

# Umbilical Cord Care: A Tool to Neonatal Morbidity and Mortality Prevention

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## Abstract

Intra-uterine life can never be complete without the unique presence and function of umbilical cord that connects the baby to implanted placenta in the mother. At birth the placenta is ligated and the stump expected to fall off within 5 to 15days. Within this period, the neonate is susceptible to infection via the cord. Hence the need for optimal umbilical cord care practices for newborns and during the first week of life will help to prevent neonatal infection. Mothers care for their babies' cords in different ways but their cord care practices may be beneficial, harmless or harmful to their infants. It is the duty of health professionals or the health educators in the health facilities which they accessed during the antenatal period to enlighten them on best practices regarding umbilical cord care.

**Keywords:** Umbilical Cord, Care, Neonatal Morbidity, Neonatal Mortality, Prevention,

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## Introduction

Globally, 2.5 million children died at their first months in 2017 alone, translating to approximately 7,000 neonatal deaths every day most of which occurred in the first week of birth. World Health Organization further reports that “a child’s risk of dying is highest in the first 28 days of life during the neonatal period with preterm birth, intra-partum related complications (birth Asphyxia, infections and birth defects) which are responsible for most neonatal deaths (WHO 2019).” Reducing neonatal mortality is increasingly important not only because the proportions of under-five deaths that occur during the neonatal period is increasing as under-five mortality declines but also because the health interventions needed to address the major causes of neonatal deaths generally differ from those needed to address other under-five deaths.

It is estimated that 40% of neonatal deaths could be prevented by providing high-quality care for both mother and baby around the time of birth. Although, the magnitude of its contribution to these deaths remains uncertain, the umbilical cord may be a common portal of entry for pathogenic bacteria (Liu et al, 2012) with or without clinical signs of omphalitis. Neonatal mortality associated with bacterial contamination of the umbilical stump may therefore rank among the greatest public health opportunities of the 21st century (Stewart & Benitz, 2016).

In Nigeria, studies have shown that umbilical cord infections accounted for between 10 and 19% of neonatal admissions and resultant estimated 30–49% neonatal deaths (Afolaranmi, et al., 2018). The National Demographic Health Survey (NDHS, 2018), stated that Nigeria experiences the neonatal mortality rate of 37 deaths per 1,000 live births and neonatal mortality differs by place of residence, zone, mother’s education, and household wealth. Mortality rates in urban areas are consistently lower than those in rural areas with infant mortality being 43 percent higher in rural areas (86 deaths per 1,000 live births) than in urban areas (60 deaths per 1,000 live births).

Neonatal sepsis is the third leading cause of deaths for infants in their first month of life (Liu, et al 2012), and infections arising from the umbilical cord continue to be an important cause of neonatal morbidity and mortality in developing countries. The newly cut umbilical cord can be a pathway for bacteria that can cause new-born sepsis and death.

The arrival of a healthy newborn finest gifts of nature to the family, it brings unexplainable joy and happiness to the family. There is no experience that compares with bringing home a newborn baby at the end of the nine month pregnancy journey (Udosen, et al., 2019). However, as much as this birth of the newborn brings Joy to the family, the newborn's health and survival is enhanced by providing essential newborn care such as cleanliness including cord care, thermal protection, initiation of breathing, early and exclusive breastfeeding and immunization (Mohamed, 2018).

Intra-uterine life can never be complete without the presence of a patent umbilical cord. According to the British Medical Dictionary, the umbilical cord is a rope-like structure connecting the foetus to the placenta that supplies the foetus with oxygen and nutrients from the mother’s circulation with a mean length of 63.86cm (Tadfor, 2015).

Cord infections and neonatal tetanus contribute significantly to high neonatal mortality rates in developing countries (WHO, 2016). Aside neonatal tetanus, the umbilical cord stump can also be colonized by bacteria from environmental sources such as the mother's birth canal, skin flora, and the hands of caregivers. The unhealed umbilical cord is an important portal for local and invasive infections through the patent vessels that provide direct communication of microorganisms (Mohamed, 2018).

