

Cord Care Practices and Omphalitis among Neonates Aged 3 - 28 Days at Pumwani Maternity Hospital, Kenya

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Received 23 October 2015; accepted 4 January 2016; published 7 January 2016

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Abstract

Background: Omphalitis (umbilical cord infection) among new-borns is common and a major cause of neonatal deaths in developing countries. Annually about 4 million neonatal deaths occur around the world; of these, more than 30% are caused by infections. Majority of these infections start as umbilical cord infection. **Objective:** The aim of the present study was to establish cord care practices associated with omphalitis among neonates aged 3 - 28 days at Pumwani Maternity Hospital, Kenya. **Methodology:** Cross-sectional descriptive study was employed among 178 mothers with neonates of 3 - 28 days. Participants were selected systematically and data was collected on new-born cord care practices. Omphalitis was defined as pus discharge, redness with or without pus and swelling of umbilical cord. Pearson's chi-square test ($P < 0.05$) was performed to compare the significant discrepancies. Crude and adjusted odds ratios with corresponding 95% confidence interval were also used to determine the strength of association between omphalitis and cord care practices. **Results:** Among 178 neonates, 67 (37.6%) were diagnosed with omphalitis. In logistic regression analysis, the main predictors of omphalitis were initiation of breastfeeding after one hour of delivery [AOR = 2.47; 95%CI = 1.15 - 5.30; $P < 0.05$] compared to within one hour and application of saliva to the cord [AOR = 6.59; 95%CI = 2.02 - 21.46; $P < 0.01$] compared to dry cord. **Conclusion:** The prevalence of omphalitis among neonates was high. Health workers need to participate in educating the mothers to initiate breastfeeding within one hour and to avoid application of harmful cord care practices.

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Keywords

Cord Care, Neonates, Omphalitis, Practices

1. Introduction

Each year, approximately four million neonatal deaths occur globally and infections account for 36% of these deaths [1]. Cord care practices may directly contribute to infections in the new-born which account for a large proportion of the four million annual global neonatal deaths [2]-[6]. Cord infections are more prevalent in developing countries because of the high rates of unhygienic cord care practices [7]. Omphalitis is an infection of the umbilical cord stump, defined as either pus discharge with erythema of the abdominal skin or severe redness with or without pus [8] [9].

Data on the incidence of omphalitis in low-income countries is generally scarce, the available data estimate the risk to range between 2 and 77 per 1000 live births in hospital settings, with fatality rates of between 1% and 15% depending on the definition of omphalitis used [10]. Community-based data show even higher infection rates: for example, 105 per 1000 live births in Nepal [6], 217 per 1000 live births in Pakistan and about 197 per 1000 live births in India [10]. Remarkably, no data are currently available from most countries in Africa where most deliveries still occur at home and where neonatal mortality remains high [1].

As cord infections should be preventable in most cases [11], it is important to identify best cord care practices to reduce neonatal mortality and morbidity and offer an alternative to widespread potentially harmful traditional practices. Examples of such practices include use of traditional herbs mixed with cooking oil or water that has been used to wash an adult woman's genitals or application of ash, breast milk, fluid from pumpkin flowers, powder ground from local trees, cow dung, ghee and saliva that may be applied to the cord area and which may be harmful [9] [12].

Furthermore, many maternal and new-born deaths can be averted through changes in household level practices regarding delivery and new-born care [13]. A set of practices that reduces new-born morbidity and mortality has been identified as essential and these include clean cord care (cutting and tying of the umbilical cord with sterilized instrument and thread), thermal care (drying and wrapping the new-born immediately after delivery and delaying the new-born's first bath for at least six hours or several days to reduce the risk of hypothermia), attendants' hand-washing practices and initiating breastfeeding within the first hour of birth [6] [14] [15].

In Kenya though there is no available information on the prevalence/incidence of omphalitis, it is presumed to be a problem. It is also reported that mothers in Nairobi had good knowledge on need for hygiene when cutting the cord, but had poor practices in other aspects of cord care, and were afraid of handling the cord [16]. Therefore, this study sought to determine the cord care practices associated with omphalitis among neonates aged 3 - 28 days at Pumwani Maternity Hospital.

