

**Original Research Article**

Effect of blood loss on packed cell volume following elective caesarean section at a tertiary hospital in Southern Nigeria

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Abstract

Caesarean section (C/S) is associated with the risk of excessive blood loss and possible need for transfusion. Therefore there is need to do packed cell volume of parturients before and after the procedure to detect anaemia.

Objectives: To determine the prevalence of anaemia and factors influencing intra-operative blood loss in women undergoing elective caesarean section at the University of Port Harcourt Teaching Hospital (UPTH).

Methods: This was a prospective observational study. One hundred and four booked parturients who had elective c/s at the UPTH over a period of six months were studied. Anaemia was evaluated by packed cell volume done a day prior to the surgery and two days after. Data analysis was carried out with (SPSS) IBM version 23.0. Chi-square and students t tests were used to compare the groups as appropriate. P value of <0.05 was assumed to be statistically significant.

Results: The mean estimated blood loss (EBL) for the study was 597 ± 155.9 mls. Majority (52%) of the women were between 30-34 years and 95.3% of C/S were done at 37 weeks and above. Twelve women (11.6%) were anaemic before C/S while 57 (54.8%) were anaemic following C/S. The mean EBL for non closure and closure of peritoneum were 573.53 ± 145.19 mls and 641.61 ± 167.55 mls respectively. The mean EBL for blunt and sharp expansion of uterine incisions were 591.18 ± 150.80 mls and 900 ± 141.42 mls respectively. Only their differences were statistically significant.

Conclusion: The prevalence of anaemia following elective caesarean section was 54.8%. Blood loss was significantly affected by sharp dissection of uterine incision and closure of peritoneum.

Keywords: Anaemia, Blood loss, Caesarean section, Packed cell volume, Southern Nigeria.

Introduction

Caesarean section is the birth of a fetus through a surgical incision in the anterior abdominal wall and the uterine wall after the age of viability which is 28 weeks in Nigeria^[1-4]. It can be carried

out as an elective or an emergency procedure. Caesarean section has contributed immensely to improve obstetric care throughout the world but it is associated with significantly higher maternal morbidity and mortality than vaginal delivery^[5-8].

Some of the reported short term morbidities include haemorrhage which can cause anaemia and need for blood transfusion^[6-10].

Intra-operative haemorrhage during caesarean section when severe can result in anaemia with significant morbidity and mortality^[11-15]. The World Health Organization (WHO) defines anaemia in pregnancy as a haemoglobin concentration of less than 11g/dl or a haematocrit equivalent of less than 33% in the peripheral blood. However, in tropical countries like Nigeria, a lower value of less than 10g/dl or haematocrit less than 30% is accepted^[1,2,15]. This followed a study done in Zaria, Nigeria where it was confirmed that the proportion of low birth weight babies and perinatal mortality rates began to increase with maternal haematocrit levels below 30%^[15]. For this study, haematocrit less than 30% was taken as anaemia.

Anaemia in pregnancy is supposed to be corrected during antenatal care in preparation for delivery. This is done using haematinics and antimalarials because in developing countries like Nigeria, the commonest causes of anaemia are nutritional deficiencies of iron and folic acid and malaria. Blood transfusion may also be needed to correct anaemia prior to caesarean section. Blood loss during caesarean section is poorly tolerated especially for a parturient that was anaemic prior to the surgery leading to a worsening clinical state following surgery^[15].

It is difficult to estimate blood loss during caesarean section because of dispersion of blood lost and blood mixing with amniotic fluid^[16-21]. Different figures varying from less than 500mls to more than 1000mls have been recorded as the estimated blood loss at caesarean section^[17-19]. Blood loss in excess of 500mls is considered significant. Various techniques have been described to measure blood loss during caesarean section. The most practical method is the direct volumetric method, measuring the blood volume in basins, swabs and graduated bottle of a suctioning machine^[20,21]. A gravimetric method used in assessment of blood loss has also been

described. It involves converting the increase in weight of blood-stained swabs into millimeters of blood on a millimeters per gramme basis^[20,21].

