: Surgical antisepsis. In: Block SS, ed. *Disinfection, Sterilization, and Preservation*. Philadelphia: Lippincott Williams & Wilkins; 2001;919–936.

⁵ United States Food and Drug Administration. FDA Drug Safety Communication: FDA warns about rare but serious allergic reactions with the skin antiseptic chlorhexidine gluconate. February 2, 2017. Available at <https://www.fda.gov/Drugs/DrugSafety/ucm530975.htm>.

⁶ Ozdemir H, Bilgen H, Topuzoglu A, Coskun S, Soyletir G, Bakir M, Ozek E. Impact of different antiseptics on umbilical cord colonization and cord separation time. *The Journal of Infection in Developing Countries*. 2017;11(2):152–157. doi:10.3855/jidc.7224.

⁷ Nangia S, Dhingra U, Dhingra P, Dutta A, Menon VP, Black RE, Sazawal S. Effect of 4% chlorhexidine on cord colonization among hospital and community births in India: a randomized controlled study. *BMC Pediatrics*. 2016;16:121. doi:10.1186/s12887-016-0625-7.

⁸ Mullany LC, Saha SK, Shah R, Islam MS, Rahman M, Islam M, Talukder RR, El Arifeen S, Darmstadt GL, Baqui AH. Impact of 4.0% chlorhexidine cord cleansing on the bacteriologic profile of the newborn umbilical stump in rural Sylhet District, Bangladesh: a community-based, cluster-randomized trial. *Pediatric Infectious Disease Journal*. 2012;31(5):444–450. doi:10.1097/INF.0b013e3182468ff0.

⁹ Shariff JA, Lee KC, Leyton A, Abdala S. Neonatal mortality and topical application of chlorhexidine on umbilical cord stump: a meta-analysis of randomized control trials. *Public Health*. 2016;139:27–35. doi:10.1016/j.puhe.2016.05.006.

¹⁰ Mullany LC, Arifeen SE, Khatri SK, Katz J, Shah R, Baqui AH, Tielsch JM. Impact of chlorhexidine cord cleansing on mortality, omphalitis and cord separation time among facility-born babies in Nepal and Bangladesh. *Pediatric Infectious Disease Journal*. 2017;36(10):1011–1013. doi:10.1097/INF.0000000000001617.

¹¹ Mullany LC, Darmstadt GL, Tielsch JM. Safety and impact of chlorhexidine antiseptics interventions for improving neonatal health in developing countries. *Pediatric Infectious Disease Journal*. 2006;25(8):665–675. doi:10.1097/01.inf.00000223489.02791.70.

¹² Mullany LC, Darmstadt GL, Tielsch JM. Role of antimicrobial applications to the umbilical cord in neonates to prevent bacterial colonization and infection: a review of the evidence. *Pediatric Infectious Disease Journal*. 2003;22(11):996–1002. doi:10.1097/01.inf.0000095429.97172.48

