

FACTORS INFLUENCE THE SEPARATION TIME OF THE UMBILICAL CORD IN HEALTHY TERM NEWBORNS

¹Dr. Sawsan Abdulwahab Hommadi, ²Dr. Amal Abdulnabi Hussien and ³Dr. Akram Hatim Salih

¹MB.ChB.D.C.H, Central Child Teaching Hospital, Baghdad, Iraq

²C.A.B.P, Central Child Teaching Hospital, Baghdad, Iraq

³M.B.Ch.B, Central Child Teaching Hospital, Baghdad, Iraq

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ABSTRACT

Background: More than 4 million neonates died yearly because of infections, among them, umbilical cord infections contribute to one million of them, thus, proper handling and care of the umbilical cord after delivery may have a great benefit in reducing worldwide neonatal mortality.

Objectives: Estimation of the mean time of separation of the umbilical cord within a limited sample size of the term newborns and assessing the influence of different factors on the time of separation of the umbilical cord.

Patients and method: A prospective study was held at the postnatal ward of gynecology and obstetrics department in Al- Yarmouk teaching hospital where 150 healthy term newborns were surveyed for the time of separation of their umbilical cord. Information were taken regarding age of the mother, parity, educational level, the type of residency and mode of delivery. All surveyed newborns were followed up by phone calls of the closest caregiver for cord care modality and exact day of separation of the cord

Results: The estimated mean time of separation of the umbilical cord in the current study was 8.4 days with a range of (4-14) days. Alcohol mode of care was the most popular one (59 cases (39%)) with a mean time of separation of 9.2 days (the longest time among other methods), the dry cord method stood in the 2nd rank (43 cases (26%)) with mean separation time of 7.1 days (the shortest time among the other methods), whereas the least common identified method was Povidine application (7 cases (7%)), cord care method has significant impact on the mean time of separation with a P value of 0.006. Other factors (maternal and neonatal) had no significant values.

Conclusion: The mean time of separation of the umbilical cord in this study was 8.4 days. Among the different maternal, natal and postnatal factors, only the cord care method showed significant impact on the time of separation of the umbilical cord in this study.

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INTRODUCTION

The time at which the umbilical cord separates is often a cause of concern to parents. Although the precise mechanism of cord separation is not known, drying, infarction, collagenase activity, necrosis, and granulocyte influx may all influence the time at which it occurs. Superimposed bacterial infection of the umbilicus may delay this process (Hayward, 1979).

The world health organization (WHO) estimates that 4 million children die each year during the neonatal period. Importantly, infections are the most common cause of neonatal mortality. Umbilical cord (UC) infections contribute to the increased morbidity and mortality in the newborns. Approximately 1 million newborns dying annually worldwide from UC bacterial infections (Vural, 2006). The normal time of Separation of the UC may vary from 2 days up to 28 days, thus it is influenced by many factors include place and mode of delivery, gender of infants and cord care practice. Knowledge of the normal range of time it takes for separation of the cord after birth is important to prevent unnecessary and maybe harmful

*Corresponding author: Dr. Sawsan Abdulwahab Hommadi
MB.ChB.D.C.H, Central Child Teaching Hospital, Baghdad, Iraq

interventions (Imuetinyan, 2011). Delayed cord separation does not have a specific definition, primarily because of the variation in normal cord separation. In general, any cord that persists after three weeks probably represents delayed cord separation. Delayed cord separation can be associated with underlying immunodeficiency, infection, or urachal abnormality (Razvi, 2001).

Care of the UC stump: In developed countries, where aseptic care is routine in the clamping and cutting of the UC, it is unclear whether additional topical care is needed to prevent omphalitis (Pezzati, 2002). In developing countries, where aseptic delivery care is not readily available, antiseptic topical care of the umbilicus reduces the risk of omphalitis and neonatal mortality (Mullany, 2006). However, WHO has clear cut say in that issue : "Daily chlorhexidine (7.1% chlorhexidine digluconate aqueous solution or gel, delivering 4% chlorhexidine) application to the umbilical cord stump during the first week of life is recommended for newborns who are born at home in settings with high neonatal mortality (30 or more neonatal deaths per 1000 live births). Clean, dry cord care is recommended for newborns born in health facilities and at home in low neonatal mortality settings. Use of chlorhexidine in these situations may be considered only to replace application of a harmful traditional substance, such as cow dung, to the cord stump (www.who.org; guidelines for umbilical cord care).

