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ORIGINAL RESEARCH

Length of Hospital Stay After Cesarean Delivery and Its Determinants Among Women in Eastern Sudan

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Background: There is an increasing caesarean delivery (CD) rate globally. Length of hospital stay (LoS) is longer in CD compared with vaginal delivery. There are few published data on LoS following CD in Africa, including Sudan. We aimed to investigate LoS after CD in eastern Sudan and its associated risk factors.

Methods: A cross-sectional study was conducted at Gadarif hospital in eastern Sudan from May to December 2020. Sociodemographic, clinical and obstetrical data were gathered through questionnaires. Poisson regressions were used to model the LoS and provide relative risk (RR) and a 95.0% confidence interval (CI).

Results: We enrolled 544 women with CD. The median (interquartile range, IQR) of their age and parity was 28.0 (24.0 –32.0) years and 3(2–3), respectively. The LoS range was 1.0–9.0 days (mean = 2.7 days) and its median (IRQ) was 3.0 (2.0–3.0) days. The median (IQR) of the LoS was significantly higher in women who had emergency CD vs elective CD, [3 (3.0–3.0) vs 3 (2.0–3.0) days, $P < 0.001$] and in women with maternal complications vs women who had no maternal complications [3 (2.0–3.0) vs 3 (2.0–3.0) days, $P < 0.001$]. Poisson regression showed that women with emergency CD stayed for 13.0% longer than women with elective CD (RR=1.13, 95% CI=1.01–1.29). Women with maternal complications stayed 24.0% longer than women who had no maternal complications (RR=1.24, 95% CI=1.07–1.43). Women who had neonatal complications stayed for 21.0% longer than women who had no neonatal complications (RR=1.21, 95% CI=1.05–1.40). Age, parity, residence, education, occupation and postoperative haemoglobin were not associated with LoS.

Conclusion: The mean LoS in this study was 2.7 days, and women with emergency CD and maternal and neonatal complications had longer LoS.

Keywords: caesarean delivery, emergency, elective, hospital stay, Sudan

Introduction

There is an increasing caesarean delivery (CD) rate globally (from 7% in 1990 to 21% in 2021) [1] and in the sub-Saharan region in particular (from 3.2% in 2012 to 5.9% in 2016).[2] Compared with vaginal delivery (VD), CD is associated with increased maternal and perinatal morbidity and mortality rates.[3] One of these factors is the length of stay (LoS) in the hospital, which is reported to be longer in CD than VD.[4,5] Length of hospital stay is becoming an area of interest for researchers worldwide, as it is a readily available health indicator reflecting hospital activity and is an indirect estimator of resource consumption and efficiency.[6,7] However, there is much debate on LoS and its duration after CD.

Early hospital discharge has been reported as a widespread practice nowadays, especially in the era of the COVID-19 pandemic.[8] After CD, a short hospital stay may reduce the cost, staff and bed capacity.[6,9] Moreover, short post-CD LoS is not associated with an increased readmission rate.[9] However, the quality of care can be improved with the traditional discharge policy after four days, reducing the need for home care.[6] The increasing number of days of stay is associated with an increase in delivery costs, especially in the private sector.[5] The concept of a short LoS post-CD of fewer than

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four days was adopted by the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists.[4,10]

There are few published data on LoS[4,5,9,11,12] in CD and none of these exist in sub-Saharan Africa. Moreover, different criteria were used in these reports, yielding different results. Prolonged LoS was associated with older maternal age, parous, uneducated, low socioeconomic status and rural residents.[4,5,12] Obstetric conditions, such as CD history, preeclampsia, preterm labour, low birth weight and multiple pregnancies, were associated with a prolonged LoS.[12] Postoperative complications, such as wound infection and endometritis, were associated with prolonged LoS.[13]

Sudan is one of the low-income countries where the health system is deficient in staff and beds. There has been a dramatic increase in the CD rate in Sudan (43.2% in 2011).[14] We aimed to assess LoS after CD in eastern Sudan and the associated factors. With the findings from this study, researchers and policymakers can help establish a protocol for hospital discharge to ensure proper postnatal care.

Materials and Methods

Study Settings

A cross-sectional study was conducted at the Gadarif hospital in eastern Sudan from May to December 2020. Gadarif hospital is a tertiary public hospital. The participants were recruited from the postnatal clinics of the hospital. All women who underwent CD during the study period attended the postnatal clinics, and consented to participate were included.