### **Anatomy of the Umbilical Cord**

The umbilical cord is a unique tissue consisting of two (2) arteries and one (vein) covered by a connective tissue called Wharton's Jelly which is thin and mucoid in nature and continuous with that of the placenta (WHO, 1998, Whitmore, 2010). During the period of pregnancy, the umbilical cord is the cord tube that connects the foetus (baby) to the mother and supplies all the needs for foetal growth. In the human foetus, the umbilical cord arises from the abdomen and by the time of birth it is about 2 feet (60 cm) long and 0.5 inches (1.3 cm) in diameter. It contains two umbilical arteries and one umbilical vein through which the foetal heart pumps blood to and from the placenta in exchange for nutrients and waste products with the circulatory system of the mother.

The main function of the cord is to carry oxygenated blood and nutrients from the placenta to the foetus where the navel forms, and also to carry deoxygenated blood and waste products from the foetus to the placenta. The umbilical cord forms at about the fifth week of pregnancy, towards the end of the pregnancy period. The placenta passes antibodies through the umbilical cord from the mother to child. The antibodies give the baby immunity from infections for about 3 months after birth.

During pregnancy, the placenta supplies all material for fetal growth and removes waste products. Blood flows through the umbilical cord from the placenta and brings all nutrients and oxygen to the fetus and carries away carbon dioxide and metabolic wastes (WHO, 2016; Udosen, et al., 2019; Whitmore, 2010). Because of this function, the umbilical cord is seen as the lifeline of the fetus during pregnancy. However, immediately after birth of the baby, this cord is no longer needed by the baby, it therefore has to be clamped and cut close to the navel few minutes following birth (Udosen, et al, 2019; Whitmore, 2010).

Once the umbilical cord is cut, the cord stump is deprived of its oxygen blood supply and it begins to dry, turning black and stiff in appearance. Drying and separation of the stump is facilitated by exposure to air (WHO, 2016). The umbilical vessels are still patent for a few days following birth which provides direct access to the bloodstream. The devitalized umbilical cord often proves to be an ideal substrate for bacterial growth and also provides direct access to the bloodstream of the neonate especially if the stump is kept moist or if unclean substances are applied to it (Udosen, et al, 2019; Whitmore, 2010, Painter, 2021).

After the birth of the baby, umbilical cord is clamped or tied and then cut at a level in which the baby is held in relation to the mother's abdomen. The stump of the cord that remains attached to the baby then withers by undergoing a healing process and falls off after few days (5-14days) leaving circular depression in the abdomen called the Navel. The cord usually falls off by itself in about 2 to 3 weeks. However, in some babies, it takes longer. Because the umbilical cord may be a channel for infection to enter the baby's body, it is important to take care of it properly. Cord care is an essential step in neonatal care to successfully accomplish stump separation efficiently and safely without further complications. Intra-abdominal abscesses, thrombophlebitis in the umbilical and/or portal veins, periumbilical cellulitis, peritonitis, and bowel ischemia can all occur with inadequate cord care (Stewart & Benitz, 2016).

### **Concept of Umbilical Cord Care**

Cord care are the basic steps that are entailed in the care of the cord. It simply means keeping the cord clean. Hygienic cord care is necessary and important for the well-being and survival of the new-born child. Cord care helps prevent infection and it involves the steps used in management of the umbilical cord stump. Cord care is the series of steps applied in the handling of the umbilical cord after delivery of the new born and if not meticulously carried

out, it will contribute significantly to new-born' risk of infection and mortality (Afolaranmi, et al., 2018). Abhulimhen-Iyoha and Ibadin (2015) also stated that the basic principle of umbilical cord care is to keep it clean and dry as this provides the fastest and safest umbilical cord healing.

Cord care simply means keeping the cord clean in an hygienic manner. Cord care is necessary and as well important for the well-being and survival of the new-born child. Cord care is a basic care that helps prevent infection and this involves washing of hands before doing it and certain substance (antimicrobial agent) are used to clean the cord stump topically. It involves leaving the cord stump to dry and not tucking it into the diaper.