2. Methodology

This was a cross sectional study carried out at the Pumwani Maternity Hospital, Nairobi, Kenya. Participants consisted of mothers presenting with neonates aged 3 to 28 days at the child welfare clinic of the hospital. The sample size of 178 was calculated by using single population proportion formula ($n = Z^2pq/d^2$). They were selected using systematic sampling method. A structured questionnaire was administered to collect information on cord care practices including instruments used to cut and tie the cord, initiation of breastfeeding, thermal care, any substance application on the cord, methods used to care for the cord, appropriate application of diaper, washing hands and etc. Moreover, omphalitis was defined as pus discharge, redness with or without pus and swelling of umbilical cord.

The data were coded and then entered into a Microsoft excel spread sheet and analysed using Statistical Package for Scientific Solutions (SPSS) Version 20.0. Results were expressed as frequencies and proportions. Chi-square statistics was used to test for significance. Odds ratios with corresponding 95% confidence interval were also calculated for the variables. Binary logistic regression was used to assess the roles of the cord care practices on omphalitis. Level of significance was set at a p value of less than or equal to 0.05.

The study received ethical approval from Kenyatta National Hospital/University of Nairobi (KNH/UON),

Ethics and Research Committee. Written informed consent was sought from all study participants before being interviewed.

3. Results

3.1. Background Attributes of the Participants

The background characteristic of study participants is shown in **Table 1**. More female neonates (53.4%) than males (46.6%) were participated in the study. The ages of the neonates ranged from 3 days to 28 days with mean age of 11.7 days. Three quarters of the neonates (75.3%) were aged between 3 to 14 days while the age category of 15 to 28 days was 24.7%. The prevalence of umbilical cord infection was found to be 37.6% with 95% confidence interval of 30.48% to 44.72%. Among those who had umbilical cord infection, 49.3% presented with redness, 13.4% presented with swelling and 37.3% presented with pus.

Table 1. Background characteristics of the participants.

Background attributes	n = 178	%
Neonate's sex		
Female	95	53.4
Male	83	46.6
Neonate's age in days		
3 to 14	134	75.3
15 to 28	44	24.7
Birth weight in Kg		
2.0 - 3.0	84	47.2
3.1 - 4.2	94	52.8
Current status of umbilical cord infection		
Present	67	37.6
Absent	111	62.4
Description of umbilical cord infection (n = 67)		
Reddened	33	49.3
Swollen	9	13.4
Pus	25	37.3
Mother's age in years		
16 - 22	61	34.3
23 - 29	83	46.6
31 - 39	34	19.1
Mother's level of education		
Primary	59	33.2
Secondary	94	52.8
College/University	25	14.0
Mother's religion		
Christian	168	94.4
Muslim	10	5.6
Mother's marital status		
Married	127	71.3
Single	51	28.7

The table further shows that about half of the mothers (46.6%) were in the age category of 23 - 29 years and about a third (34.3%) were 16 - 22 years. The educational level of education for the mothers was as follows; 33.2% in primary, 52.8% in secondary and 14.0% in tertiary. Most of the mothers (94.4%) were Christians whereas the remaining 5.6% were Muslims. More than two thirds (71.9%) of the mothers were married.

3.2. Descriptive Analyses of Cord Care Practices among the Mothers

A large percentage (94.9%) of the mothers indicated that the umbilical cord was tied with a cord clamp while only 5.1% used thread. About two thirds (63.5%) of the mothers initiated breastfeeding after one hour of delivery. Most of the mothers (93.3%) reported that they stay with the baby in the same room ([Table 2](#)).

Table 2. Mothers' knowledge and practices on cord care.