Aim of study

- A trial for Estimation of the range and mean time of separation of the UC within the limited sample size of the study.
- Assessing the influence of the maternal age, parity, residence, educational level and mode of delivery, sex and weight of newborn, length of the umbilical stump and umbilical cord care method on the time of separation of the UC.

PATIENTS AND METHODS

A prospective study was performed on 173 healthy term newborn babies who had been examined in postnatal ward of gynecology and obstetrics department at Al-Yarmouq teaching hospital . At the postnatal ward; the families of the recruited newborn babies were questioned for name, sex, mode of delivery, date and time of birth, residence (whether it is rural or urban), educational level of the mother whether it was low or medium or high (low: who didn't get to school or didn't finish primary school, medium: who got but didn't finish the secondary school, high: who finished the secondary school and got to a high educational study), maternal age and parity of the mother, being a term baby has been confirmed from the LMP and EDD of the mother which were documented in the mother's medical records. All the involved newborns were examined for their weight, possible presence of gross congenital abnormalities (for the latter, to be dismissed from the study initially) and finally the length of UC stump for each examined newborn has been measured by the researcher. A phone number of the closest caregiver of the included newborn has been taken in order to contact them to question about the time of separation of the UC , mode of care of the UC, the phone calls were used to be done every 5 days till the onset of separation of the UC. Those newborns with history of maternal

diseases or who got any sort of illness during the period of study (for which admission to NICU was required) or any newborn who had a gross congenital anomaly or any newborn with history of redness or swelling or abnormal discharge of the UC (possible UC infection?) during the time of the study had been excluded from the study in addition to those who refused to answer the phones, so, the final studied group were limited to 150 newborns (the predesigned targeted sample size).

RESULTS

The total surveyed newborns were 173. From them, 23 cases were dismissed from the study due to the following causes:

- A-16 cases due to lack of cooperation with the phone calls.
- B-3 cases due to developing symptoms of cord infection.
- C-4 cases due to admission to NICU.

After dismissing the previous cases, total sample size was reduced to 150 cases.

Time of separation of UC

In the studied newborns, the mean time of separation was 8.4 days, shortest documented time of separation of UC was 4 days (3 cases) while the longest time of separation was 14 days (one case only) as shown in figure 1.

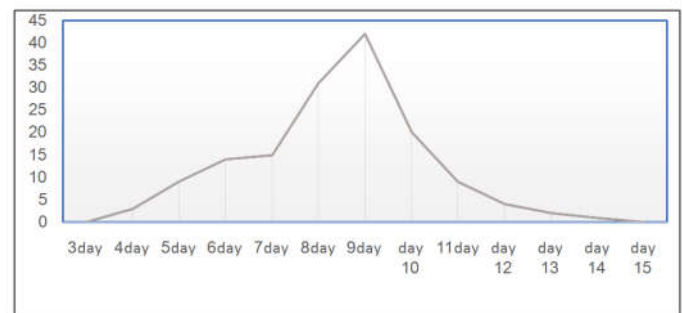


Figure 1. Distribution of newborns according to the time (exact day) of separation of the UC

Most of the cases; 71 (57%) cases had separated the UC in the time period (>8 to 11 days), whereas the least group separated the UC in the time period (>11 days) (Table 1).

Table 1. Distribution of cases according to time of separation of the cord

Time (days)	3 to5	5 to 8	8 to 11	>11
No. of case	12	60	71	7
Percentage	8%	40%	47.33%	4.66%

Impact of newborns sex on the time of separation of the UC

Among the total 150 surveyed cases, 71 cases were males (47.33%), 79 cases were females (52.66%). The mean time of separation for the male cases was 8.5 days, whereas that of the female cases was 8.3 days. The results showed that the sex of the newborn has no impact on the time of separation of the UC with a P value equal to 0.086 (Table 2).

