Effect of Two Different Cord Care Regimens on Umbilical Cord Stump Separation Time among Neonates at Cairo University Hospitals

Azza A. Abd El Hamid; Nagwa A. El Fadil and Hanan F. Azzam

Department of Maternal and Newborn Health Nursing, Faculty of Nursing, Cairo University, Cairo, Egypt
Azzaali_aliazza@yahoo.com

Abstract: Background, a major cause of death in developing countries is umbilical cord infections. Aim of this research was to compare the effect of topical application of breast milk versus distilled water on umbilical cord stump separation time and occurrence of bacterial colonization among neonates. Design, quasi- experimental design. Setting was postpartum unit at El Manial Maternity Hospital. Sample, a total of 100 neonates was randomly selected immediately after admission to the postpartum unit according to certain criteria. The sample was randomly assigned into two groups (50 neonates each) group A who received cord care with breast milk, and group B who received cord care with distilled water. Tools, three tools developed and filled by the researchers: - structured interview schedule; Cord swab bacteriological examination tool; and Follow up Schedule for signs of cord infection tool. Results indicated that, no statistically significant differences between groups were found in relation to, maternal socio-demographic or neonatal characteristics. Gestational age mean was 38.60 ± 1.08 weeks gestation for neonates in breast milk group while, it was 38.92 ± 1.15 weeks gestation for neonates in distilled water group (T= 1.42, P=0.15). Neonatal weight mean was 2973.00 ± 218.96 gm for neonates in breast milk group and it was 2898.00 ± 315.08 gm for neonates in distilled water group (T= 0.71, P=0.47). Umbilical cord separation time occurred early for neonates in the breast milk group Vs neonates in the distilled water group (5.60 ± 1.04 & 7.92 ± 1.08 days, respectively). Moreover, low percentage of neonates in the breast milk group and Distilled water group had bacterial colonization (14% & 10%, respectively) with no statistical significance difference between groups was found (X^2 =0.37, P= 0.76). In conclusion, use of topical application of breast milk on umbilical cord care was associated with shorter cord stump separation time than in distilled water. Also, breast milk reduced incidence of omphalitis, and reduced bacterial colonization especially with pathogenic microorganisms as the same as distilled water. This research recommends that, breast milk can be used as easy, cheap and highly effective for umbilical cord care.
[Azza A. Abd El Hamid; Nagwa A. El Fadil and Hanan F. Azzam **Effect of Two Different Cord Care Regimens on Umbilical Cord Stump Separation Time among Neonates at Cairo University Hospitals]** Journal of American Science 2011; 7(12):920-926]. (ISSN: 1545-1003). http://www.americanscience.org.

Key words: Distilled water, Breast milk, umbilical cord stump separation time, Bacterial Colonization

1. Introduction

The umbilical cord during pregnancy carries nutrients and oxygen from the mother to the fetus and carries away carbon dioxide and metabolic wastes through the placenta. After birth, umbilical cord is an important site for bacterial colonization. A possible consequence of bacterial colonization is cord stump infection (omphalitis), a factor that can greatly increase morbidity and mortality for infants in developing countries [1, 2]. The vessel in the umbilical cord serves as a direct entry site for invasion of pathogenic microorganisms into the circulation of newborn babies, delays in cord detachment may increase risk of bacterial infection[3].

The newborn has no protective flora at birth, and normal skin flora begin to be acquired within 24hours. The first stage of microbial infection is colonization which means the establishment of the pathogen at the appropriate portal of entry. Pathogens usually colonize host tissues that are in contact with the external environment. The umbilicus is colonized by bacteria from environmental sources such as the mother's vagina, her skin flora, and the hands of caregivers so; colonization rates with pathogenic organisms and infections are significantly lower in rooming-in babies than in babies kept in nurseries [4,5]. Factors that delay the process of cord stump separation are the application of antiseptics to the stump, infection and caesarean section. Delayed cord separation with antiseptics may be due to destruction of the normal flora around the umbilicus (navel) and a subsequent decrease in the number of leucocytes attracted to the cord [6]. The greatest period of risk for umbilical stump contamination with bacteria and Tetanus, is the first three days of life and the risk decreases with time as the umbilical wound heals and the stump separates [7].

