The postnatal management for the newborn umbilical cord is surprisingly controversial. Numerous investigators have explored the optimal approach to cord care, whether it is performed during the first 24 hours of life, or in the first weeks of life until the cord spontaneously separates from the body.

The average length of cord retention varies from 3 to 45 days, with a mean separation time of 13.9 days. During past comparative evaluations of several treatment options of the cord, a few options have been shown to prolong the separation of the cord. However, when compared with dry cord care, most treatments have been associated with a decreased risk for secondary infections.

Initial options also vary widely from hospital to hospital; some initially apply triple dye, chlorhexidine, or povidone iodine, whereas others use no treatment.

Recommendations for the post-hospital management of the cord also range from daily applications of alcohol, to soap and water washings, to nontreatment.

Treatment Rationales

In the past, most pediatricians were concerned about bacterial colonization of the cord and subsequent increased risk for secondary invasive bacterial infection. With its slowly necrotizing tissue, the umbilical stump is a prime source for colonization by gram-negative bacteria such as *Escherichia coli*, *Klebsiella*, and pseudomonas, along with gram-positive bacteria such as *Staphylococcus aureus* and streptococcal species.

Secondary infections of the cord/stump include a commonly encountered mild purulent discharge some have termed “mild funisitis” (see Figure 1), occasional impetigo or cellulitis, and very rare infections such as severe funisitis, frank omphalitis, and necrotizing fasciitis.
Funisitis is an infection of the connective tissue of the cord itself, usually associated with mild malodorous discharge from streptococcal species, but also may be associated with a more severe infection of chorioamnionitis, which is usually seen in stillborns and preterm infants.\textsuperscript{2,3}

Omphalitis is a severe infection of the entire umbilical stump and surrounding skin, most often associated with \textit{S. aureus}.\textsuperscript{3}

**Bacterial Colonization of the Umbilical Cord**

Three studies of neonates conducted in the UK during the 1990s evaluated the correlation between \textit{S. aureus} colonization and infection when the umbilical cord was left untreated. Untreated cords in 102 neonates were 1.75 times more likely to be colonized with \textit{S. aureus} than treated cords.\textsuperscript{4}

An untreated cord was associated with a heavy colonization by \textit{S. aureus} in 49\% (171 neonates) of patients. More importantly, 12\% (44 neonates) of the entire sample size developed a staphylococcal infection.\textsuperscript{5} When dry cord care was compared with hexachlorophane (which should probably not be used due to reports of neurotoxicity when used inappropriately) or chlorhexidine, the rate of \textit{S. aureus} colonization was unacceptably high.

Dry cord care has also been associated with intermittent outbreaks of neonatal bullous impetigo.\textsuperscript{6} Another randomized trial of 766 newborns in British Columbia compared dry cord care with a treatment regimen of two applications of triple dye on the day of birth along with twice daily alcohol swabbing until cord separation.\textsuperscript{7} Compared with the treatment group, the major findings in the dry cord care group were the following: a 10-fold higher rate of \textit{S. aureus}. 
*aureus* colonization (31.3% vs. 2.8%); higher rates of cord exudates (7.4% vs. 0.3%) and foul odor (2.9% vs. 0.7%); and a single case of omphalitis.

The authors in each of these studies concluded that prevention of early *S. aureus* colonization was the most critical factor in routine cord care. The study by Verber and colleagues\(^6\) surmised that perhaps, hospital physicians do not become aware of some of the cord problems and the rare actual infections that may occur until the cord separates. For example, when a community hospital in Tampa, FL with 3,000 annual births instituted a dry cord care policy, three cases of *S. aureus* bullous impetigo of the umbilicus were reported within 3 months of the new policy compared with no cases in the previous years.\(^8\)

**The Dry Cord Argument**

Many pediatricians become quite concerned when spontaneous separation of the cord is delayed beyond the age of 3 to 4 weeks. We have been taught about the association between delayed cord separation and genetic defect of diminished neutrophil mobility/severe recurrent bacterial infections.\(^9\)

This phenomenon is usually caused by a severe autoimmune, autosomal recessive disorder known as type 1 leukocyte adhesion deficiency (LAD-1), which has a mutation in the beta\(_2\) integrin subunit, CD18, localized to chromosome 21. Yet, since the disorder was identified more than 30 years ago, according to the latest edition (6\(^{th}\)) of *Textbook of Pediatric Infectious Diseases*,\(^2\) it has been identified in only about 150 individuals worldwide. It also has a broad ethnic diversity.

The issue of delayed cord separation has evolved into a major justification for dry cord care. Some argue that the longer the cord stays on, the higher the risk of becoming infected. The commonly used treatments (triple dye, alcohol, and chlorhexidine) delay cord separation for merely 1 to 5 days. However, even when over 15,000 neonates with treated cords were prospectively evaluated, delayed cord separation was not associated with an increased risk of infection when compared with dry cord care.\(^1,10\) Furthermore, topical applications of an antiseptic which may prolong cord separation cannot create an exceedingly rare genetic defect.

