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Maternal Characteristics as Risk Factor of Abnormal Blood Loss among Women Enduring Repeat Cesarean Delivery

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Abstract: To evaluate maternal characteristics that may be predictive of abnormal blood-loss among women undergoing repeat cesarean delivery. The retrospective case controlled study consisted of case notes of women with cesarean deliveries (December-January 2009). After exclusion of women without a prior cesarean delivery, only 104 were used for analysis. The researchers assessed the relationship of abnormal blood-loss and key characteristics that included: Age, parity, type of cesarean delivery, booking status, cadre of attending staff, abdominal scar, type of anesthesia, gestational age and length of hospital stay. Continuous data were analyzed using the student t-test and categorical data were analyzed using the χ^2-test. The independent association between the exposures and outcome of interest was assessed with multivariable logistic regression. As compared to mothers with parity of less than four, mothers with a higher parity and abnormal blood loss were 8 times more likely to experience abnormal blood-loss (Adjusted OR = 8.1, 95% CI: 1.2-53.5). Diffrence in risk was also observed between length of hospital stay and blood-loss status. No difference in risk was observed between the any of the other maternal characteristics and abnormal blood-loss. Cesarean deliveries in developing settings carry a greater risk compared to those performed in developed locations, especially among women enduring a repeat cesarean delivery. The risk of abnormal blood-loss among women in the study with parity of greater than four was substantially high. There is need for additional research to understand the association between high parity and abnormal blood-loss in developing settings.

Key words: Cesarean delivery, abnormal blood loss, maternal outcome, Ilorin, booking status, gestational age

INTRODUCTION

In developed countries the risk associated with cesarean delivery has dramatically reduced due to implementation of measures that ensure the lowest morbidity and mortality risks for both mother and infant (Creasy *et al*., 2004). However, in developing countries the risk of adverse pregnancy outcomes (placenta previa, hemorrhage and maternal and fetal mortality) associated with cesarean deliveries are still high (Aboyeji and Fawole, 2003; Ozumba and Anya, 2002; Elkins *et al*.,1988). Previous studies have indicated the high percentage of adverse outcomes attributed to cesarean delivery in developing countries (Ozumba and Anya, 2002). Risks of adverse outcomes are even higher for women with prior cesarean deliveries as compared to women with prior vaginal deliveries (Ananth *et al*., 1997; Clark *et al*., 1985).

Despite the fact that cesarean delivery has become one of the most common obstetric procedures, low resource settings present high risk for maternal and fetal morbidity and mortality. For that reason, the researchers undertook this study to evaluate maternal characteristics that are predictive of abnormal blood loss among women undergoing repeat cesarean delivery using data from the University of Ilorin Teaching Hospital in Ilorin, Nigeria.

MATERIALS AND METHODS

For this analysis the researchers used data from the University of Ilorin Teaching Hospital in Ilorin, Nigeria. Data was collected through case notes of women with recorded cesarean deliveries from December to January of 2009. Data was subsequently entered into a Microsoft Excel database prepared specifically for the study. The

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information in the database included: Maternal age, parity, gestational age, fetal outcome and various other factors describing the delivery process.

The main exposures of interest were maternal characteristics such as: Age, parity, type of cesarean delivery, booking status, cadre of anesthetist and surgeon, abdominal scar, type of anesthesia, length of hospital stay and gestational age. Age groups were classified as <30 years of age and ≥30 years of age with the former being the referent group. Parity groups were classified as <4 and ≥4 with the former being the referent group. Type of cesarean delivery was classified as emergency or elective with the former being the referent group. For booking status being booked in a hospital or herbal/faith home was the referent group. For cadre of staff attendant, consultants and senior registrars were considered the referent group. Lastly, the referent category for abdominal scar and type of anesthesia were transverse and general, respectively. The main outcome of interest was abnormal blood loss and this was defined as having lost ≥1000 mL of blood during labor.