A wide variety of cultural practices and beliefs are associated with care of the umbilical cord. Some are beneficial and others are associated with increased risk of complications; however, as the World Health Organization (WHO) has reported, practices will not change unless people are convinced that a new alternative is indeed better [8].

Using Alcohol does not promote cord drying, less effective against bacteria than other antimicrobials and delays cord separation. Therefore, it is not suitable either for cleaning or for routine application to the cord stump[9]. While, umbilical disinfection seems to be necessary in hospital nurseries to prevent the spread of bacteria, no studies indicate that, this is needed in rooming-in babies or at home where clean cord care is practiced[5]. The effect of topical antimicrobials in reducing infections is less clear. These antimicrobials agents seem to be the most effective in reducing colonization, but their use should be questioned in light of the development of resistance. Also, there is no enough evidence to recommend the widespread use of topical antimicrobials on the cord stump[10].

One of the agents that be used for umbilical cord care is topical application of breast milk and distilled water. Applying human milk to the cord stump is one of the cultural cord care practices used in Turkey. According to the WHO, this could be beneficial in view of the antibacterial factors present in breast milk also; it has a lot of immunologic and anti-infective agents. Colostrum contains significantly quantities of complement components that act as natural antimicrobial agents and is also equipped with protective factors that provide specific and non specific passive immunity [3].

Recent research done in Egypt done by **Yonis (2010)**, [11] who examine the effect of topical application of human milk comparable with 70% ethyl Alcohol on umbilical cord separation time in newborn infant, reported that, there were significant differences between the two groups in the total viable colonization count (p< 0.001), cord separation mean time in human milk was shorter than 70% alcohol respectively (4± 1 & 8± 2) (p<0.001).

Medves and O'Brien [12] examined cleaning solutions and bacterial colonization in promoting healing and early separation of the umbilical cord in healthy newborns. They conducted their research on 136 healthy term infants born at a tertiary care hospital in Western Canada; In their research they utilized sterile water versus Alcohol 70%. They found that, cords which cleaned with sterile water separated more quickly than those cleaned with alcohol (p=0.002), no statistically significance difference between groups regarding colonization rates was found (p=0.20), and umbilical infection did not occur. Also, they concluded that, cleaning with alcohol will increase the length of time from birth to cord separation but will not prevent colonization of the umbilical area. In contrast, very recent research done in Egypt (2011) [13] examined the effect of topical application of alcohol 70% versus distilled water on umbilical cord stump separation time and

bacterial colonization. Reported that, separation of umbilical cord stump occurred early for neonates in the Alcohol group Vs neonates in the distilled water group (6.70 + 1.03 days & 7.92 + 1.08 days respectively). There was statistical significance difference between groups regarding occurrence of bacterial colonization. High percentage of neonates in the Alcohol group had bacterial colonization (48%) Vs low percentage (10%) of neonates in the Distilled water group (p< 0.001).

Nurses play a crucial role in practicing cord care at birth and in the days following birth which is effective in preventing cord infections. Clean cord care practices which be done firstly at birth by nurses include washing hands with clean water and soap before delivery and wear sterile gloves before cutting the cord, lying the newborn on a clean surface, cutting the cord with a sterile instrument, keeping the cord stump dry, exposed to air or loosely covered with clean clothes [14]. Moreover, the other practices which the nurses do that may reduce the risk of cord infection are the use of 24-hours rooming-in instead of nurseries in institutions and skin-to-skin contact with the mother at birth to promote colonization of the newborn with non-pathogenic bacteria from the mother's skin flora. Also, nurses encourage early and frequent breast feeding that will provide the newborn with antibodies against infections [15].

Significant

Each year approximately one million newborns world-wide die from infection caused by bacteria that enter the body via the umbilical cord[2]. The world health organization (WHO) estimates that, 4 million children die during the neonatal period each year, with most death occurring in developing countries. Infections are the most important cause of neonatal mortality; it is estimated that, 300.000 infants die annually from tetanus, and a further 460.000 die because of severe bacterial infections, of which umbilical cord infections are an important precursor. Necrotic tissue of the umbilical cord is an excellent medium for bacterial growth[8].

