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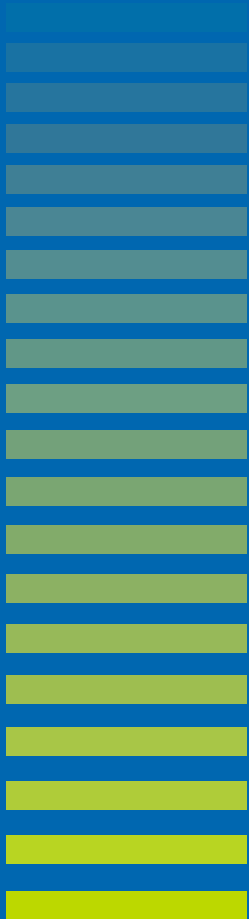
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Do patients require routine hematocrit testing following uncomplicated cesarean delivery?

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ABSTRACT

Background: Cesarean delivery is associated with increased risk of hemorrhage, and this necessitated the practice of routine hematocrit testing to detect anemia and the need for blood transfusion. **Objectives:** To ascertain the necessity of this routine investigation and to identify factors predictive of anemia following uncomplicated cesarean delivery at this clinical setting. **Materials and Methods:** A prospective observational study of 236 women who had uneventful cesarean delivery at term over a 12-month period. Relevant sociodemographic and obstetric data were extracted, and clinical assessment of the women including postoperative hematocrit was done on second postoperative day. Data were analyzed using SPSS version 16 for Windows. Multivariate logistic regression analysis was done to identify independent risk factors predictive of anemia postcesarean section. **Results:** Average age and parity of the women were 29.8 ± 4.9 years and 2.2 ± 1.5 respectively. Mean pre and postcesarean hematocrit was $35.2\% \pm 3.4\%$ and $30.7\% \pm 4.0\%$ respectively with an average drop of $4.6\% \pm 3.3\%$. Only 5.9% had hematocrit decline of $>10\%$ and none was transfused. Preoperative hematocrit $\leq 35\%$ ($P < 0.0001$, OR: 4.43, 95% confidence intervals (CI): 2.00-9.80), fatigue ($P = 0.04$, OR: 3.92, 95% CI: 1.07-14.39), and conjunctival pallor ($P = 0.02$, OR: 5.01, 95% CI: 1.32-19.02) were independent factors predictive of anemia postcesarean delivery. **Conclusion:** This study suggests that routine postcesarean hematocrit testing is unnecessary following uncomplicated procedure but may be indicated in women with preoperative hematocrit $\leq 35\%$, postoperative fatigue, and conjunctival pallor.

Key words: Hematocrit, low-risk, routine, uncomplicated cesarean section

INTRODUCTION

Routine laboratory investigations, which are done in the absence of any specific clinical indication^[1] are widely carried out among clinicians. Cesarean section is associated with increased risk of hemorrhage and related morbidity including postpartum anemia.^[2,3] Traditionally, routine postcesarean section hematocrit testing is carried out mainly to diagnose and treat anemia early and to identify patients that may need blood transfusion.^[4] Despite these, the relevance of this routine investigation after uncomplicated

cesarean section has been questioned by researchers in European settings.^[4,5]

There are several reports of insignificant decline in hemoglobin level of 0.46-1.37 g/dl after cesarean deliveries.^[4,6] Moreover, the risk of blood transfusion after uneventful cesarean section has been found to be very low.^[6,7] This may be because the increased blood volume during pregnancy^[8] compensate for expected blood loss during delivery. With the improvement in surgical techniques and safer anesthesia, justification for this routine investigation is questionable.

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An approach of selective testing after clinical assessment of patients reduces cost without sacrificing the safety or quality of surgical care.

This study was undertaken to ascertain the necessity of routine hematocrit testing after uncomplicated cesarean section and to determine the place of clinical parameters in detecting anemia after cesarean delivery. Findings from this study may influence postoperative management following cesarean delivery at our clinical setting.