**Umbilical Cord Care Options**

The current treatment options for umbilical cord care usually include:\(^7\)

- **Triple dye** (brilliant green, proflavine hemisulfate, and crystal violet). This is considered one of the most effective agents for bacteriocidal prophylaxis, particularly for *S. aureus*, but arguably it also may promote gram-negative bacteria colonization. Parents complain about the purple cord, the inadvertent purple staining of the surrounding abdominal skin, and the brittle nature of the cord at home. One or two applications have not been shown to be toxic.

- **Isopropyl alcohol.** By itself, this may have the least antibacterial activity of all agents. It also dries out and may irritate the periumbilical skin. Many parents are unaware of how to properly apply alcohol onto the base of the cord. Although it has been proven to prolong cord separation, it does dry up the discharge and foul odor associated with nontreatment of the stump. With heavy exposure or an occlusive dressing, it could cause alcohol intoxication and subsequent acidoses and hypoglycemia.

- **Povidone iodine.** This has been demonstrated to be less effective than triple dye for both prevention of colonization and infection. Iodine toxicity and transient hypothyroidism is possible, particularly for low birth weight infants, as plasma iodide levels may increase up to 400% for nearly 3 days.\(^11\)

- **Topical antibiotics** (eg, neomycin, bacitracin). These may promote bacterial antibiotic resistance and later hyper-sensitivity to antibiotics. Triple dye has been shown to be superior for prevention of both colonization and infection.

- **Chlorhexidine.** Although an effective broad spectrum antimicrobial, particularly for cord colonization with *S. aureus*, some recent studies suggest it may promote bacterial resistance when used frequently.\(^12\)

In underdeveloped countries, chlorhexidine has been shown to significantly reduce mortality from omphalitis.\(^13\) Occlusion must be avoided; local skin reactions may occur. A single daily application is necessary for at least the first week of life.

**Advice for Cord Care**

Several days of delayed separation of the cord, regardless of which treatment, is probably not an important consideration relative to possible increased risk for colonization and infection of the cord. I think at least a single
application of triple dye in the nursery may be optimal because this method appears to have the lowest rates of colonization and infection. We have been successfully using this technique in our nursery for over 30 years.

After hospital discharge, I also recommend the application of alcohol to the base of the cord with a cotton-tipped applicator 2 to 3 times daily until the cord is separated. Even though it is a poor antibacterial and still of unproven efficacy, alcohol applications usually seem to prevent the putrid, green discharge and the foul odor associated with either dry cord care or with soap and water care of the cord.

During the first office visit at day 4 or 5 of life, when the infant's upper cord has mostly dried up, I demonstrate to the parents the technique of separating the cord inferiorly and superiorly from the umbilical skin (see Figure 1). At this visit, many babies will already have developed a wet, green purulent discharge at the unseparated junction of skin and cord (See Figure 2 and Figure 3).
Figure 2. The umbilical cord of a 4-day-old male infant whose cord was treated with an initial single application of triple paste. No further treatment was used. Once the cord remnant was lifted from the base of the umbilicus, a purulent wet discharge was noted. The cord was treated with three times daily applications of rubbing alcohol, and the discharge dried up within a few days.
I also recommend that parents only sponge bathe the baby until the cord separates, and not to get the cord wet at all. In my experience, the worst smelling and the worst umbilical discharge is associated with water-wetted cords, probably due to pseudomonas overgrowth.

When the cord finally separates, some mild bleeding at the base is normal. If bleeding, malodor, or green discharge of the umbilicus persists beyond the first week, I advocate an application of a 75% silver nitrate stick to the interior of the umbilicus if the cord has separated already, or to the interior base of the cord-skin junction if the cord is still attached (See Figure 4 and Figure 5).
Umbilical Granuloma

Occasionally, a small 3- to 5-mm fungating mass, which has a mild green or sanguinous discharge, may develop within the umbilical stump. This lesion is best eradicated with an application or two of 75% silver nitrate stick to the entire mass. Very rarely, when the lesion does not respond to this therapy, or when the lesion is larger than 10 mm, you are likely dealing with an umbilical polyp. Polyps often contain intestinal or urachal remnants; they are best managed by surgical removal.

Evaluation for the Single Umbilical Artery

I wish to clarify an important issue regarding umbilical cord management. It is commonly believed that neonates with a single umbilical artery (SUA), reported in 0.2% to 0.6% of live born infants, have a significantly increased risk for congenital renal anomalies. This notion prompts many practitioners to obtain a renal ultrasound in all infants who have SUA, at considerable expense and notable parental anxiety. But what are the real odds of finding any significant congenital renal abnormalities?

Two different studies, which evaluated about 45,000 infants in the 1960s and 1970s, reported no increased risk of renal abnormalities in infants with SUA. The only malformation reported as significantly higher in children with SUA than in a control population was the rate of inguinal hernia.
Forego the renal ultrasound. As stated in the 2012 online medical textbook, *Uptodate.com*: "We do not perform further imaging for healthy term infants with an isolated SUA, as there is a low likelihood of a renal or urological abnormality." 

References

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