Interventions introduced in both developed and developing countries to reduce exposure of the cord to infectious pathogens include clean cord cutting, hand-washing before and after handling the baby, bathing of the infant with antimicrobial agents, and application of antimicrobials to the cord[6]. Therefore, keeping the stump clean and dry is very important in preventing infection[7]. Regarding to the complications of umbilical cord care regimens, recommendation of WHO is dry cord cares but the best way to treat the umbilical stump after birth is a controversial issue, especially in developing countries[8]. In Egypt there were few scattered researches studied breast milk or

distilled water as alternative to alcohol cleansing of the umbilical cord in newborns. So, it is important to determine the best practice for umbilical cord stump care in order to minimize cord infections and mortality in millions of babies born each year.

Operational Definition
Two different cord care regimens
In this research includes topical application of breast milk versus distilled water on umbilical cord stump.
Colonization
Means contamination of skin with bacteria whatever pathogenic or normal flora as measured by swab analysis
Distilled Water
Water which has been cleansed by passing through one or more evaporation-condensation cycles until it contains a very low amount of dissolved solids
Aim
The aim of this research was to compare the effect of topical application of breast milk versus distilled water on umbilical cord stump separation time and occurrence of bacterial colonization among neonates.
Null-hypotheses
1-There is no difference between topical application of breast milk or distilled water on umbilical cord stump separation time.
2-There is no difference between topical application of breast milk or distilled water on occurrence of bacterial colonization

2. Subjects and Methods
Design
A quasi- experimental design (after only Non equivalent) was adopted in this research
Setting
Neonates were recruited from the postpartum unit in El Manial Maternity Hospital at Cairo University Hospitals. It is a university affiliated hospital providing free health care to maternity as well as gynecological and family planning services. The total annual admission to the postpartum unit was 9976 women after delivery (6767 vaginal delivery that equal 67.8%) [16].
Sample
A total of 100 neonates based on rule of sum (number of variables multiply by constant 5) were randomly selected. Researchers selected the odd numbers of beds who met the following inclusion criteria (random sample): healthy full term neonates (38-42 weeks gestation); free from congenital anomalies; roomed-in with their mothers; breast fed; birth weight 2500 to 4000 grams; Apgar score at first

and fifth minute equal 7 or more, nothing was applied to the umbilical cord stump, including topical agent or wrapping with sterile gauze and they were delivered vaginally to be included in the research. Exclusion criteria: - neonates with problems requiring immediate transfer to a higher neonatal care center, those of high risk women; those of mothers who cannot read and write and multiple gestation. Two groups were constituted 50 neonates each according to the random assignment into group (A) who received cord care with breast milk, and group (B) who received cord care with distilled water. The researchers determined certain days of the week to collect data from group (A) and other days of the week to collect data from group (B) (random assignment).
Tool
Three tools developed and filled by the researchers to collect data: - structured interview schedule; Cord swab bacteriological examination and follow up schedule for signs of cord infection. Content of tools was determined through an extensive review of literatures and researches about cord care.
1-**Structured interview Schedule.**
This tool included two parts: **the first part** included data related to the mother as code, mother's age and educational level; **the second part** includes data related to the neonate as gestational age, gender and birth weight. ;
2- Cord swab bacteriological examination tool.
Swab 1 (immediately after delivery) and second swab (after 3 days);
3- Follow up Schedule for signs of cord infection tool.
This schedule developed by the researchers and filled by them. This tool included two parts: - the first was checklist to follow up the compliance of mothers about cord care and the second one, to check the presence or not of signs of cord infection (redness, swelling, secretion of blood or pus, odor or tenderness) until cord detachment occur.
Tools Validity
Tools were submitted to a panel of three experts in the field of neonatology, maternity nursing and obstetric medicine to test the content validity. Modification was carried out according to the panel judgment on clarity of sentences and appropriateness of content.
Ethical Consideration
An official permission was granted from the director of the Maternity Hospital. The researchers introduced themselves to mothers who had neonates met the inclusion criteria and informed them about the purpose of this research in order to obtain their acceptance to share in this research. The researchers

assured that, the research posed no risk or hazards on their neonates. All mothers were informed that, participation in the research is voluntary and she can withdraw from this research anytime. A written informed consent was obtained from mothers who were willing to participate in the research.

Pilot Research

A pilot research was carried out on 10% of the total sample to check clarity of items and determine the feasibility of the research. All neonates participated in the pilot research were excluded from the research sample.