The purpose of cord care includes: prevention of infection, promotion of cord separation, prevention of complications like bleeding, granuloma, umbilical hernia among others, and elimination of the incidence of omphalitis and subsequent mortality (Susmita & Smita, 2017).

### **Methods of Umbilical Cord Care**

The method of caring for the umbilical cord after birth affects both bacterial colonization and time to cord separation (Stewart & Benitz, 2016). WHO advocates for dry umbilical cord care and application of topical antiseptics in situations where hygienic conditions are poor or infection rates are high (WHO, 1998; Stewart D & Benitz, 2016). However, the Nigerian government recommends the use of Methylated spirit or chlorhexidine solution for cord care (Afolaranmi et al, 2018). Some steps of cord care involves:

1. Wash hands before cleaning the cord with soap and water.
2. Cleans the baby with soap and water when diaper is soiled with urine or faeces first.
3. Clean cord with cotton wool and methylated spirit or Chlorhexidine gel only.
4. Gently wipe from the base of the stump with a cotton swab damped with methylated spirit or chlorhexidine gel.
5. Cleans the entire cord stump and its base with swab damped with methylated spirit or chlorhexidine gel.
6. Fold the front side of the diaper down below the cord stump for air/ exposed to ventilation.
7. Do not pull on the cord stump but allow it to fall on its own when it dries off.
8. Do not use other materials on the cord stump such as herbs, mentholatum, dusting powder, charcoal.
9. Do not tuck cord stump into diaper or nappy to allow fresh air.
10. Allows cord to dry up naturally.
11. Avoids touching of the cord after cleaning.
12. Continue applying agent few days after to completely heal, even after the stump fall off.
13. Wash hands after cleaning the cord with soap and water.

In a study conducted by Gras-Le Guen et al, the results of the study using 8698 healthy, full-term newborns in a high-income country with systematic use of antiseptic cord care practices showed that dry umbilical cord care was not inferior in preventing omphalitis compared with care with antiseptics (Gras-Le Guen et al, 2017). This is also supported by Semrau et al, 2021 in a community based randomised clustered control trial study in Zambia where the researchers applied 4% chlorhexidine gel to newborns within 24hours of birth and control group that used dry method (Semrau et al, 2021). Likewise, Zupan et al. (2004) in Whitmore, 2010; performed a meta-analysis of twenty-one (21) studies involving 8959 participants to assess the effects of topical cord care in preventing cord infection, illness and death. The

researchers found that there were no advantages in terms of the use of antibiotics or antiseptics over simply keeping umbilical cords clean and dry (Whitmore, 2010).

**Standard cord care** consisted application of 70% alcohol at birth followed by other 2 times a day while dry cord care by the only application of sterile gauze around the base of the Umbilical Cord at the 1st day of life and after the cord has been exposed to air outside the diaper edge (Quattrin, 2016).

**Dry cord care:** Clean, dry cord care is recommended for newborns born in health facilities and at home in low neonatal mortality settings (WHO, 2013). Dry cord care is an easy, straight-forward, and safe method of handling the umbilical cord in healthy newborn infants born in a hospital setting. It involves keeping the cord clean without application of anything and leaving it exposed to air or loosely covered by a clean cloth, in case it becomes soiled it is only cleaned with water, it advocates the neonate be sponged bath, not dressed with very tight clothing (Quattrin, 2016, Tadford 2015).

**Use of 70% Alcohol:** Methylated spirit in cotton wool is what has been used to clean the cord of babies for a long time. Usually done twice a day, care should be taken to ensure that the spirit comes into contact with the base of the cord well and not just the skin around the cord (Boye, 2021).

**Use of Chlorhexidine:** Chlorhexidine use is not part of the standard cord care but a recommendation from WHO for newborns who are born at home in settings with high neonatal mortality (30 or more neonatal deaths per 1000 live births), and its use in low neonatal mortality settings may be considered only as replacement of harmful traditional substance applications (WHO, 2013).