Data Collection

Sociodemographic, clinical and obstetrical data were gathered through a questionnaire, which was filled by a direct interview. These data included maternal characteristics [eg, age, education, residence, occupation and body mass index (BMI)], neonatal characteristics (eg, gender, birth weight, neonatal intensive care admission and neonatal death) and obstetrics data (eg, parity, gestational age at the time of delivery, CD and anaesthesia types). Other data [eg, haemorrhage, postoperative maternal haemoglobin (second day), postoperative fever, wound infection, endometritis, urinary tract infection and LoS] were also collected from each participant and from the medical records through a questionnaire administered by a trained medical officer.

Outcome Definitions

Low birth weight (LBW) was defined as a birth weight of 2500 grams or less, as per the World Health Organization.[15] Wound infection was counted in the presence of seropurulent discharge, redness (or both), induration or swelling of wound site.[16] Postoperative fever was defined as a temperature higher than 38°C (100.4°F).[17] Post-caesarean endometritis is a clinical diagnosis that includes fever, uterine tenderness and/or purulent lochia requiring antibiotics prescription.[17]

Maternal complications in this study included preoperative obstetric disorders (eg gestational diabetes, preeclampsia, antepartum haemorrhage and others), anaesthetic complications (eg, infections meningitis, direct needle trauma and vertebral canal hematoma), uterine artery injury, ureteric injury, caesarean hysterectomy, intraoperative haemorrhage, wound infections and postoperative fever. Neonatal complications were LBW deliveries, low APGAR score at one minute, low APGAR score at 5 min, admission to NICU and neonatal death.

Sample Size Calculation

As previously reported,[18] the sample size of 544 women was calculated based on the assumption that there was a significant minimum difference in the correlations ($r = 0.12$) between LoS and the other independent factors, such as age, parity, BMI and haemoglobin. This sample size (544) was necessary to achieve a 95% confidence level with a 5% margin of error and 80% power.

Statistical Analyses

The data were analysed with the Statistical Package for the Social Sciences (SPSS) Statistics for Windows, version 22.0 (IBM, Armonk, NY, USA). Continuous data were checked for normality using the Shapiro–Wilk test. When they were

found not to be normally distributed, they were expressed as a median (interquartile range [IQR]), while the categorised data were expressed as a frequency (proportion). Univariate analyses were performed to compare variables with LoS using the Mann–Whitney *U*–test (non-parametric) or Spearman correlations. The variables in the univariate analysis, with their $P < 0.200$, were shifted to build Poisson regression to model the LoS and provide relative risk (RR) and 95.0% confidence interval (CI). The LoS was considered the dependent variable, while sociodemographic, obstetric and neonatal factors were the independent variables. A two-sided p-value of less than 0.05 was considered statistically significant.

Results

General Characteristics

We enrolled 544 women with CD. The median (interquartile range, IQR) of their age and parity was 28.0 (24.0 –32.0) years and 3(2–3), respectively. Around one-third (32.4%) of them had ≥ secondary level of education. The majority (91.0%) of these 544 women were housewives. Over half of them (53.1%) resided in rural areas. Almost four out of five (79.6%) had elective CD, and all had spinal anaesthesia. The median (IQR) of the postoperative haemoglobin was 10.3 (9.6 –11.2) g/dl, Table 1.

Table 1 Maternal and Neonatal Characteristics Women Who Had Caesarean Delivery in Eastern Sudan, 2020

Variables		**Median**	**Interquartile Range**
Age group, years		28.0	24.0–32.0
Parity		3	2–3
Number of previous caesarean delivery		2	1–2
Gestational age, weeks		38.0	38.0–38.0
Body mass index, kg/m^2		25.7	24.0–27.7
Birth weight, gm		3000	2700–3000
		Frequency	**Proportion**
Type of caesarean delivery	Emergency	111	20.4
	Elective	433	79.6
Education	≥ secondary level	176	32.4
	< secondary level	368	67.6
Occupation	Employee	49	9.0
	Housewives	495	91.0
Residence	Rural	289	53.1
	Urban	255	46.9
Maternal complications:			
Obstetric disorders (gestational diabetes, preeclampsia, antepartum hemorrhage and others).	Yes	21	3.9
	No	523	96.1

(*Continued*)

Table 1 (Continued).