Variables	n = 178	%
Things used to tie umbilical cord		
Cord clamp	169	94.9
Thread	9	5.1
Things used to cut umbilical cord		
Scissors	178	100.0
Initiation of breast feeding		
>1 hour	113	63.5
≤1 hour	65	36.5
Staying with the baby in the same room		
Yes	166	93.3
No	12	6.7
Thermal care		
Wearing hat	76	42.7
Warming the room	17	9.6
Wrapping the baby warmly	61	34.3
Skin-to-skin contact	24	13.5
Methods used to care baby's cord		
Apply saliva	19	10.7
Apply spirit	44	24.7
Applying warm salty water	18	10.1
Air dry	97	54.5
Whether wearing the diaper above or below the cord		
Above cord	82	46.1
Below cord	96	53.9
Bathing practice		
Not yet	18	10.1
Every day	151	84.8
Every other day or more	9	5.1
Substances (hand/body soap) added to the bath water		
Yes	108	67.5
No	52	32.5
Not applicable	18	
Ways of bathing the baby		
Immersion in water	33	20.6
Pour water over baby	41	25.6
Wipe baby with cloth	86	53.8
Not applicable	18	
How do you wash your hands		
Basin	86	48.3
Running water	92	51.7

Air drying was the main method (54.5%) used for caring the baby's umbilical cord followed by spirit application at 24.7%, saliva at 10.7% and warm salty water at 10.1%. Ninety six (53.9%) of the mothers tied the diaper below umbilical cord while the remaining (46.1%) tied the diaper above the cord. Majority of the mothers (84.8%) bathed their babies every day and 67.5% added hand/body soap to the bath water. About half (51.7%) of the mothers were using running water to wash their hands while the remaining 48.3% were using basin (Table 2).

3.3. Cord Care Practices Associated with Omphalitis

In the bivariate analysis, initiation of breastfeeding after one hour, application of saliva on cord, substances (hand/body soap) added to the bath water and using basin to wash hands were factors associated with omphalitis. However, in the multivariate analysis, initiation of breastfeeding after one hour and application of saliva on the cord remained significantly and independently associated with omphalitis.

Babies who were initiated breastfeeding after one hour of delivery were about 2.5 times more likely to develop omphalitis than those who were initiated within the first one hour [AOR = 2.47; 95%CI = 1.15 - 5.30; $P < 0.05$]. Babies whose mothers applied saliva to their umbilical cord had significantly 6.5 times more likely to have omphalitis [AOR = 6.59; 95%CI = 2.02 - 21.46; $P < 0.01$] than babies whose mothers practiced air drying (Table 3).

4. Discussion

The umbilical stump represents a unique but universally acquired wound in which devitalized tissue provides a medium that could support bacterial growth. Thus, the immediate care of the umbilical cord requires strict aseptic techniques following healthy clamping and severance of the cord. If these basic conditions of the best cord care practices are overlooked, grievous infections may occur [4] that can lead to sepsis and death.

The study shows that initiation of breastfeeding was a predicting factor for umbilical cord infection. Babies who initiated breastfeeding after one hour of delivery were about 2.5 times more likely to develop cord infection than those who were initiated within one hour. This is in agreement with a study carried out by Mullany *et al.* [3] who reported breast-feeding within the first hour after birth was associated with lower risk of infection in multivariate analyses. There are several biological mechanisms thought to account for the relationship between breastfeeding initiation and cord infection. Breast milk contains secretory IgA, lysozymes, white blood cells, and lactoferrin. It has been shown to promote the growth of healthy *Lactobacilli* and reduce the growth of *E. coli* and other Gram-negative pathogenic bacteria [17]. Early initiation and exclusive breastfeeding is associated with significant reductions in diarrhea and acute respiratory infections in neonates while other observational studies have demonstrated impact on infection specific mortality rates during the neonatal period [18]-[20]. In addition, breastfeeding in the first hour of life is also recognized by the WHO as an important component of protection and should be implemented as routine hospital practice in all countries in order to reduce neonatal mortality [4].

In the present study, babies whose mothers applied saliva to care the cord had significantly 6.5 times more likely to have omphalitis than babies whose mothers practiced air drying. This practice is often harmful, because the mother's saliva is liable to being contaminated with micro-organism, thus increasing the risk of infection. Internationally, WHO has advocated since 1998 for the use of dry umbilical cord care (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). World Health Organization recommends topical antiseptics (e.g., chlorhexidine) in situations where hygienic conditions are poor and/or infection rates are high [4].