Immediately after cutting the cord, apply chlorhexidine to the tip of the cord, the stump, and around the base of the stump. Wash hands before and after use and keep chlorhexidine away from eyes and ears. Repeat application once daily through the first week of life. It is most important that chlorhexidine be applied within the first 24 hours of birth. Applied once daily for 7 days can reduce risk of local infection and may displace non-hygienic traditional applications. Discard product at the end of the specified application period (CWG, 2017).

### **Skills and Practice of Cord Care**

Coffey and Brown (2017) indicated that cord-care practices are not consistent throughout low- and middle-income countries. However, there is a firm tradition of umbilical cord care in every culture. Cord-care practices vary by country, regions, or cultural groups within a country and employ a wide range of substances. The desires to promote healing and hasten cord separation are the underlying beliefs related to application of substances to the umbilical cord. The frequency of application of the substance (either the number of days or the number of times per day the substance was applied) and the source and cost of products used are not well characterized. This desire to actively care for the umbilical cord of a newborn could be utilized to promote positive behaviour change. They also stated that cord care practices and beliefs points toward the need to contextualize any behaviour change approach to align with the local culture in rural communities.

Stewart and Benitz (2016) stated that neonatal mortality associated with bacterial contamination of the umbilical stump may rank among the greatest public health opportunities in the 21<sup>st</sup> century. According to World Health Organization (2019), neonatal mortality occur due to cord infection which arose from poor care practices by mothers. A large number of these babies could be saved with lower cost, low skill action, most of which are already in policy but is not fully integrated and implemented by mothers and caregivers in rural communities.

Cord care practices are often embedded in institutional tradition. However, few data were gathered in the past regarding the most effective method. It is true that aseptic cord care decreases cord bacterial colonization, but it does not necessarily lower the risk of infection. Besides that, aseptic cord care delays cord separation. Abhulimhen-Iyoha and Ibadin (2012) stated that in developing countries, isolated cases and epidemics of cord infections continue to occur, and a number of factors contribute to the high incidence of neonatal tetanus and infections in these countries. Some are traceable to unhygienic circumstances and deliveries conducted by untrained birth attendants. Harmful cord care practices have also been pointed to as a contributing factor.

Mothers care for their infants' umbilical cords in various ways especially after discharge from hospital. Several studies have been conducted to document different cord care practices; where some of these are beneficial, others are not. The question of who and what influence the choice of cord care practiced by these mothers have not been fully explored. Due to the fact that cord care practices are taught by nurses/ medical officers during and after natal session. This training learned during the ante and post-natal classes influence the skills and practices of mothers attending immunization clinics in health centers in the community to carry out accurate cord care practices for their children after they leave the health facilities. In this light, it is of essence to determine what constitute cord care for infants and who influenced the choice of care.

Cord care which involved the use of methylated spirit alone is often considered beneficial while other forms of cord care are taken as poor (non-beneficial). Examples of poor cord care practices includes the use of hot compress, herbs, native chalk, salt, sand, saliva, palm oil, menthol-containing balm, petroleum jelly, and toothpaste alone or in combination. These practices are mainly done after discharge from health facilities and practiced at home.

#### **Traditional Method of Cord Care**

Contrary to the teachings and practices of orthodox health facilities are the traditional/cultural practices of cord care particularly in developing nations (Abhulimhen-Iyoha & Ibadin, 2015). These practices are mainly done to hasten the separation of the umbilical cord; stimulating its occurrence within the first few days of life despite the fact that studies have revealed normal cord separation time to extend for as long as 28 days in some cases (Oladokun, 2005). These practices involve the application of harmful substances such as sand, salt, native chalk, saliva, petroleum jelly, menthol-containing balm, herbs, and hot fomentations on the cord stump (Abhulimhen-Iyoha & Ibadin, 2015).

In a literature by Lawrence et al (2017), it is customary in many African societies for indigenous midwives to apply some cow's dung, or mud and any dirt on the umbilical stump even after a hospital birth. Interviewed women of the Asante, who delivered in a hospital, stated that they left the hospital immediately after birth in order to let the cord be dressed by an indigenous midwife. The women indicated that they prefer the indigenous way of dressing compare to the hospital. Similarly, a study in Nigeria reported that 93% of the respondent's preferred traditional cord care practice to the hospital routine (Orthodox Practice), (Osuchukwu, et al, 2017).