Variables		Median	Interquartile Range
Anaesthetic complications	Yes	3	0.6
	No	541	99.4
Uterine artery injury	Yes	3	0.6
	No	541	99.4
Ureteric injury	Yes	1	0.2
	No	543	99.8
Caesarean hysterectomy	Yes	2	0.4
	No	542	99.6
Intraoperative haemorrhage	Yes	9	1.7
	No	535	98.3
Wound infections	Yes	8	1.5
	No	536	98.5
Postoperative fever	Yes	21	3.9
	No	523	96.1
Gender of newborn	Male	291	53.5
	Female	253	46.5
Neonatal complications:			
Low birth weoight deliveries	Yes	46	8.5
	No	498	91.5
Low PGAR score at 1 min	Yes	14	2.6
	No	530	97.4
Admission to neonatal intensive care unit	Yes	29	5.3
	No	515	94.7
Neonatal death	Yes	7	1.3
	No	537	98.7

Sixty-eight (12.5%) of these women had maternal complications. There were obstetric disorders (21, 3.9%), anaesthetic complications (3, 0.6%), uterine artery injury (3, 0.6%), ureteric injury (1, 0.2%), caesarean hysterectomy (2, 0.4%), intraoperative haemorrhage (9, 1.7%), wound infections (8, 1.5%) and postoperative fever (21, 3.9%). Only 8.8% of these women had two or more complications. There was no case of endometritis. There was no maternal death (Table 1).

Of these 544 CD patients, 76 (14.0%) had neonatal complications. These were LBW deliveries (46, 8.5%), low PGAR score at 1 min (14, 2.6%), low PGAR score at 5 min (2, 0.4%), admission to NICU (29, 5.3%) and neonatal death (7, 1.3%). Less than one-third (28.9%) had two or more neonatal complications (Table 1).

The LoS range was 1–9 days (mean = 2.7 days), its median (IRQ) was 3.0 (2–3) days, and the 90th percentile was three days. Of these 544 women, 227 (41.7%) were discharged in less or equal to two days, 286 (52.6%) were discharged on the third day and 31 (5.7%) were discharged on four or more days. Out of 433 women who underwent elective CD, 204 (47.1%) were discharged in less or equal to two days, 213 (49.2%) were discharged on the third day and 16 (3.7%) were discharged on four or more days. Of 111 mothers who had emergency CD, 22 (19.8%) were discharged in less or equal to two days, 73 (65.8%) were discharged on the third day and 16 (14.4%) were discharged on four or more days (Figure 1).

There were significant positive correlations related to age, BMI and LoS. There was a significant negative correlation between postoperative haemoglobin and LoS. There was no significant correlation between parity, gestational age and LoS. The median (IQR) of the LoS was significantly higher in women who had emergency CD (n = 111) vs elective CD (n = 433) [3 (3.0–3.0) days vs. 3 (2.0–3.0) days, P < 0.001], women with maternal complications (n = 68) vs women who had no maternal complications (n = 476) [3 (2.0–3.0) days vs 3 (2.0–3.0) days, P < 0.001] and in women who had neonatal complications (n = 67) vs women who did not had neonatal complications (n = 67) [3 (30.0 –3.75) days vs 3 (2.0–3.0) days, P < 0.001]. LoS was not significantly different regarding residence, occupation and education (Table 2).

Women with emergency CD stayed 13.0% longer than women with elective CD (RR = 1.13, 95% CI = 1.01–1.29) according to Poisson regression. Women with maternal complications stayed 24.0% longer than women with no maternal complications (RR = 1.24, 95% CI = 1.07–1.43). Women with neonatal complications stayed 21.0% longer than women without neonatal complications (RR = 1.21, 95% CI = 1.05–1.40). Age, parity, residence, education, occupation and postoperative haemoglobin were not associated with LoS (Table 3).