A variety of surgical techniques have been compared over the years to know the ones that reduce blood loss at caesarean section. They include controlled cord traction versus manual delivery of placenta, in situ repair of uterine incision versus uterine exteriorization, comparison of Joel-Cohen technique with Pfannenstiel technique and blunt versus sharp expansion of uterine incisions in low transverse caesarean section^[6].

The transverse skin incision of choice is Joel-Cohen incision which is a straight skin incision, 3 cm above the symphysis pubis or 2-3 cm higher than the Pfannenstiel. The subsequent tissue layers following a Joel-Cohen incision are opened bluntly and if necessary, extended with the scissors and not a knife as in Pfannenstiel incision. A recent Cochrane review cited that the advantages of the Joel-Cohen incision compared to the Pfannenstiel incision include less fever, pain and analgesic requirements, less blood loss, shorter duration of surgery and hospital stay^[21].

The commonest type of uterine incision used today is the transverse which runs from side to side transversely in the lower uterine segment^[6,21]. The uterine incision can be made by a variety of techniques. A scalpel should be used to incise the exposed lower uterine segment for 1-2 cm in the midline carefully avoiding injury to the foetus. Once the uterus is opened the incision can be extended laterally either by cutting with scissors (sharp method) or by spreading the incision, using lateral and upward pressure applied with the index fingers (blunt method)^[6,21]. The force required to expand the incision cannot be controlled and may therefore result in unintended extension of incision into the broad ligament, damaging the major vessels. Such inadvertent tears may involve the cervix or vagina^[21]. The sharp method using scissors expands the incision and the extension is controlled and precise. The main disadvantage of this method may be

increased blood loss due to severed blood vessels in the myometrium and foetal laceration injuries which occur in about 2%^[22-24].

The uterus may be repaired either by exteriorizing it through the abdominal wall or by closing the incision while the uterus remains in the abdominal cavity. Some of the advantages of exteriorizing the uterus include easy recognition of atonic uterus and ease of manual massage of the uterus thereby reducing blood loss, easier visualization of bleeding points, easier access to placing of sutures and better adnexal exposure^[25,26]. Exteriorizing the uterus is associated with more abdominal pain and vomiting^[26]. A recent Cochrane review found that there was no evidence to make a definitive conclusion about position of the uterus during closure, exteriorizing or not exteriorizing, offers greater advantage^[26]. This prospective observational study was aimed at determining the prevalence of anaemia among booked parturients undergoing elective caesarean section at the UPTH and identifying the factors influencing intraoperative blood loss in these women.

Methods

This study took place in the antenatal ward, labour ward theatre and postnatal ward of the University of Port Harcourt Teaching Hospital (UPTH) in Rivers state, Nigeria. UPTH is a tertiary health institution located in Port Harcourt, the capital of Rivers state. It serves as a referral centre for Rivers State with a population of over five million people, as well as the surrounding states. The labour ward has 2 admission rooms, 2 first stage rooms, 5 delivery suites and two theatres where all the caesarean sections in the department are performed. The delivery capacity of the unit is between 2,500 and 3,000 per annum with caesarean section rate of 32-36%.

It was a prospective observational study conducted among one hundred and four (104) booked parturients admitted in antenatal ward for elective caesarean section over a period of six months. The eligible women were counseled and

informed consent was obtained. Parturients with antepartum haemorrhage, sickle cell disease, multiple pregnancy and those that received blood transfusion were excluded from the study. Anaemia was evaluated by packed cell volume done a day prior to the surgery and two days after. Anaemia was defined as packed cell volume of less than 30%.