Procedure

Researchers collected data four days per week (Sunday & Monday to collect data from group A, Tuesday & Wednesday to collect data from group B). After mothers had been fully informed about the research and consented for participation in the research. **Structured interview** was conducted to collect data related to the mother and neonate. Researchers asked questions in Arabic and recorded the answers in the structure interview tool. Interview consumed about 10 minutes for each mother. Researchers took the first swab from base of umbilical cord stump immediately after admission to postpartum unit to be a base line data, and the second swab was on the third day of delivery, to detect early the occurrence of colonization. Home visit was carried out in case of inability of the parents to attend the baby in the promised time at hospital.

Bacteriological examination

Microbial growth was examined immediately after the swab was taken at laboratory by a trained technologist who was unaware of the cleaning solution to which neonate was assigned. The technologist followed the swabs for bacterial growth as the following schedule: first 24 hours after collecting the swabs, if there was no bacterial growth, he followed it for a week after to confirm the result. When there was a bacterial growth the technologist followed this bacterial growth up to two weeks.

Implementing cord care regimens:

Researchers gave mothers instructions about gently clean the umbilical cord stump and the surrounding skin every 12hours and as needed during diaper changes. Mothers in the topical application of breast milk group advised to apply foremilk (before lactation) to the umbilical stump 3hrs after birth. Mothers were instructed to keep the milk on the stump until it dried and the milk not washed off later. Regarding distilled water group mothers were instructed to soak a cotton swab or cotton ball into distilled water to wet it thoroughly. A cotton swab is usually the easiest way to clean the umbilical cord. Gently wipe around the sides of the stump and the

skin around it. Wipe along the entire cord from the umbilical base upward. Wipe away any wet, sticky, or dirty substances. These consumed about 15 minutes for each mother.

General instructions given to mothers in both groups

Keep your baby's diaper folded below the umbilical cord stump to keep the stump exposed to air. It also helps prevent diaper contents, such as urine, from irritating and contaminating the stump. Instruct mothers that umbilical cord stump will change from yellowish green to brown to black as it dries out and eventually falls off, usually between 1 and 2 weeks after birth. It is important to keep the umbilical cord stump and surrounding skin clean and dry. After the stump falls off continue cleaning around the navel at least once a day until the navel has completely healed (about 2 days after stump falls off). Moreover, sponge bath is preferable during the healing process. Regarding the mothers who bathing their babies in sink, instructed to keep the umbilical cord stump above the water level until the stump falls off and heals. Everyday mothers notice that the cord will get smaller and pull away from the center of the belly button. Mothers also, informed to avoid pull the cord off. When the stump falls off, mother can bath the baby in a baby's tub or sink. These basic care help to prevent the occurrence of infection and help the umbilical cord stump to fall off and the navel to heal more quickly.

All mothers had educational pamphlet which developed by the researchers before discharge from the hospital included: method of cord care, time of cord detachment and when to call the researchers to make referral to the pediatrician (if the baby develops a fever or if the umbilical area appears red and swollen around the cord; crying when the mother touches the cord or skin around it; continues to bleed; or oozes yellowish pus; and produces a foul-smelling discharge). It is normal to notice oozing of fluid for one or two days after the stump fell off. These consumed about 15 minutes for each mother.

Follow up for signs of cord infection, researchers follow up the compliance of mothers regarding instructions of cord care using checklist, signs of cord infection, and the day of cord detachment by daily phone call until cord fall off. The duration for umbilical cord separation was measured from the date of birth to the date of separation. Home visit was done on third day for cases of the parents enable to attend the baby in the promised time at hospital to take second swab.

Statistical Analysis

Collected data were coded and tabulated using personal computer. Statistical package for social science (SPSS) version 11 was used. Inferential

statistics was used to answer research hypotheses. In this research, student's t test was used to compare means of two different groups, chi-square to compare between two qualitative variables were used as inferential statistics. Statistical significance was considered at p-value <0.05.

3. Results

Findings of this quasi- experimental research will be presented in three main parts: 1) description of mothers and neonates; 2) umbilical cord stump separation time and 3) occurrence of bacterial colonization.