MATERIALS AND METHODS

A prospective observational study of consecutive pregnant women who had uneventful cesarean delivery at ≥ 37 weeks' gestation at Maternity unit of Bingham University Teaching Hospital, Jos, Nigeria from January to December 2013. Uneventful cesarean delivery was defined as cesarean section at ≥ 37 weeks of gestation, estimated blood loss of ≤ 1000 mL, and no postprocedure complication. Excluded from the study were women who were anemic preoperatively (Packed cell volume $< 30\%$), had a history of antepartum hemorrhage, preoperative signs of hemodynamic instability, and transfused with blood for any indication. Also, women with hypertensive disorders, HIV infection, diabetes mellitus and multiple pregnancies were ineligible.

Consent was obtained, and they were interviewed on second postoperative day to ascertain their demographic and obstetric features and subjective symptoms of anemia. They were then examined for conjunctival pallor, pulse rate, and blood pressure. Also documented were preoperative hematocrit, type of cesarean section, anesthetic method, indications for cesarean section, anesthesiologist's estimated intraoperative blood loss and the postcesarean section hematocrit level on second postoperative day. All the women had between 1500 and 2000 mL intravenous fluids during surgery and 3000 mL postoperatively over 24 h period as well as prophylactic antibiotics and analgesics.

The data were analyzed using SPSS statistical package, version 16 for windows (SPSS Inc., Chicago, IL, USA). Means and standard deviations were calculated for continuous variables. Subjects' features were analyzed descriptively. Associations between clinical parameters and postoperative anemia were evaluated using the Chi-square test. Multivariate logistic regression analysis was applied to factors identified on univariate analysis to ascertain independent risk factors predictive of anemia postcesarean section. A $P < 0.05$ was considered statistically significant.

Ethical approval was granted for the study by the Health Research and Ethics Committee of Bingham University Teaching Hospital, Jos.

RESULTS

A total of 236 women fulfilled the inclusion criteria and participated in the study. Mean age was 29.8 ± 4.9 years, with a range of 18-43 years. Most of them were of parity 1-4 (215/236 [91.1%]) with an average and range of 2.2 ± 1.5 and 1-9 respectively. The average gestational age at delivery was 38.7 ± 1.5 weeks. Table 1 depicts the sociodemographic as well as some clinical findings of the women.

One hundred and seventy-four (73.7%) women had emergency cesarean section while 62 (26.3%) had an elective procedure. The most common indications for cesarean section were failure to progress in labor, two or more previous cesarean section, and successful obstetric fistula repair. Spinal anesthesia was administered on 228 (96.6%) women while 8 (3.4%) had general anesthesia. The average estimated intraoperative blood loss was 597.4 ± 212.6 mL with a range of 200-1000 mL. Table 2 summarizes the indications for cesarean section and pattern of blood loss.

The mean preoperative hematocrit was $35.2\% \pm 3.4\%$ with a range of 30-44%. Average postoperative hematocrit was $30.7\% \pm 4.0\%$, ranging from 24% to 41%. Two hundred

Table 1: Sociodemographic and other features of the women

Features	Frequency	Percentage
Age (years)		
≤20	7	3.0
21-25	39	16.5
26-30	93	39.4
31-35	64	27.1
≥36	33	14.0
Total	236	100.0
Parity		
1-4	215	91.1
≥5	21	8.9
Total	236	100.0
Preoperative hematocrit (%)		
30-35	130	55.1
36-40	90	38.1
>40	16	6.8
Total	236	100.0
Postoperative hematocrit (%)		
≤30	123	52.1
31-35	91	38.6
36-40	20	8.5
>40	2	0.8
Total	236	100.0
Mean BP (mmHg)		
SBP	115.8±14.8	
DBP	75.8±1.03	

BP: Blood pressure; SBP: Systolic blood pressure; DBP: Diastolic blood pressure

and twenty-eight (96.6%) women had varying degrees of decline in hematocrit postcesarean delivery while eight had no change (3.4%). The average drop in hematocrit among the women was $4.6\% \pm 3.3\%$. Only 14 (5.9%) had hematocrit decline of $>10\%$. 81 (34.2%) of the women had postoperative hematocrit of $<30\%$ (anemia) with 61 (75.3%) of them having mild anemia (27-29%), 20 (24.7%) had moderate anemia with ranged hematocrit values of 24-26% while none had severe anemia. None of the women had blood transfusion.