Blood loss in this study was evaluated using direct volumetric methods. Blood loss estimation was undertaken by the operating surgeon, anaesthetists and the scrubbed nurse. This was done by measurement of blood in the container of a surgical suction machine which was put on as soon as the surgery started to mop off as much blood as possible with minimal staining of the drapes and operating table, and visual estimation of the blood on the surgical sponges and laparotomy pads. A fully soaked 4 x 4 inches sponge was estimated to hold 10mls of blood and a soaked laparotomy pad holds 120mls^[18]. The limitations here were the liquor amnii that mixed with the blood loss and the little amount of blood in the peritoneal cavity. Data collection was done using a proforma. Data collected included socio-demographic characteristics, gestational age at caesarean section, indications for caesarean section, packed cell volume 24 hours before and 48 hours after caesarean section, type of anaesthesia, type of abdominal incision, level of surgeon, closure of pelvic peritoneum, extension of a uterine incision, mode of placental removal, estimated blood loss, duration of surgery and duration of hospital stay. The data was entered in a spreadsheet using SPSS IBM version 23.0 statistical software, analyzed and presented as percentages, means and standard deviations in tables, charts and figures. Chi-square and students tests were used to compare the groups as appropriate. P value of <0.05 was assumed to be statistically significant.

Ethical Consideration

In designing this study, the following ethical issues were put into consideration. The purpose of the study was explained to all the eligible

participants. They were assured of the confidentiality of the information obtained from them. Ethical approval for this study was obtained from the hospital ethical review board.

Results

The socio-demographic characteristics of the patients are illustrated in table 1.

The mean age of the parturients was 31.92 ± 4.29 years (range 18-43). Seventy seven (74%) women were between 20-34 years, one patient (1%) was less than 20 years and 26 (25%) were 35 years and above. All the clients had formal education. Majority of the women (70.2%) had tertiary education, 27 (26%) had secondary education while 4 (3.8%) had primary education. Twenty nine (27.9%) women were traders, 25 (24%) were housewives, public and civil servants were 15 (14.5%) and 25 (24%) respectively while students were 10 (9.7%). Twenty nine (27.9%) women were nulliparae, 59 (68.3%) were multiparae and 4 (3.8%) were grandmultiparae. Ninety nine percent were married while 1% was single. Only 1 (1%) was a Moslem while 103 (99%) were Christians.

Gestational age at Caesarean section (C/S) and their indications

The mean gestational age at C/S was 38.14 ± 1.33 . Ninety nine (95.3%) patients had elective caesarean section at term while 5 (4.9%) had it preterm. This is shown in figure 1.

Sixty four (61.5%) women had had at least one previous C/S. One previous C/S with other obstetric factors like macrosomic baby, abnormal lies, hypertensive diseases and prolonged pregnancy accounted for 31 (29.8%) of the indications. Two or more previous C/S accounted for 33 (31.7%) of the cases. Other indications were primigravida breech, 10 (9.6%); transverse lie at term, 7 (6.7%); prevention of mother to child transmission of Human Immunodeficiency Virus, 8 (7.7%); hypertensive diseases, 11 (10.5%); previous myomectomies, 3 (3%) and secondary infertility 1 (1%). Thus in 40 women (38.5%), the C/S was primary.

Preoperative Packed Cell Volume (PCV)

Twelve (11.6%) women had PCV values less than 30% while 88.4% had PCV values 30% and above.

Type of Anaesthesia

Ninety seven (93.3%) women had spinal anaesthesia while 7 (6.7%) had general anaesthesia.

Level of Surgeon

Seventy five surgeries (72.1%) were done by senior registrars, 19 (18.3%) by registrars and 10 (9.6%) by consultants.

Closure of Pelvic Peritoneum

The pelvic peritoneum was closed in 36 (34.6%) cases and left unsutured in 68 (65.4%).

Extension of Uterine Incision

Blunt dissection was used in 102 (98.1%) C/S while sharp dissection was used in 2 (1.9%) C/S.

Method of Delivering of Placenta

Placentae were removed by controlled cord traction in 69 (66.4%) cases while 35 (33.6%) were removed manually.

Estimated Blood Loss (EBL)

The mean EBL was 597 ± 155.9 mls. Seventeen women (16.3%) lost less than 500mls of blood, 84 (80.8%) lost between 500 and < 1000mls and 3 (2.9%) lost 1000mls.