I- Description of Mothers and Neonates

Results indicated that, no statistically significant differences between both groups were found in relation to maternal socio-demographic characteristics. The age range was 20-30 years old with mean of 25.16 ± 2.62 years for mothers in breast milk group and it was 24.92 ± 3.07 years for mothers in distilled water group (T=0.42, P=0.67). High percentage of mothers in both groups had secondary school education, 38% in the breast milk group and 48% in the distilled water group. While, low percentage in both groups had university education represented as 12% in the breast milk group and 8% in the distilled water group (X^2=1.40, P=0.84) (Table, 1).

Regarding neonates, there was no statistical significant difference between groups in relation to neonatal characteristics. About half of neonates in both groups were males represented as 54% in the breast milk group and 48% in the distilled water group (Fisher's exact test, P= 0.84). Gestational age range was 38-41 weeks gestation with mean of 38.60 ± 1.08 weeks gestation for neonates in breast milk group while, it was 38.92 ± 1.15 weeks gestation for neonates in distilled water group (T= 1.42, P=0.15). Neonatal weight range was 2500 -3800g with mean of 2973.00 ± 218.96 g for neonates in breast milk group and it was 2898.00 ± 315.08 g for neonates in distilled water group (T= 0.71, P=0.47).

II-Umbilical Cord Stump Separation Time

All of neonates in both groups were received cord care by their mothers. There was statistical significance difference between groups regarding umbilical cord stump separation time (X^2 = 39.91, P < 0.001). More than half (58%) of neonates in the breast milk group their umbilical cord stump separated on 5th and 6th day after birth Vs 14% of neonates in the distilled water group(Figure, 1). Separation occurred early for neonates in the breast milk group Vs neonates in the distilled water group (5.60 ± 1.04 days & 7.92 ± 1.08 days respectively).

III- Occurrence of Bacterial Colonization

Low percentage of neonates in the breast milk and distilled water groups had bacterial colonization (14% & 10% respectively) no statistical significance difference between groups was found (X^2=0.37, P=0.76). The pathogenic organisms were *Staphylococcus aureus*, Acimtobacter (gram negative bacilli), and *Escherichia coli* colonization in neonates without statistically significance difference between the two groups were found (Table, 2). However, there was no statistically significance difference between both groups regarding occurrence of infection (P=0.71). None of neonates in the breast milk group had signs of infection (redness, warmth, exudates, odor & tenderness) Vs 6% of neonates in the distilled water group. There was no statistical significance difference between groups (X^2=3.09, P=0.07).

Table, (1): Distribution of Mothers in both Groups According to their Educational Level

Variable	Breast Milk Group (n= 50)		Distilled Water Group (n= 50)	
Educational Level	**Freq.**	**%**	**Freq.**	**%**
Can Read & Write	12	24	11	22
Preparatory School	11	22	10	20
Secondary School	19	38	24	48
University	6	12	4	8
Master Degree	2	4	1	2
X^2 = 1.40, P= 0.84				

(Table, 2) Distribution of Neonates in both Groups according to Occurrence of Bacterial Colonization

Variable	east Milk Group (n= 50)		Distilled Water Group (n= 50)	
	Freq.	**%**	**Freq.**	**%**
Colonization				
Pathogenic	7	14	5	10
Normal skin flora (Staphylococcus epidermidis)	43	86	45	90
X^2 =0.37, P= 0.76				
Name of Pathogenic Organism	**N= 50**		**N= 50**	
Staphylococcus aureus	2	4	0	0
X^2 = 2.04, P= 0.15				
Acimtobacter (gram negative)	3	6	2	4
X^2 = 0.21, P= 0.64				
Escherichia coli	2	4	3	6
X^2 = 0.21, P= 0.64				

4. Discussion

This research presents important findings related to topical application of breast milk versus distilled water in the umbilical cord stump care for full term neonates in relation to, time of cord stump separation and occurrence of bacterial colonization. Findings of the present research reject the first null-