Table 2. Distribution of newborns' sex categories into time of separation of UC

Sex	NO.	Distribution of cases according to the time of separation of the UC (in days)				Mean time	P value
		3 to 5	>5 to 8	>8to11	>11		
Male	71	7 10%(9.85)	21 30%	40 56%	3 4%	8.5	0.086
Female	79	5 6%	39 50%	31 39%	4 5%	8.3	
Total	150	12	60	71	7	8.4	

The above percentages has been calculated from the total number of the corresponding category

Table 3. Distribution of newborn's body weights categories into time of separation of UC

Birth weight	NO.	Distribution of cases according to the time of separation of the UC				Mean time	P value
		3 to 5	>5 to 8	>8 to 11	>11		
< 2.5 kg	7	0 0%	1 14%	5 72%	1 14%	8.4	0.533
2.5 – 4.5 kg	137	12 8.7%	56 41%	63 46%	6 4.3%	8.7	
>4.5 kg	6	0 0%	3 50%	3 50%	0 0%	8.2	
Total	150	12	60	71	7	8.4	

The above percentages has been calculated from the total number of the corresponding category

Table 4. Distribution of mode of delivery categories into time of separation of UC

Mode of delivery	NO.	Distribution of cases according to the time of separation of the UC				Mean time	P value
		3 to 5	>5 to 8	>8 to 11	>11		
Cesarean section	124	10 8%	49 40%	59 47%	6 5%	8.5	0.992
VD	26	2 7.5%	11 42.5%	12 46%	1 4%	8.2	
Total	150	12	60	71	7	8.4	

The above percentages has been calculated from the total number of the corresponding category

Table 5. Numbers and percentages and mean time of separation of the UC for the cases according to their preference to certain method of care of the UC and for each group

Method	No.	Percentage	Mean time of separation
Alcohol	59	39%	9.2
Dry cord	43	26%	7.1
Water and soap (usual bathing)	19	11%	8.2
Topical Abs	12	8%	8.7
Povidine	7	7%	8.5
Others	10	9%	7.6
Total	150	100%	8.4

Impact of birth weight on the time of separation of the UC

The vast majority of cases (137 cases (91.3%)) were born with body weight ranging from 2.5 to 4.5 kg with a mean time of separation of the UC equal to 8.4 days, only 7 cases (4.7%) were born with body weights < 2.5 kg, their mean time of separation of the UC was 8.8 days, the rest 6 cases (4%) were born with body weights >4.5 kg with a mean time of separation equal to 7.9 days (table 3). According to statistical testing, the birth weight has no significance influence on the time of separation of the UC (P value: 0.533).

Impact of mode of delivery of the newborns on the time of separation of the UC

In the present study, 124 cases (83%) were delivered by cesarean section, their mean time of separation of the UC was 8.5 days, the rest; 26 cases (17%) were delivered vaginally with a mean time of separation equal to 8.2 days (Table 4).

According to the statistical finding; mode of delivery of the newborn has no influence on the time of separation of the UC (P value: 0.992) (Table 4).

Impact of the Cord care's methods on the Time of separation of the UC

The study showed that alcohol preparation was the most popular method for care of the UC (59 cases (39%)), Followed by Dry cord method which (described previously in the introduction) (43 cases (26%)). Whereas the least common identified method was Povidine solution application (7 cases (7%)) as described in Table 5. Table 5 also shows that alcohol method is associated with the longest mean separation time among the other modes (mean time of separation of UC equal to 9.2 days), meanwhile, the dry cord method produced the shortest time with a mean time of separation equal to 7.1 days. By testing the statistical significance of effect of choosing a certain mode of care on the time of separation of the UC, the results show it is highly significant with a P value equal to 0.006 (Table 6).