Duration of Surgery

The mean duration of operation was 56.85 ± 15.2 mins. Seventy (67.1%) surgeries lasted 60mins or less while 34 (32.9%) lasted more than 60mins.

Postoperative Packed Cell Volume

Those with PCV value less than 30% were 57 (54.8%) while those with PCV value of 30% and above were 47 (45.2%). This is illustrated in figure 3

The relationship between the estimated blood loss (EBL) and packed cell volume (PCV), and the factors affecting blood loss at C/S is illustrated in table 2.

Table 1: Sociodemographic characteristics of participants

Characteristic	No	Percentage %
Age		
< 20	1	1
20-24	5	4.8
25-29	18	17.3
30-34	54	51.9
>35	26	25.0
Educational level		
None	0	0
Primary	4	3.8
Secondary	27	26.0
Tertiary	73	70.2
Occupation		
Public servant	15	14.4
Civil servant	25	24.0
Student	10	9.7
Trading	29	27.9
House wife	25	24.0
Parity		
0	29	27.9
1-2	59	56.8
3-4	12	11.5
≥5	4	3.8
Marital status		
Single	1	1
Married	103	99
Religion		
Christian	103	99
Moslem	1	1

Figure 1: Gestational age at Caesarean section

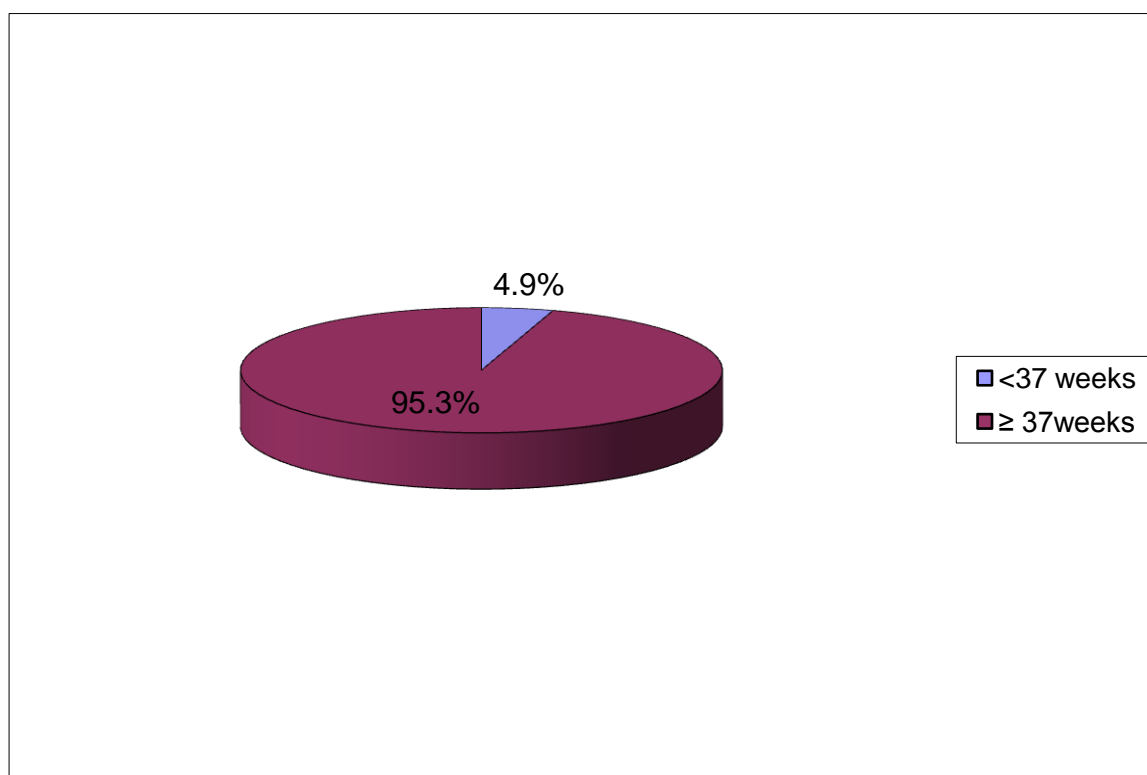


Figure 2: Type of Caesarean section

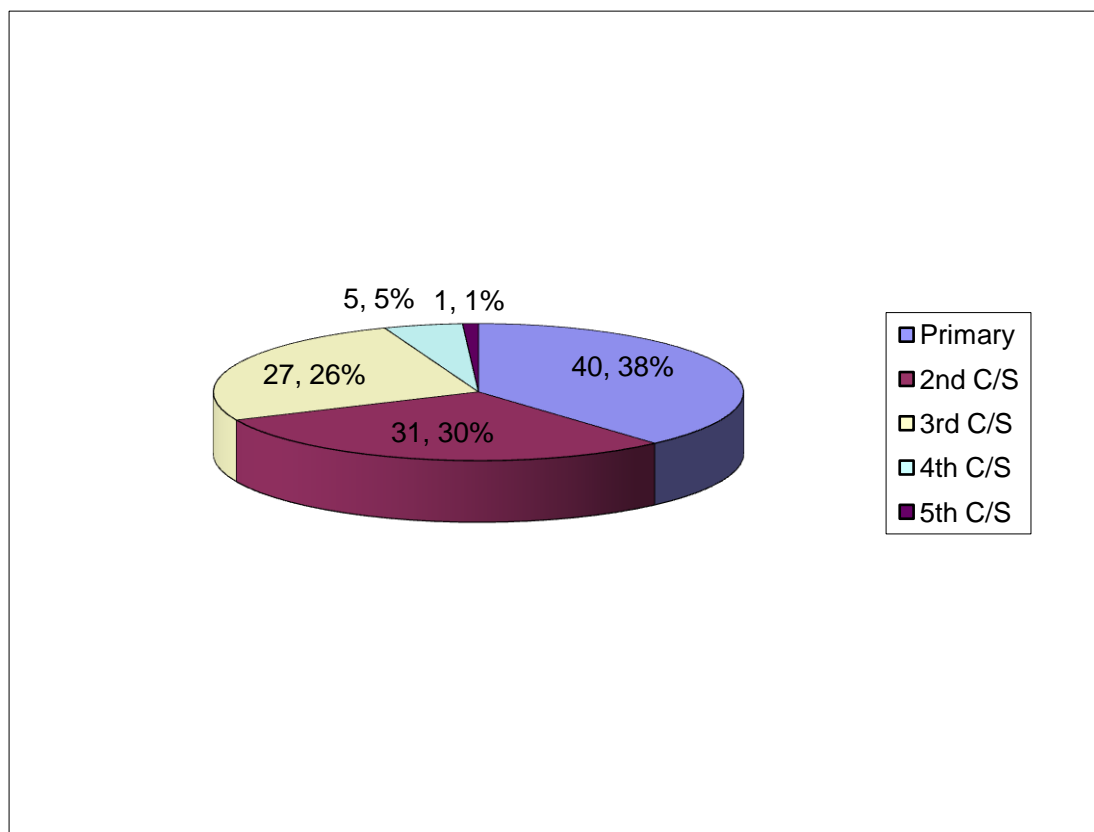


Figure 3: Packed cell volume before and after caesarean section

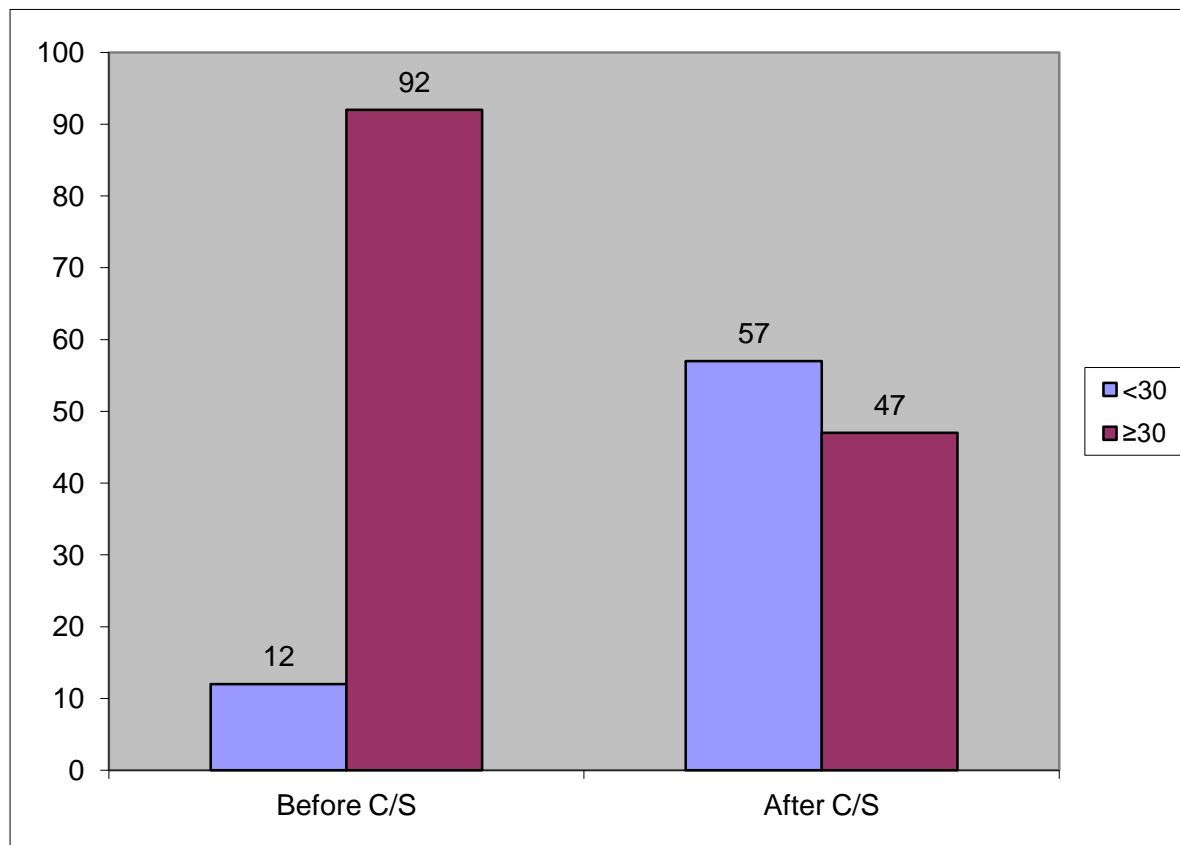


Table 2: EBL and Postoperative PCV versus factors influencing blood loss at C/S

	General Anesthesia			Spinal Anaesthesia				
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	T	P
Estimated blood loss (mls)	5	720.00	164.317	99	590.91	153.756	1.827	.07
Postop. packed cell volume (%)	5	28.60	3.362	99	29.07	2.512	0.403	.69

	Mid-Line Sub-Umbilical Incision			Transverse Suprapubic				
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	T	P
Estimated blood loss (mls)	52	595.19	155.065	52	599.04	158.266	0.125	0.90
Postop. packed cell volume (%)	52	29.29	2.460	52	28.81	2.620	0.965	0.34

	No Closure			Closure				
	N	Mean	SD	N	Mean	SD	T	P
Estimated blood loss (mls)	68	573.53	145.189	36	641.67	167.545	2.157	0.03
Postop. packed cell volume (%)	68	29.09	2.417	36	28.97	2.793	.221	0.83
Duration of surgery (mins)	68	55.91	14.274	36	58.61	16.932	0.859	0.39

	Blunt Dissection			Sharp Dissection				
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	T	P
Estimated blood loss (mls)	102	591.18	150.808	2	900.00	141.421	2.870	.005
Post op. PCV (%)	102	29.11	2.525	2	26.00	1.414	1.730	.087