Inquiry about subjective symptoms of anemia revealed that 40 of them had dizziness (16.9%), 10 (4.2%) had palpitations while 45 (19.1%) had fatigue. 50 (21.2%) women had conjunctival pallor while 30 (12.7%) had tachycardia. The mean pulse rate was 87.4 ± 10.1 beats per minute.

On univariate analysis, preoperative hematocrit of $\leq 35\%$, estimated blood loss >800 mL, use of general anesthesia, dizziness, fatigue, palpitations, conjunctival pallor, and tachycardia were associated with anemia postcesarean delivery. Table 3 depicts the factors on univariate analysis.

Table 2: Indications for cesarean section and pattern of intra-operative blood loss

Indications	Frequency	Percentage
Failure to progress in labor	56	23.7
Two or more previous cesarean section	42	17.8
Previous successful obstetric fistula repair	32	13.6
Suspected fetal distress	21	8.9
Severe preeclampsia/eclampsia	19	8.0
Breech presentation	17	7.2
Obstructed labor	16	6.8
Failed induction of labor	7	3.0
Others**	26	11.0
Total	236	100.0
Pattern of intra-operative blood loss (mL)		
≤ 400	61	25.8
401-800	155	65.7
801-1000	20	8.5
Total	236	100.0

**Others: Previous myomectomy, previous cesarean section with infertility; previous cesarean section and prolonged pregnancy, cord prolapse

Table 3: Univariate analysis of factors predictive of anemia postcesarean section

Factors	P	OR	95% CI
Maternal age >35	0.60	1.24	0.56-2.74
Grand-multiparity	0.39	0.67	0.27-1.67
Blood loss >800 mL	0.003	0.25	0.09-0.65
Preoperative hematocrit $\leq 35\%$	<0.0001	4.60	2.49-8.48
Type of cesarean section	0.69	0.88	0.48-1.64
General anesthesia	0.01	0.16	0.03-0.83
Dizziness	<0.0001	22.83	8.45-61.65
Palpitations	0.002	8.38	1.74-40.47
Fatigue	<0.0001	18.68	7.79-44.81
Conjunctival pallor	<0.0001	23.93	9.98-57.38
Tachycardia (>100 beats/min)	<0.0001	0.03	0.01-0.11

OR: Odds ratio; CI: Confidence interval

Multiple logistic regression analysis showed preoperative hematocrit $\leq 35\%$ ($P < 0.0001$, OR: 4.43, 95% confidence intervals (CI): 2.00-9.80), fatigue ($P = 0.04$, OR: 3.92, 95% CI: 1.07-14.39), and conjunctival pallor ($P = 0.02$, OR: 5.01, 95% CI: 1.32-19.02) as independent factors predictive of anemia following uncomplicated cesarean delivery.

DISCUSSION

This study revealed that though 96.6% of the women had a drop in hematocrit postoperatively, only 5.9% had a drop of $>10\%$ and none had blood transfusion. The mean drop of hematocrit of 4.6% corroborate with previously reported figures of between 4.0% and 4.2%^[4,9] but lower than 5.49% from Kathmandu, Nepal.^[10] Also, 3.4% of the women experienced no drop in hematocrit, and this agrees with the figure of 3.5% by Api *et al.*^[11] but contrary to 17.0% detected by Combs *et al.*^[9] Blood loss during surgery and iron stores during pregnancy influence postcesarean section hematocrit level^[10] and the fact that iron supplements are routinely given to pregnant women at this clinical setting may have influenced the relatively low drop in hematocrit.