Table 6. Distribution of mode of UC care categories into time of separation of UC

Mode of care	Distribution of cases according to the time of separation of the UC (in days)				P value (total)
	3 to 5	>5 to 8	>8 to 11	>11	
Alcohol	1 1.5%	15 25%	39 67%	4 6.5%	0.006
Dry cord	6 14%	26 60%	10 24%	1 2%	
Water and soap (usual bathing)	2 10.5%	7 37%	10 52.6%	0 0%	
Topical ABs	1 8.5%	4 33%	6 50%	1 8.5%	
Povidine	0 0%	2 28%	4 58%	1 14%	
others	2 20%	6 60%	2 20%	0 0%	
Total	12	60	71	7	

The above percentages has been calculated from the total number of the corresponding category

Table 7. Distribution of cord stump's length categories into time of separation of UC

Length of the cord stump	NO.	Distribution of cases according to the time of separation of the UC				Mean time	P value
		3 to 5	>5 to 8	>8 to 11	>11		
< 1.5 cm	81	7 8.5%	33 41%	37 45.5%	4 5%	8.4	0.986
1.5 – 3 cm	58	4 7%	22 38%	29 50%	3 5%	8.7	
>3 cm	11	1 9%	5 45.5%	5 45.5%	0 0%	8.2	
Total	150	12	60	71	7	8.4	

The above percentages has been calculated from the total number of the corresponding category

Table 8. Distribution of maternal age categories into time of separation of UC

Maternal age	NO.	Distribution of cases according to the time of separation of the UC				Mean time	P value
		3 to 5	>5 to 8	>8 to 11	>11		
< 25 yrs.	43	1 2%	16 37%	24 56.5%	2 4.5%	8.8	0.486
25 – 35 yrs.	78	8 10%	31 40%	34 43.5%	5 6.5%	8.3	
>35 yrs.	29	3 10%	13 45%	13 45%	0 0%	8.1	
Total	150	12	60	71	7	8.4	

The above percentages has been calculated from the total number of the corresponding category

Impact of umbilical stump's length on the time of separation of the UC

The results showed that the most frequent stump length was below 1.5 cm (81 cases (54%)), while 58 cases (38.6%); their umbilical stumps length ranged from >1.5 to 3 cm, a minority group (11cases (7.3%)) were with UC stump length >3cm (Table 7). For the <1.5 cm group, the mean time of separation of the UC was 8.4 days, for the 1.5 – 3 cm group; the mean time of separation was 8.7 days. Whereas the >3cm group; their mean time of separation was 8.2 days. Overall; length of stump has no significant impact on time of separation of the UC (P value: 0.986) (Table 7).

Impact of the maternal age on the time of separation of the UC

78 (52%) mothers were between 25 to 35 years of age, the mean time of separation of the UC in their babies was 8.8 days, while 43 cases (28.6%) were below 25 years old with a mean time of separation 8.8 days, the rest 29 cases (19.3%) were >35 years old, their mean time of separation was 8.1 days (table 8). This was statistically not significant with a P value of 0.486.

Impact of parity of the mother on time of separation of the UC

In the collected data, most of the mothers (76 cases (51%)) with parity of (2 to 4) with a mean time of separation equal to 7.9 days, 32 (21%) mothers were primi with a mean time of separation of 8.7 days, rest of the cases; were with parity more than 4. Their mean time of separation of the UC was 8.6 days (table 9). After testing the statistical significance of parity of the mother on the time of separation of the UC, it was not significant with a P value equal to 0.942 (Table 9).

Impact of the type of family residence on the time of separation of the UC

Among the total sample, 122 newborns (81.3%) belong to urban families, the rest, 28 cases (18.6%) belong to rural families. The mean time of separation of the UC for the (urban) newborns was 8.9 days. For the (rural) newborns was 7.1 days. The statistics showed that the type of residence has no significance on the time of separation of the UC, with P value equal to 0.507 (table 10). In the sample of study, 51 cases (34%) belonged to mothers with low educational level, their mean time of separation of the UC was 8.0 days, 65 cases (43.3%) belong to mothers with medium educational level (the

Table 9. Distribution of maternal parity categories into time of separation of UC