5. Conclusion

In conclusion, the prevalence of omphalitis among neonates was high. The study shows that initiation of breast feeding after one hour and application of saliva on the cord are predictors of omphalitis. Programs promoting cord care among mothers should raise awareness by emphasizing immediate initiation of breast feeding after delivery and discouraging the application of potentially harmful substances (e.g. saliva) to the umbilical cord.

6. Limitations

The study relied only on physical examination to assess umbilical cord infection. It did not include swab sam-

Table 3. Cord care practices associated with omphalitis.

Variables	Cord infection		Bivariate analysis	Multivariate analysis
	Yes, n (%)	No, n (%)	COR (95%CI)	AOR (95%CI)
Things used to tie umbilical cord				
Cord clamp	61 (36.1%)	108 (63.9%)	0.28 (0.07 - 1.17)	-
Thread	6 (66.7%)	3 (33.3%)	Reference	-
Initiation of breast feeding				
>1 hour	51 (45.1%)	62 (54.9%)	2.52 (1.28 - 4.95)	2.47 (1.15 - 5.30)*
≤1 hour	16 (24.6%)	49 (75.4%)	Reference	Reference
Staying with the baby in the same room				
Yes	60 (36.1%)	106 (63.9%)	0.40 (0.12 - 1.33)	-
No	7 (58.3%)	5 (41.7%)	Reference	-
Thermal care				
Wearing hat	36 (47.4%)	40 (52.6%)	1.80 (0.69 - 4.71)	-
Warming the room	7 (41.2%)	10 (58.8%)	1.40 (0.39 - 5.06)	-
Wrapping the baby warmly	16 (26.2%)	45 (73.8%)	0.71 (0.26 - 1.98)	-
Skin-to-skin contact	8 (33.3%)	16 (66.7%)	Reference	-
Methods used to care for baby's cord				
Apply saliva	9 (64.3%)	5 (35.7%)	4.41 (1.36 - 14.28)	6.59 (2.02 - 21.46)**
Apply spirit	20 (44.4%)	25 (55.6%)	1.96 (0.94 - 4.06)	1.62 (0.72 - 3.67)
Applying warm salty water	9 (47.4%)	10 (52.6%)	2.20 (0.81 - 4.06)	1.52 (0.47 - 4.90)
Air dry	29 (29.0%)	71 (71.0%)	Reference	Reference
Whether wearing the diaper above or below the cord				
Above cord	32 (39.0%)	50 (61.0%)	1.12 (0.61 - 2.05)	-
Below cord	35 (36.5%)	61 (63.5%)	Reference	-
Bathing practice				
Not yet (3 - 13 days)	7 (38.9%)	11 (61.1%)	1.27 (0.24 - 6.82)	-
Every day	57 (37.7%)	94 (62.3%)	1.21 (0.29 - 5.04)	-
Every other day or more	3 (33.3%)	6 (66.7%)	Reference	-
Bathing was started after delivery				
First day	17 (41.5%)	24 (58.5%)	1.15 (0.54 - 2.44)	-
Second day	16 (33.3)	32 (66.7%)	0.81 (0.39 - 1.69)	-
Third day and above	34 (38.2%)	55 (61.8%)	Reference	-
Substances (hand/body soap) added to the bath water				
Yes	47 (43.5%)	61 (56.5%)	2.31 (1.11 - 4.82)	2.14 (0.89 - 5.11)
No	13 (25.0%)	39 (75.0%)	Reference	Reference
Ways of bathing the baby				
Immersion in water	13 (39.4%)	20 (60.6%)	0.90 (0.40 - 2.05)	-
Pour water over baby	11 (26.8%)	30 (73.2%)	0.51 (0.23 - 1.15)	-
Wipe baby with cloth	36 (41.9%)	50 (58.1%)	Reference	-
How do you wash your hands				
Basin	44 (50.0%)	44 (50.0%)	2.91 (1.55 - 5.48)	2.16 (0.98 - 4.46)
Running water	23 (25.6%)	67 (74.4%)	Reference	Reference

Abbreviations: COR = Crude Odds Ratio, AOR = Adjusted Odds Ratio, CI = Confidence Interval, *P < 0.05, **P < 0.01.

ples for culture test that would have determined the specific bacteria. Another limitation was reliance on the participants' response to the questionnaire. However, collecting data with trained interviewers and anonymity would facilitate participants in disclosing their information.