hypothesis that is; there is no difference between topical application of breast milk or distilled water on umbilical cord stump separation time. Findings of this research showed that, the duration of the umbilical cord stump separation time in breast milk group is shorter than in the distilled water group by about two days. In spit the umbilical cords were detached in both groups within the normal period (between 5-15 days following the birth) documented in literatures. There was statistically significant difference between the two groups. This result is matched with **Farahani et al. (2008)[17]**, who examined the effect of topical application of breast milk and dry cord care on bacterial colonization and umbilical cord separation time in neonates. They reported that, the mean umbilical cord stump separation time in breast milk group was significantly shorter than in the dry cord care group (6.4+ 2.03 & 7.3 + 2.44 days respectively) (P=0.01). In addition, **Yonis, (2010)[11]** in his study reported that, umbilical cord stump separation time in human milk group was shorter than in the alcohol group (4+1 & 8+2 days respectively) (P< 0.001). Moreover, recent study done in Egypt by **Azzam et al., (2011) [13]** examined the effect of topical application of alcohol 70% versus distilled water on umbilical cord stump separation time and bacterial colonization, they reported that, separation time of umbilical cord stump occurred early for neonates in the Alcohol group Vs neonates in the distilled water group (6.70 + 1.03 days & 7.92 + 1.08 days respectively). This difference between various studies regarding to the separation time of umbilical cord stump might be due to intervening factors such as local circumstances and community as (sanitation, weather, and humidity).
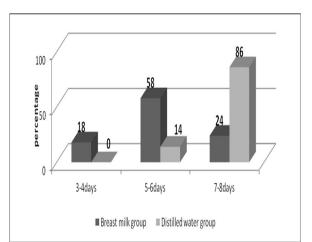

Figure (1) Distribution of Neonates in both Groups According to their Umbilical Cord Stump Separation Time

Findings of this research accepted the second null-hypothesis that there is no difference between neonates who received cord care by the breast milk and those who received cord care by distilled water. Although, the rate of bacterial colonization was recorded in both groups, no statistical significance difference was found between them. These findings indicate high efficacy of breast milk and distilled water in relation to; reducing bacterial colonization. This might be due to a drop of breast milk contains around one million of white blood cells, these cells called macrophages. Also, breast milk has a lot of immunologic and the anti-infective agents and Colostrum contain natural antimicrobial agents, and equipped with protective factors that provide passive immunity[18]. Distilled water has had all chemical and minerals removed usually by steaming and condensation, and treated by heat to destroy pathogens (any living organisms) and removed water born biological contaminants such as bacteria, viruses, organic and inorganic chemicals, heavy metals, volatile gases, cysts and other contaminants. So, distilled water sold as sterile water and packed to avoid contamination[12]. In the same context, a study done by **Farahani et al.,** (2008)[17] found a statistically significance difference between breast milk group and dry cord care group on occurrence of bacterial colonization. High percentage of pathogenic organisms was found in the dry cord care group, statistically significance difference between groups was found. In addition, **Yonis, (2010)[11]** in his study found, a statistically significance difference between human milk group and 70% ethyl alcohol group. High percentage of pathogenic organisms was found in the 70% ethyl Alcohol group. Moreover, **Azzam et al., (2011)[13]** found a statistical significance difference between 70% ethyl Alcohol and distilled water groups regarding occurrence of bacterial colonization. High percentage of bacterial colonization was found in the 70% ethyl Alcohol group Vs low percentage in the distilled water group. While, this finding was contradictory with the research findings of **Pezzati et al., (2003)[19]** who found bacterial colonization rates for distilled water group were higher than in alcohol group.

Findings of this research showed that, no statistically significance difference between two groups was found regarding to the occurrence of umbilical cord stump infection signs as warmth, bad odor, tenderness and inflammation (P= 0.07). This might be due to, high efficacy of breast milk and distilled water in reducing the signs of umbilical cord stump infection as sterile agents. This finding is in accordance with the research findings of **Azzam et al., (2011)[13]** reported that, no statistical significance difference between groups was found regarding to

signs of infection however, the neonates in the alcohol cord care group had more redness around their umbilical cord stump than in the distilled water cord care group and this may be due to the alcohol absorption and its effect on the neonatal skin.

In conclusion, use of topical application of breast milk on umbilical cord care was associated with shorter cord stump separation time than in distilled water. Also, Breast milk reduced incidence of omphalitis, and reduced bacterial colonization especially with pathogenic microorganisms as the same as distilled water.

Recommendations:
Based on the findings of the present research the following recommendations are suggested

1. Breast milk can be used as easy, cheap and highly effective for umbilical cord care.
2. Comparisons between these two topical methods of cord care on larger sample size and apply for all neonates' categories including preterm and multiple gestations.
3. Disseminate the advantages of cord care with breast milk and distilled water among health care providers and postpartum mothers.