Parity of the mother	NO.	Distribution of cases according to the time of separation of the UC (in days)				Mean time	P value
		3 to 5	>5 to 8	>8 to 11	>11		
Primi	32	4	12	15	1	7.9	0.942
2 to 4	76	12.5%	37.5%	47%	3%	8.7	
>4	42	6	31	35	4	8.6	
Total	150	8%	41%	46%	5%	8.4	

The above percentages has been calculated from the total number of the corresponding category

Table 10. Distribution of newborns' type of residence categories into time of separation of UC

Type of residence	NO.	Distribution of cases according to the time of separation of the UC				Mean time	P value
		3 to 5	>5 to 8	>8 to 11	>11		
urban	122	8	48	60	6	8.9	0.507
Rural	28	6.5%	40%	48.5%	5%	7.1	
Total	150	4	12	11	1	8.4	
		14%	43%	40%	3%		

Table 11. Distribution of maternal educational level categories into time of separation of UC

Level of education	NO.	Distribution of cases according to the time of separation of the UC				Mean time	P value
		3 to 5	>5 to 8	>8 to 11	>11		
Low	51	7	21	22	1	8.1	0.158
Medium	65	13.7%	41%	43.1%	2%	8.5	
High	34	2	22	37	4	8.4	
Total	150	3%	34%	57%	6%	8.4	

The above percentages has been calculated from the total number of the corresponding category.

largest group) with a mean time of separation of the UC equal to 8.5 days, the rest, 34 cases (22.6%) were born to mothers with high educational level (the smallest group), their mean time of separation was 8.5 days (table 11). The results showed that the educational level of the mother has no significant influence on the time of separation of the UC with a P value equals to 0.158 (Table 11).

DISCUSSION

As mentioned previously in this study, the range of UC separation time was 4 to 14 days with no odd cases of much longer time period of separation, the demonstrated range is similar to that of Yola, Iliyasu *et al* study (Ozdemir, 2017), while it is considered short in comparison to other studies; time range of separation in study of Singh and Sharma *et al* was 3-31 days (Ayyildiz, 2015), that of Oladukon and Orimadegun *et al* was 3-21 days (Oladokun, 2006), while the time range in Helen Bailey study was 2-28 days (Bailey, 1990). The relatively narrow range in the current study could be explained due to limited sample size (150 cases only) in comparison to other relatively large sample size studies ((250 cases) (536 cases) (233cases) respectively for the later three study). The mean time of separation of the UC was 8.4 days, which was similar to that of Tudu, Mishra *et al* study in India (mean time of 8.6 days) (Asit Kumar, 2015), while it was longer than the time of separation In Loksha, Anil *et al* study in India (mean time of 5.6 days) (Shetty, 2014), whereas it was shorter than that of Novack, Mueller *et al* in America (mean time 13.9 days) (Novack, 1988), and Medves, Beverley *et al* in Canada (mean time of 13.8 days) (Medves, 2002).

The latter difference might be due to high hygiene level in the developed countries leading to less bacterial colonization of UC and subsequently delayed dryness and fall of UC [16], also climate variation between the developed and developing countries may contribute to that difference; where is the atmosphere tends to be colder in the western and northern countries leading to more clothing of newborns resulting in decreasing the certain air exposure and dryness required for the separation of the UC (Novack, 1988). In an attempt to study the influence of the newborn sex, the results showed that it had no impact (P value: 0.086), which was the same outcome in study of Aghamohammadi, Zafari *et al* (Aghamohammadi, 2012). and in that of Loksha, Shetty *et al* (Shetty, 2014) and study of Quattrin, Iacobucci *et al* (Quattrin, 2016), with a P value >0.05 for the latter 3 studies. The collected data showed that the newborns' birth weight had no effect on the time of separation of the UC (P value: 0.533) which was compatible with other studies like; Loksha, Shetty *et al* (Shetty, 2014), Ozdemir and Bilgen *et al* (Ozdemir, 2017). Regarding the mode of delivery, the results showed 83% of cases were delivered by cesarean section, and less than 17% cases were delivered vaginally. This huge numerical discrepancy is due to difficulty in access to (normal vaginal delivery ward) and short post labor admission time. Overall, the present study showed that the mode of delivery had no influence on the time of separation of UC (P value:0.992), which was the same outcome in many studies, like; Aghamohammadi, Zafar *et al*. (Aghamohammadi, 2012), Ozdemir and Bilgen *et al* (Ozdemir, 2017), Yola and Iliyasu *et al*. (Mukhtar-Yola, 2011). In contrast; certain studies, like: Oladukon and Orimadegun *et al* (Oladokun, 2006), and Helen bailey study [11] had shown that the cesarean section was