Acknowledgements

We wish to express our profound gratitude to the respondents involved in this study for their cooperation and time. We also acknowledge the health workers and management staff of the Pumwani Maternity Hospital for their assistance.

The funding is from the Linked-Strengthening Maternal, Newborn and Child Health (MNCH) Research Training in Kenya. The grant is linked to Partnership for Innovative Medical Education in Kenya (PRIME-K). The project was supported by Award Number 5R24TW008907 from the US National Institutes of Health. The content is solely the responsibility of the authors and does not necessarily represent the official views of the US National Institutes of Health

Competing Interests

The authors declare that they have no competing interests.

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Appendix I: Questionnaire in English and Swahili

Serial Number (Nambari).....

Date (Tarehe):

Demographic data of mothers (Takwimu za wakazi wa akina mama)

1. Age in years: _____

Umri (miaka) _____

2. Level of education: Primary ☐, Secondary ☐, College ☐, None ☐

Masomo Yako: Msingi ☐, upili ☐, chuo ☐, hakuna ☐.

3. Religion: Christian ☐, Muslim ☐, Others (Specify).....

Dini: Ukristo ☐, uislam ☐, zingine (eleza)

4. Marital status: Married ☐ Single ☐,

Hali ya ndoa: ndio ☐, sinlge ☐.

Baby's information (Maelezo ya mtoto)

1. Sex Male ☐ Female ☐.

Jinsia: mume ☐, mke ☐

2. Age in days:

Umri (siku)

3. Birth weight:

Uzito wa kuzaliwa

4. Status of the umbilical cord infection (assessed by the researchers):

Present ☐ Absent ☐

5. Description of umbilical cord infection

Redness/erythema ☐ Pus ☐ Swelling and/or foul smell ☐ Others (specify).....

Cord care practices (Mazoea huduma kamba)

1. What was used to tie your baby's umbilical cord?

Cord clamp ☐, Thread ☐, Others (Specify).....

Ni nini ilitumiwa kufunga kitovu cha mototo wako?

Chaka ya kitofu ☐, uzi ☐, zingine (eleza)

2. What was used to cut your baby's umbilical cord?

Scissors ☐, Razor blade ☐, Knife ☐, Others (Specify).....

Ni nini ilitumiwa kukata kitovu cha mototo wako? Makasi ☐, wembe ☐,

kisu ☐, zingine (eleza)

3. When did you initiate breastfeeding to your child?

Ulianisha kunyonya motto wako baada ya mda gani?

4. Do you always stay with your baby in the same room?

Yes ☐, No ☐.

Unakaa na mtoto kwa chumba kimoja kila wakati?

Ndio ☐, la ☐.

5. What do you apply on your baby's umbilical cord?

Air dry ☐, Spirit ☐, Chlohexidine ☐, Others (Specify)

Unatunza aje kiziki cha kitovu cha motto wako?

Hakuna ☐, spirit ☐, zingine (eleza)

6. What do you do to keep the baby warm?

Nini kufanya ili kuweka mtoto mtamu?

7. How often do you bath your child?

Ni mara ngapi wewe umwagaji wa mtoto wako?

8. Do you add any substances (hand/body soap or Dettol) to the baby's bath water?

Yes ☐, No ☐.

Je, kuongeza vitu yoyote (mkono / mwili sabuni au Dettol) kwa umwagaji wa maji mtoto ?

Ndio ☐, la ☐.

9. How do you bath your baby?

Immersion in water ☐ Pour water over the body ☐ Others (Specify)

Jinsi gani unaweza umwagaji mtoto wako ?

Kuzamisha katika maji ☐ Kuifuta kwa kitambaa mtoto ☐ zingine (eleza)

10. How do you apply Diaper/Napkin on your baby?.....(Explain-observe)

Unamfung aje Diaper/Kitambaa motto wako?(eleza).

11. How do you wash your hands?

Basin ☐ Running water ☐

Ni vipi unanawa mikono?

bonde la ☐ maji ya bomba ☐

Thank you