Studies on traditional cord care in Nigeria have not being thoroughly explored but few studies have been done in some parts of the country. In South- South, Nigeria, Osuchukwu, et al (2017) said about 280 (93.3%) mothers applied traditional substances on the cord stumps of their new-born. The substances are white native chalk (Calcium carbonate) with salt (46 %), leaves of Bryophyllum Pinnatum (Miracle leaf) (66.7%), clean hot sand (20%), leaves of Occimum gratissium (Labiatae) (6.7%), expressed breast milk (colostrums) (6.7%), and palm

oil with hen's feather (6.7%). These substances were prepared and applied differently on the cord stump.

In a similar study on traditional cord care practice in the Northern Nigeria by Ambe et al., (2009), it was reported that 126 (31.5%) applied hot fermentation, 78(19.5%) used rag and lantern, 38 (9.5%) applied Vaseline, ash/ charcoal, 37(9.3%) applied methylated spirit or disinfectant, 34 (8.5%) applied groundnut/palm/mangrove, 33(8.3%) applied oil, (6.5%) applied powder, (3.5%) applied red sand, (2.0%) applied hot/saline water, and (1.5%) either left it alone or applied salt.

Contrary to this study, another study in the Northern part of Nigeria reported that the following agents are used in cord care: majority 349(60.9%) mothers applied methylated spirit, 145(25.3%) hot compress, while 50(8.7%) applied toothpaste. Other applications included herbal preparation 20 (3.5%) and dusting powder in nine (1.6%) (Mwaura, 2016). Some cultural practices hinder the health and survival of the new-born. These include applying tooth paste, ash or other substances such as cow dung to the umbilical stump. These practices are often harmful because the substances are often contaminated with bacteria and spores consequently increasing the risk of infection (Ambe, et al, 2009).

### **Modern method of cord care**

Cord care practices vary greatly from institution to institution. According to the American Academy of Paediatricians, no single method of cord care has proven superior in limiting bacterial colonization and disease (Perry, 1982). Methods of cord care that are currently used include triple dye, alcohol, antibiotic ointments, povidone-iodine (Betadine), soap and water, or no treatment at all (Amare, 2014). In general, the umbilical stump is expected to be kept clean and uncovered to promote healing, drying, and cord separation. For decades, the use of alcohol daily and as often as each diaper change has been recommended to decrease infection and shorten cord separation time. However, there is an absence of studies that show the benefits of using alcohol (Amare, 2014).

It is important to note that the exposed necrotic tissue of the umbilical stump is readily colonized and infected by pathogenic bacteria. Ready access of the bacteria into the systemic circulation places neonates at high risk for infection. In developing countries, hygienic umbilical care is believed to reduce umbilical colonization, infection, tetanus, and sepsis, but the role of antiseptic cord care in reducing infections is unclear. Although studies in the less developed countries addressing cord care are lacking, historical controls and studies have demonstrated the decrease in infection during epidemic outbreaks in the 1950s. Recurrent epidemics of streptococcal infections have also been reported with the use of dry treatment or the use of alcohol alone, suggesting these regimens are insufficient.

Since 1998, the WHO advocates the use of dry umbilical cord care in high-resource settings (WHO, 1998). Dry cord care includes keeping the cord clean and leaving it exposed to air or loosely covered by a clean cloth. If it becomes soiled, the remnant of the cord is cleaned with soap and sterile water. In situations in which hygienic conditions are poor and/or infection rates are high, the WHO recommends chlorhexidine (Samuel, et al, 1994). There is some uncertainty as to the effect of chlorhexidine on mortality when applied to the umbilical cords of new-born infants in the hospital setting, but there is moderate evidence for its effects on infection prevention. Although the application of chlorhexidine is regarded as safe, trace levels of the compound are sometimes detected in the blood of infants after umbilical cord cleaning. In addition, contact dermatitis has been reported in up to 15% of very low birth weight infants after placement of a 0.5% chlorhexidine impregnated dressing over a central venous catheter (Garland, et al, 2001) The data on the safety of chlorhexidine application are