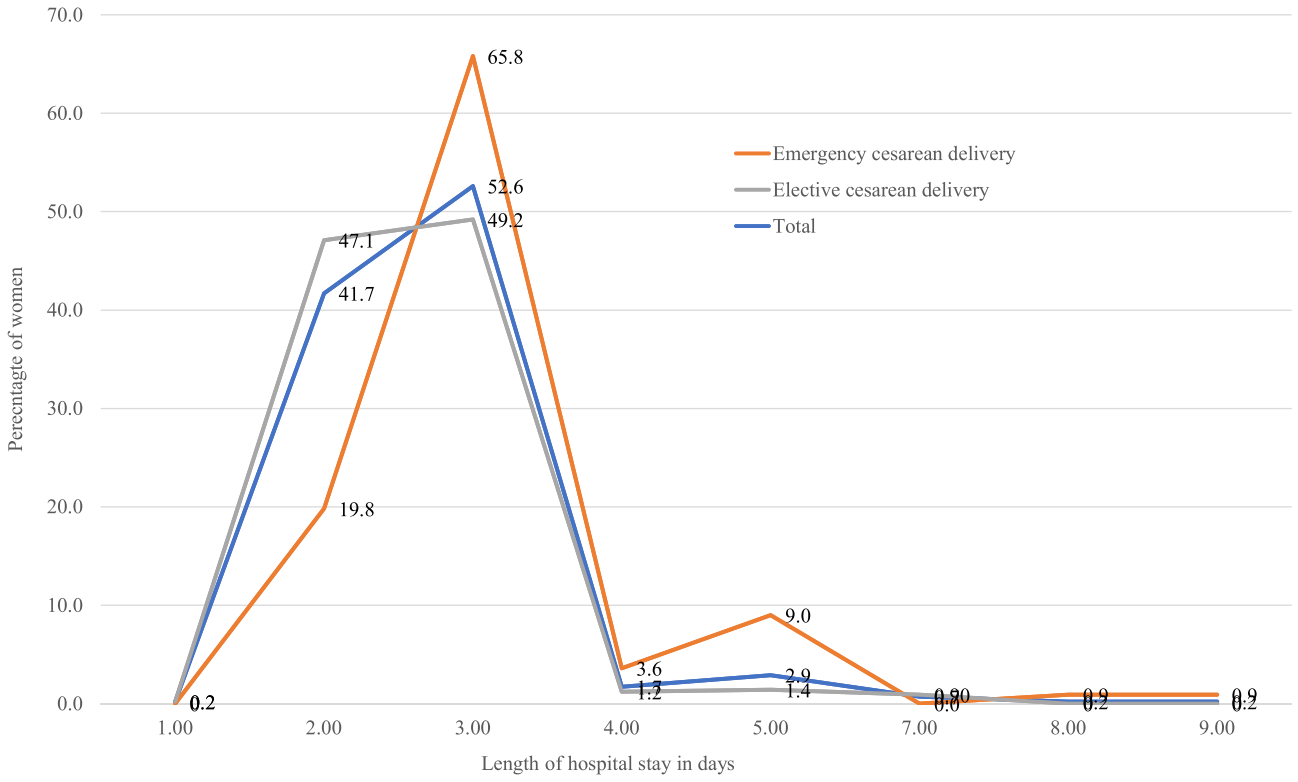

Figure 1 Comparing proportion of women between emergency and elective cesarean delivery and length of hospital stay.

Table 2 Univariate Analysis of the Factors Associated with Length of Stay Post-Cesarean Delivery in Eastern Sudan

Variables			
Spearman correlations			
	r		**P**
Age group, years	0.090		0.035
Parity	0.035		0.421
Gestational age, weeks	– 0.047		0.270
Body mass index(kg/m^2)	0.096		0.025
Post-operative hemoglobin, g/dl	–0.159		<0.001
Mann–Whitney U			
Median (interquartile range) P			
Education	≥ Secondary level	3 (2.0 –3.0)	0.615
	< Secondary level	3 (2.0–3.0)	
Occupation	Employee	3 (2.0–3.0)	0.854
	Housewives	3 (2.0–3.0)	
Residence	Rural	3 (2.0–3.0)	0.784
	Urban	3 (2.0–3.0)	
Maternal complications	Yes	3 (2.0–3.0)	<0.001
	No	3 (2.0–3.0)	
Neonatal complications	Yes	3 (30.0 –3.75)	<0.001
	No	3 (2.0–3.0)	
Type of cesarean delivery	Emergency	3 (3.0–3.0)	<0.001
	Elective	3 (2.0–3.0)	

Table 3 Poisson Regression Analysis of the Factors Associated with Length of Stay Post-Cesarean Delivery in Eastern Sudan, 2020