A total of 450 women were in the database but after excluding women without a prior cesarean delivery, only 104 were used in the analysis. Continuous data were analyzed using the student t-test and categorical data were analyzed using the χ^2-test. The independent association between maternal characteristics and risk of abnormal blood loss was assessed with multivariable logistic regression. The researchers also assessed the association between the exposures and outcome by additionally including gestational age and length of hospital stay in the logistic regression model. Lastly, the researchers constructed two logistic models to visually illustrate the estimated adjusted probability for abnormal blood loss associated with parity and maternal age while adjusting for all other maternal characteristics. The researchers used the following formula:

$$P=\frac{e^{(\alpha+\beta_2X_2+\beta_2X_2+.....+\beta_9X_9)}}{1+e^{(\alpha+\beta_2X_2+\beta_2X_2+.....+\beta_9X_9)}}$$

Where:

- P = Adjusted probability
- e = Exponential to the natural logarithm
- α = Baseline risk
- β_2 = Coefficient variable coding for parity or maternal age
- β_3 = Coefficient variable coding for cesarean delivery status
- β_4 = Coefficient variable coding for maternal age
- β_4 = variable coding for booking status
- β_5 = Coefficient variable coding for cadre of anesthetist
- β_6 = Coefficient variable coding for cadre of surgeon
- β_7 = Coefficient variable coding for abdominal scar
- β_8 = Coefficient variable coding for type of anesthesia
- β_9 = Coefficient variable coding for length of hospital stay

All tests of hypothesis were two-tailed with a type 1 error rate fixed at 5%. SAS version 9.2 (SAS Institute, Cary, NC) was used to perform all analyses. This study was approved by the Institutional review board at the University of Ilorin Teaching Hospital.

RESULTS AND DISCUSSION

Of 450 cesarean deliveries, 104 were repeat cesarean deliveries and included in the analysis. There were 13 instances of abnormal blood loss. Maternal characteristics for the study population are shown in Table 1. Women who received a prior cesarean delivery tended to be older had a parity of less than four and experienced a high frequency of emergency cesarean deliveries. This group of women was also more likely to be booked have a registrar as attending staff have a longitudinal scar and have spinal anesthesia.

Regarding blood loss, mothers in both groups (normal and abnormal) tended to be older have parity of less than four have an emergency cesarean delivery, identified as booked have a registrar as attending staff have a longitudinal abdominal scar and have spinal anesthesia.

Table 1: Maternal characteristics of mothers with prior cesarean delivery and blood loss status, University of Ilorin Teaching hospital, Nigeria (N = 104)

Characteristics	Total study population N = 104	Normal range blood loss N = 91	Abnormal blood loss N = 13	p-value
Age	%	%	%	0.47
<30	29.8	28.6	38.5	-
≥30	70.2	71.4	61.5	-
Parity	-	-	-	0.08
<4	90.4	92.3	76.9	-
≥4	9.6	7.7	23.1	-
Type of cesarean delivery	-	-	-	0.43
Elective	32.7	34.1	23.1	-
Emergency	67.3	65.9	76.9	-
Booking status	-	-	-	0.23
Booked	68.3	70.3	53.9	-
Unbooked	31.7	29.7	46.1	-
Cadre of anesthetist	-	-	-	0.97
Registrar	61.0	60.9	61.5	-
Senior registrar/consultant	39.0	39.1	38.5	-
Cadre of surgeon	-	-	-	0.12
Registrar	65.4	62.6	84.6	-
Senior registrar/consultant	34.6	37.4	15.4	-
Abdominal scar	-	-	-	0.76
Transverse	42.3	42.9	38.5	-
Longitudinal	57.7	57.1	61.5	-
Type of anesthesia	-	-	-	0.05
General	13.5	11.0	30.8	-
Spinal	86.5	89.0	69.2	-

Table 2: Association between selected maternal characteristics and abnormal blood loss, University of Ilorin Teaching hospital, Nigeria (N = 104)