incomplete, and the amount of exposure to chlorhexidine that can be considered safe is not known (Sinha, 2015). In addition to the incremental increase in the cost of using chlorhexidine, the practice of reducing bacterial colonization may have the unintended consequences of selecting more virulent bacterial strains without demonstrable benefits. Because the incidence of omphalitis is very low in high resource countries and the severity is mild, the prevalence of evidence favours dry cord care.

### **Factors Influencing Cord Care Practices**

Major factors that influence cord care practices among mothers in rural communities includes maternal age, maternal educational status, and gender of infants. The older mothers/women practice more of beneficial cord care than the younger ones which can be attributed to experience gathered over time from previous deliveries. Besides, the younger mothers are more likely to be influenced by other caregivers. However, the use of beneficial cord care practice has increased with increasing maternal education. This highlights the importance of female education in ideal healthcare seeking attitude. Most of the mothers who deliver in private clinics and teaching hospitals indicates that they are well off to be able to access such facilities. More of those who deliver in tertiary hospitals often practice beneficial cord stump care practices and this may be because they are more likely to be able to afford it. In consonance with what was found by Ambe et al. (2009) and Joel-Medewase et al (2008) where the use of harmful agents is more common among mothers of babies delivered in the traditional birth attendants' places, maternities, and private hospitals.

Most times, mothers delivering outside orthodox health facilities are less likely to benefit from improved Ante-Natal Clinic (ANC) and to such extent are more prone to non-beneficial practices. They are also more likely to be influenced by other caregivers and stuck to tradition. Most mothers are aware of hygienic/beneficial cord care. The choices of cord care methods eventually practiced, particularly non-beneficial ones, were determined mainly by influences of nurses, participants' mothers, and their mothers-in-law. These are indeed important personalities in the lives of these mothers and it is therefore not surprising that they would concede to them. This means it would be pertinent to target this group of people in the campaign against the use of harmful substances in the treatment of the umbilical cord stumps in babies.

Also, the fact that more male infants were treated with beneficial cord care than the female infants probably because of the preference of the male child over the female one in this part of the world has been a contributing factor to increasing neonatal mortality caused by cord infections (Labeodan, 2005).

### **Conclusion**

Standard umbilical cord care is pivotal to mitigating the rate of neonatal morbidity and mortality in Nigeria. This can only be achieved if mothers have adequate knowledge of standard cord care practices. The care given to the new-born determines the child's survival. Hence, umbilical cord care is an essential neonatal care practice that prevents the likelihood of contracting infection by the neonate because it is an aspect of neonatal care that increases the quality of life in the baby. The umbilical cord stump could serve as a portal of entry for infections as it supports growth of some innocuous or beneficial microorganisms (commensals) and other harmful microorganisms which after entering the blood stream becomes systemic (neonatal sepsis).

### **Implications to Nurses**

There are implications of this study to nursing practice in Nigeria and beyond. There is a need for nurses to be more sensitive to mothers' baseline knowledge and skills of cord care and the

factors that can influence their uptake of ideal cord care practices. Also, frequent and emphatic conversations with mothers during the Antenatal clinic visits will bridge the gaps of misconception, myths, and unacceptable traditional practices of cord care. Nurses and midwives should explain carefully the process of cord healing, teach and demonstrate the steps involved in cord care, and assist the mothers to identify recommended topical agents to use. The indications, benefits and complications of cord care must be adequately highlighted by the nurses and midwives. Mothers' mind must be prepared prior delivery that the mode of care baby's cord is a determinant of the child's survival within the first month of life. Nurses must move from the traditional way of top-bottom thinking to horizontal and participatory thinking. This also embrace the need of applying a research-based understanding of cord care in nursing and midwifery education by incorporating knowledge on the need to teach expectant mothers and delivered mothers on cord care, its benefits, and the need to accept the best method of practice.

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