References
1-Consult, M.D. (2007). Umbilical cord care in newborns. Retrived from http://www.mdconsult.com/das/patient/body/126913007-3/0/10041/31728.html
2-Zupan,J., Garner,P., & Omari, A.A.(2009). Topical umbilical cord care at birth. The Cochrane Collaboration. Cochrane Database Systemic Review, (3): CD 001057.
3-Mousa, A., Yadollah,Z., karimollah,H, Ghasem, J., Hamid, T. (2006). The effect of topical application of human milk, ethylalcohol 96%, and silver sulfadiazine on umbilical cord separation time in newborn infant. Arch Iranian Med., 9(1):33-38.
4-Mullany,L.C., Daymstadt, G.L., and Tielsch, J.M. (2003). Role of antimicrobial applications to the umbilical cord in neonates to prevent bacterial colonization and infection: a review of the evidence. The Pediatric Infectious Disease Journal; 22 (11): 996-1002.
5-Nourain, M., Allaii, F., and Heidari, A. (2009). Comparison of the effect of alcohol 70% versus dry cord care on cord bacterial colonization and cord separation time among newborns. Pak Medical Science Journal; 25(1):103-107
6-Whaly, L.F., and Wong, D. (2003). Nursing care of infants and children. 7th.ed. Mosby- Year Book, New York.
7-Mullany, L.C., Daymstadt, G.L., Katz, J., Khatry, S.K., Lecclerq, S.C., and Adhikari, R.K.(2007). Risk factors of umbilical cord infection among newborn of southern Nepal. Epidimology Amirican Journal;165:203-11.
8-Vural,G., & kiza, S.(2006).umbilical cord care: a pilot research comparing topical human milk, povidone-iodine, and dry care. Journal of Obstetrics, Gynecology and Neonatal Nursing, 35:123-128.
9-Shoaeib, F.M., All, S.A., El-Barrawy, M.A. (2005). Alcohol or traditional methods versus natural drying for newborn's cord care. Egypt Public Health Association Journal; 80(1-2):169-201
10-Pezzati, M., Biagiolio, E.C., Martelli, E., Gambi, B., Biagiotti, R., & Rubaltelli, F.F.(2002). Umbilical cord care: the effect of eight different cord care regimens on cord separation time and other outcomes. Biology of the Neonate; January; 81(1):38-44
11-Yonis, E.S. (2010). The effect of topical application of human milk comparable with 70% ethyl Alcohol on umbilical cord separation time in newborn infant at Minia University Hospital. Unpublished thesis.
12-Medves,J.M., & O'Brien, B.A. (1998). Cleaning solutions and bacterial colonization in promoting healing and early separation of the umbilical cord in healthy newborns. Canadian Journal of Public Health;88(6):380-382.
13-Azzam, H., Abd El Hamid, A., & Abd El Fadil. N. (2011). Effect of topical application of alcohol 70% versus distilled water on umbilical cord stump separation time and bacterial colonization among neonates at El Manial Maternity Hospital- Cairo University: randomized control trial . Egyptian Nursing Journal, Vol (1), No (2), ISSN,: 2090-6021
14-Swardekar, K. (2004). Changing spectrum of neonatal Omphalitis, Pediatric Infec Dis J, 23: 22-26.
15-Nandrup-Bus, I., and Ugeskr, L. (2003). Evidence concerning umbilical cord hygiene in newborn infants; Pediatrics; September 15; 165(38):3616-9.
16-Statistical department (2010).Statistical department at El-Manial University Hospital, Cairo University.
17-Farahani, L.,Mohammadzadeh,A., Tafazzoli,M.,Esmaeli,H.,& Ghazvini,K. (2008). Effect of topical application of breast milk and dry cord care on bacterial colonization and umbilical cord separation time in neonates. Journal of Chinese Clinical Medicine, 3(6): 327-332.
18-Hanson,L.,Korotkova, M., & Telemo, E.(2003). Breast feeding, infant formulas and the immune system. Ann. Allergy Asthma Immunol.90:59-63.
19-Pezzati, M., Rossi, S., Tronchin, M., Dani, C., Filippi, L., and Rubaltelli F.F.(2003). Umbilical cord care in premature infant: the effect of two different regimens on cord separation time and other outcomes. Pediatrics; 112(4):e275.

12/12/2011