Characteristics	Number of abnormal blood losses n = 13 (%)	Abnormal blood loss odds ratio[a] (95% CI)	Abnormal blood loss adjusted odds ratio[a] (95% CI)
Age			
<30	38.5	Referent	Referent
≥30	61.5	0.61 [0.2-2.5]	0.40 [0.1-2.3]
Parity			
<4	76.9	Referent	Referent
≥4	23.1	4.0 [0.7-22]	8.1 [1.2-53.5]
Type of cesarean delivery			
Elective	23.1	Referent	Referent
Emergency	76.9	1.3 [0.2-7.6]	0.72 [0.1-5.6]
Booking status			
Booked	53.9	Referent	Referent
Unbooked	46.1	1.1 [0.2-5.5]	0.63 [0.1-5.1]
Cadre of anesthetist			
Senior registrar/consultant	61.5	Referent	Referent
Registrar	38.5	2.3 [0.5-10.6]	2.6 [0.4-15.7]
Cadre of surgeon			
Senior registrar/consultant	84.6	Referent	Referent
Registrar	15.4	0.26 [0.05-1.5]	0.46 [0.1-3.0]
Abdominal scar			
Transverse	38.5	Referent	Referent
Longitudinal	61.5	1.0 [0.24-4.1]	1.0 [0.2-6.0]
Type of anesthesia			
General	30.8	Referent	Referent
Spinal	69.2	0.3 [0.1-2.24]	0.62 [0.1-5.4]

[a]All characteristics included in regression model; [b]Additionally adjusting for gestational age and length of hospital stay

No statistical difference was observed between mothers in the normal range of blood loss and mothers with abnormal blood loss regarding any of these maternal characteristics.

No difference in mean gestational age between mothers with abnormal blood loss and those within the normal blood loss range was observed (Mean gestational age±standard deviation: 38.42 weeks±2.64 compared with mothers with a normal blood loss range, 38.42 weeks± 2.39; p = 0.991). However, there was a difference in the mean length hospital stay between the two groups (Mean length of hospital stay±standard deviation: 12.3 days± 5.04 compared with mothers with a normal blood loss range, 8.97 days±2.85; p = 0.036).

Table 2 shows the association between maternal characteristics and abnormal blood loss. No difference in risk was observed for any of the predictive characteristics regarding abnormal blood loss, except parity (after adjusting for gestational age and length of hospital stay). As compared to mothers with parity of less than four, mothers with a higher parity and abnormal blood loss were eight times more likely to experience abnormal blood loss (adjusted OR = 8.1, 95% CI: 1.2-53.5). However, the wide confidence interval does reflect the lack of precision regarding this estimate.

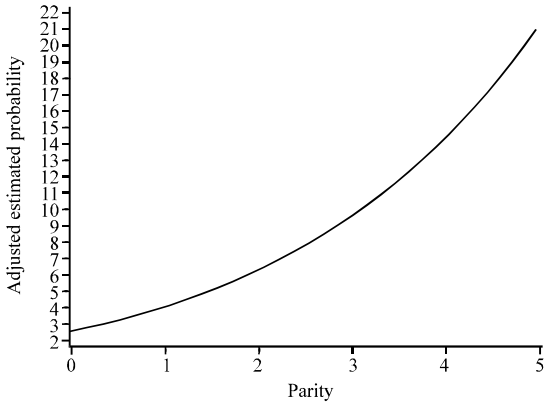

Fig. 1: Estimated adjusted* probability for abnormal blood loss associated with parity

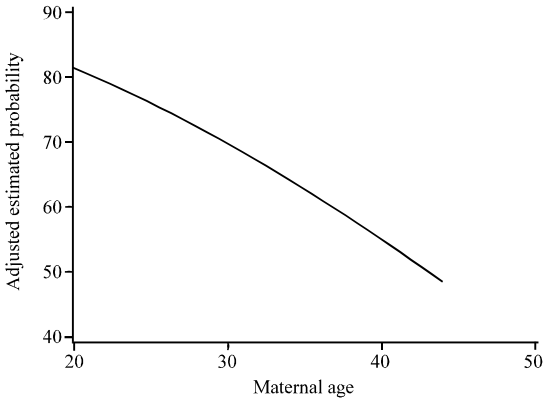

Fig. 2: Estimated adjusted* probability for abnormal blood loss associated with maternal age (*Adjusted cesarean delivery status, maternal age, type of cesarean delivery, booking status, cadre of anesthesist and surgeon, abdominal scar, type of anesthesia, gestational age and length of hospital stay)