American College of Obstetricians and Gynecologists defined postpartum hemorrhage as a change of 10% in hematocrit between admission and postpartum period or the need for transfusion.^[12] This study virtually suggests that low-risk women that undergo uncomplicated cesarean section do not experience a significant drop in hematocrit that warrants intervention. Few women with decline of $>10\%$ in hematocrit mainly had mild anemia and were managed with oral hematinics. Hence, this showed that routine postcesarean hematocrit is not indicated in all women. Moreover, physiological increased blood volume during normal pregnancy usually cushions effect resulting from inevitable blood loss that occurs during vaginal or cesarean delivery.^[13]

In addition, none of the women had postoperative blood transfusion in this study. This agrees with several studies that reported the risk of blood transfusion after cesarean section to be low and generally around 3%.^[8,9] Women can withstand posthemorrhagic hematocrit level of 20% and transfusion may be indicated when hemoglobin is 7-10 g/dl and there is associated active bleeding or comorbidities.^[14] It has also been suggested that there is no single hemoglobin level that justifies blood transfusion^[15] and there is no scientific basis for transfusion to certain hemoglobin levels to promote wound healing or reduce postoperative infection rates.^[16] Hence, the fact that most of our subjects had insignificant drop in hematocrit and none was transfused with blood depicts that the women tolerated the decline

in their hematocrit. This suggests that routine hematocrit testing in this group of women after uncomplicated cesarean delivery is not beneficial. This is consistent with previous reports that indicated that the risk of transfusion following cesarean section is low and hemoglobin testing should be restricted to those with high risk of blood transfusion.^[11,17]

In this study, postoperative fatigue, conjunctival pallor and preoperative hematocrit of $\leq 35\%$ were independent risk factors predictive for anemia postcesarean delivery. This suggests that hematocrit testing in women with these factors is appropriate so as to detect the degree of anemia and institute appropriate clinical management. However, there are inconsistent reports in published literature on the accuracy of clinical signs with a wide range of sensitivity and specificity.^[18]

Nevertheless, our finding of conjunctival pallor predictive of anemia postcesarean delivery is consistent with a report by Meda *et al.* which revealed that conjunctival pallor is predictive of anemia at a cut-off point of ≤ 7 g/dl.^[19] It is however in contrast to finding by Sheth *et al.*,^[20] which showed that this sign only adds information to the clinical decision-making process but do not lead to confident diagnosis of anemia. Though these studies were conducted among obstetric and nonobstetric population, they seem to agree with the present study that the presence of conjunctival pallor is enough reason to order for hematocrit testing. Fatigue is a nonspecific symptom of anemia that suggests decrease blood oxygen carrying capacity in such individuals.^[21] This symptom was significantly associated with postoperative anemia in this study.

There was no significant association between anemia postcesarean section and type of cesarean section. This finding is inconsistent with a report by Oluwarotimi *et al.* who found a significant risk of blood loss in subjects undergoing emergency cesarean section with attendant increased postoperative anemia and blood transfusion.^[23] It has been shown that women undergoing uncomplicated cesarean section under general anesthesia are at higher risk of blood loss, drop in hematocrit and need for blood transfusion compared to those with regional anesthesia.^[23] This is contrary to our finding that found no association between types of anesthesia and postoperative anemia.

The strengths of this study included its prospective design and follow up, and all the women had similar postoperative management. Limitations of the study however included relatively small sample size and clinical assessment of the patients by different Doctors and so the effects of inter-observer errors, though this reflects the actual practice

at this clinical setting. Also, estimated intraoperative blood loss was done by anesthetists using the volumes in the suction bottle and visual estimation of soaked pack(s).

CONCLUSION

This study suggests that routine postcesarean hematocrit testing in low risk women following uncomplicated cesarean delivery is not necessary but may be indicated in those with preoperative hematocrit $\leq 35\%$, postoperative fatigue, and conjunctival pallor.

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