Variables		**Coefficient**	**95% Confidence Interval**	**P**
Age group, years		1.00	0.99 –1.01	0.661
Body mass index, kg/m^2		1.01	0.99–1.01	0.402
Post-operative hemoglobin, g/dl		0.98	0.95–1.02	0.568
Type of cesarean delivery	Emergency	1.130	1.01–1.29	0.041
	Elective	Reference		
Maternal complications	Yes	1.24	1.07–1.43	0.004
	No	Reference		
Neonatal complications	Yes	1.21	1.05–1.40	0.007
	No	Reference		

Discussion

The main findings of the current study were that the mean LoS was 2.7 days and LoS was longer in women with emergency CD and in women with maternal and neonatal complications. In our study, the mean LoS was 2.7 days. Such findings are in agreement with a previous report in which the mean LoS was 2.71 days in California.[19] Moreover, it has previously been documented that the LoS following CD has large variability (2.5–9.3 days) in 92 low- to middle-income countries.[4] On the other hand, the mean (2.7 days) LoS following CD in our study was shorter than the mean (6.21 days) LoS following CD documented in a population-based cohort of 6632 women who gave birth in Brisbane, Australia.[11] Acharya observed that the mean LoS was seven days in Nepal.[20] Kumar et al recently reported that women had a mean LoS of 8.6 days following CD in India.[5] Recently, Federspiel et al reported that in 456,312 patients with uncomplicated CD from 1535 hospitals, few (1.8%) patients stayed less than two days following CD or more than four days (1.2%). Most patients stayed two days (39.1%), three days (46.4%) or four days (11.5%).[9] As mentioned above, this is the first data collection on the LoS in Sub-Saharan Africa. Therefore, our results should be compared with the results of later studies with caution. There are many differences in the settings; for example, some of these data are from public and private hospitals.[5] Women admitted to public hospitals stay longer following CD than those admitted to private health facilities.[5]

Moreover, we investigated the LoS in elective and emergency CD, whereas the LoS in uncomplicated CD was documented in a previous study.[9] Several factors, such as cost, insurance status, readmission and hospital distance, must be considered when dealing with LoS. Our findings may be a valuable guide for assessing LoS in VD and several other surgical procedures. It is worth mentioning that Bayoumi et al, in Egypt have reported that maternal hospital readmissions were not different if women were discharged at one day or three days following CD.[21]

The direct effect of maternal complications on LoS was observed in our results and the results of several prior studies.[5,9,11,22] Perinatal complications, such as LBW, were associated with a longer LoS in our study. A similar finding was reported in a previous Italian study.[12] The mothers of neonates with complications stayed on additional days to breastfeed their babies, explaining why they had a longer LoS. Women with emergency CD stayed 13.0% longer than women with elective CD in this study, [3 (3.0–3.0) days vs. 3 (2.0–3.0) days, $P < 0.001$], similarly to a previous study.[9] The emergency CD is associated with more maternal complications and, hence, longer hospitalisation, as observed from a study published in Sudan.[23] Thus, elective CD should be encouraged to shift the practice towards elective operations.

Furthermore, more actions are needed to minimise maternal and perinatal complications and shorten LoS. One of the factors that might shift CD towards elective ones and reduce maternal and perinatal complications is antenatal care. We did not assess antenatal care in this study. However, an inadequate level of antenatal care was observed in eastern Sudan.[24] We did not observe a significant association among age, parity, BMI, residence, education and LoS. Age, parity, residence, education and obesity were shown to be associated with LoS in previous studies.[5,11]

Conclusion

In this study, the mean LoS was 2.7 days and women with emergency CD and maternal and neonatal complications had longer LoS.

Abbreviations

CD, caesarean delivery; VD, vaginal delivery; Los, length of stay; GMH, Gadarif Maternity Hospital; BMI, body mass index; LBW, low birth weight; NICU, neonatal intensive care unit; CI, confidence interval; IQR, interquartile range; AOR, adjusted odds ratios.

Ethics Approval and Informed Consent

Ethics approval was obtained from the Ethics Committee of the Faculty of Medicine of Gadarif University, Sudan (Reference number #2020.05). Written informed consent was collected from each participant. This study complies with Declaration of Helsinki.

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Disclosure

All authors declare no conflicts of interest in this work.

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