Figure 1 shows the adjusted probability for abnormal blood loss associated with parity. The baseline risk abnormal blood loss (for nulliparous women undergoing a repeat cesarean delivery at the study site) was approximately 2.5%. The researchers noted a dose response relationship between parity and abnormal blood loss. The highest risk was approximately 22% for parity of five. Figure 2 shows the adjusted probability for abnormal blood loss associated with maternal age. The baseline risk for mothers 20 years of age was 81%. Beyond this point, the risk of abnormal blood loss decreased substantially with maternal age. The lowest risk was below 50% and was attributed to mothers over 44 years of age.

Due to the significant association between abnormal blood loss and parity, the researchers further assessed

the relationship between length of hospital association and parity. The researchers found that the mean length of hospital stay between parity groups was similar (Mean length of hospital stay±standard deviation: 8.67 days± 2.65 compared with mothers with parity of less than 4,9.52 days±3.5; p = 0.48).

In this study, the researchers found that high parity was associated with an increased risk of abnormal blood loss. Previous studies have reported the increased risk of maternal and fetal complications due to high parity (Aliyu *et al*., 2005; Shechter *et al*., 2010). The study further supports the evidence of strong association between multi-parity and post-partum hemorrhage which happens to be the principal cause of maternal mortality in developing settings similar to the own (Shechter *et al*., 2010).

Many theories of the biological plausibility of high parity and adverse pregnancy outcomes have been proposed. Earlier investigations have acknowledged the concept of the maternal depletion syndrome that suggests that too frequent pregnancies might cause nutritional stress on the mother (Aliyu *et al*., 2005; Hobcraft *et al*., 1983; Winkoff, 1983; DaVanzo *et al*., 1984; De Sweemer, 1984). This biological strain on the mother will subsequently lead to poorer successive pregnancy outcomes; this is of particular importance in developing nations where under-nutrition is common. The confounding effect of maternal age has also been proposed as the possible reasoning behind the relationship of high parity and adverse outcomes (Jahromi and Husseini, 2008). However, the study did not indicate an association between maternal age and abnormal blood loss. In fact, the effect estimate revealed a possible protective effect (although, the 95% confidence interval did not prove significance).

Overall, the researchers reported a higher frequency of emergency cesarean deliveries compared with elective deliveries and a low frequency of highly skilled staff attendants. Recent literature has shown the increased risk of cesarean deliveries in developing settings, primarily due to the fact that women with poor surgical risk are seen for the first time when an emergency cesarean delivery is needed or when at home delivery attempts are unsuccessful (Ozumba and Anya, 2002). Although, the study did not provide evidence for support of the relationship between these characteristics and abnormal blood loss, there is need for additional research on the outcomes associated skills of attendant, type of cesarean delivery and pregnancy outcome.

The researchers also found that a substantial difference in mean length of hospital stay existed between mothers with abnormal and normal range blood loss.

Women with abnormal blood loss experienced a higher mean number of days in the hospital as compared to their counterparts. Extended hospital stays provide an indicator of maternal and fetal health and this highlights the importance of understanding the association of abnormal blood loss among women enduring a repeat cesarean delivery.

This study is limited by its small sample size which resulted in wide confidence intervals that decreased the precision of the effect estimates. However, the fact that significant results were obtained (despite the sample size limitation) is indicative that the reported associations truly exist. Additionally, the criteria of including only prior cesarean deliveries is a substantial merit considering that this group has an overall higher risk of adverse outcomes for both mother and fetus (Mankuta *et al*., 2003; Richter *et al*., 2007).

CONCLUSION

The findings presented in this study reveal the need for future research in developing settings to focus on the relationship between high parity and abnormal blood loss, particularly among women with prior cesarean deliveries.

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