associated with longer separation time, thus, may be due to Decrease in bacterial contamination (that occurs normally in vaginal deliveries) leading to lower rate of leukocytes migration and subsequent delay in dryness and separation of the UC (Oladokun, 2006). In the part related to influence of cord care on the time of separation of the UC, Alcohol method was the most popular one (39%), may be due to the fact it is highly merchandised nowadays among the doctors and the pharmacies, meanwhile the dry cord method (or not to do any think) still widely used (26%), because certain mothers still adherent to their traditional heritage. The present study had already showed that cord's care methods have a significant impact on the time of separation (P value : 0.006), such finding is identical with other studies, like; Mukhtar, Iliyasu *et al* (2011), Bailey study (Bailey, 1990), Oladokun and Orimadegun *et al* study (Oladokun, 2006), Ozdemir and Bilgen *et al* (Ozdemir, 2017). with P value for the latter 3 studies <0.05. The explanations behind that are due to interference of certain topical cord applicants with UC bacterial colonization process that occurs normally after delivery, hence, interfere and decrease the subsequent leukocytes migration to the UC stump which is necessary for the dryness and separation of the UC (Quattrin, 2016).

Regarding the length of the stump, the data showed that majority of newborns had had cord stump length <1.5cm (54%), only small group (7%) had cord stump length >3cm., the study also demonstrated the cord stump length has no significance on the time of separation of the UC with a P value equal to 0.986, that means even the recommended stump length (>5 cm) ^[13] had no impact on the time of separation of the cord. Analyzing the maternal age data, showed it had no influence on the time of separation of UC (P value: 0.486). Which is not significant also in other studies, like; ayyildis, kulakci *et al* ^[19], Ozdemir and Bilgen *et al*, (2017). Questioning for Parity of the mothers hadn't show a significant influence on the time of separation of UC, with a P value equals to 0.942, this result had been supported by other studies like; Oladokun and Orimadegun *et al* study (Oladokun, 2006), Aghamohammadi, Zafari *et al* (Aghamohammadi, 2012). Regarding the residence type for the families under study, the study concluded that being an urban or rural had no influence on the time of separation of the UC (P value: 0.507), which was the same results in Coffey, Patricia *et al* study (Coffey, 2017) Zopan, Garner *et al* study (Zupan, 1998). Maternal educational level hadn't show a significant impact on the time of separation of UC in the present study, with a P value equals to 0.158, which wasn't significant also in other studies, like; ayyildis, kulakci *et al* (Ayyildiz, 2015), Mukhtar, Iliyasu *et al*. (2011) and Abd, Afey *et al*. (2017).

Conclusions and recommendations

The mean time of separation of the UC in studied newborns was 8.4 days. No evident maternal, antenatal or natal factors may contribute to early or delayed separation of the UC. Regarding the postnatal factors; only the cord care methods may attribute to alter the time of separation of the UC. Aiming to elimination the risk of cord infection, fastening the time of separation, reducing the chance for entrance of pathogen through the UC, that's why selection and education about the proper regime of cord care that may reduce such time, is of benefit to do so which is here, the dry cord method in the current study. Suggestion for large sample size study, with wider inclusion criteria; including term and preterm newborns,

such study may be more accurate in estimation of separation time of the UC. Suggestion for conduction a study that search for and emphasize on other modalities of cord care that may assure both; shorter time of separation of the UC and less contamination and infection of UC, for example; breast milk application versus dry method.

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