	CCT			Manual				
	N	Mean	Std. Deviation	N	Mean	Std. Deviation	T	P
Estimated blood loss (mls)	69	581.88	154.817	35	627.14	155.933	1.405	.163
Postop. PCV (%)	69	29.16	2.477	35	28.83	2.684	.626	.533

	Consultant N = 10		Registrar N = 19		Senior Registrar N = 75			
	Mean	(SD)	Mean	(SD)	Mean	(SD)	T	P
Estimated blood loss (mls)	660.00	(134.99)	652.63	(153.18)	574.67	(155.18)	2.90	0.06
Postop. packed cell volume (%)	30.60	(2.68)	28.63	(2.24)	28.95	(2.55)	2.23	0.11
							Minimum	Maximum
							300	1000
							22	35

Discussion

Literature is sparse on published studies on the prevalence of anaemia following caesarean section especially in developing countries like Nigeria. This study showed that the PCV of 54.8% of the booked pregnant women who had elective caesarean section at UPTH during the study period was below 30%. Preoperatively some of the women were anaemic and this contributed to the number who were anaemic following blood loss at caesarean section. It is therefore not surprising that about half of the patient were anaemic post operatively. Preoperative anaemia has remained a major predictor of blood transfusion in studies from developed and resource poor countries like Nigeria^[7,13,14]. In a study done in Ibadan, preoperative pcv of less than 26% was a major predictor of blood transfusion^[7]. Pregnant women admitted in antenatal ward for caesarean section should be in the best possible condition because their ability to withstand blood loss at the time of surgery depends on the preoperative level of packed cell volume, blood volume, volume of blood lost and associated disease state^[3,10,18]. Prior to the surgery, the cause of the anaemia was supposed to have been investigated and the anaemia corrected during their antenatal visits. Half of the women who were anaemic before the surgery were primigravidae who are prone to having anaemia in pregnancy because of their susceptibility to malaria in pregnancy^[15]. None of the grandmultiparous women were anaemic prior to surgery. Drug non compliance could have contributed to the anaemia seen in these women prior to surgery as they may not be taking the routine haematinics and antimalarials as indicated. The commonest indication for caesarean section in this study was previous caesarean sections. This is in keeping with the study done at Jos University Teaching Hospital (JUTH) by Mutahir et al^[29]. The mean EBL in this study was 597±155.9mls. This is comparable to the mean EBL of 592mls and 573mls noted in studies done by Khan FA et al and Johnson UU et al respectively^[17,30]. The compensatory mechanisms of pregnant women

enable most of them to survive extensive haemorrhages without blood transfusion and recover a normal blood volume within a relatively short time following caesarean section^[17]. These compensatory mechanisms may have contributed to the fact that the women who were anaemic postoperatively in this study did not require blood transfusion. This agrees with studies that reported the risk of blood transfusion after C/S to be low and generally around 3%^[4,11].

Majority of the women had regional anaesthesia (spinal) which is now the preferred route unless otherwise stated^[27]. It has been shown that women undergoing uncomplicated C/S under general anaesthesia (GA) as seen in this study are at higher risk of blood loss, drop in pcv and need for blood transfusion compared to those with regional anaesthesia that induces hypotension^[3]. This study showed that the mean blood loss following spinal anaesthesia was less than that of general anaesthesia although the difference was not significant. This is in keeping with a previous study done by Afolabi et al^[27].

Equal number of women had transverse suprapubic and midline sub-umbilical incisions. The mean blood loss was more with transverse suprapubic incision therefore it is expected that the postoperative PCV following this type of abdominal incision would be less though there were no significant differences in the amount of blood loss and the postoperative PCV. The midline sub-umbilical incision caused less blood loss than transverse suprapubic incision because the incision site has fewer blood vessels encountered and the vessels run along the line of incision.

Majority (75%) of the surgeries were performed by senior registrars with the least blood loss. The highest mean blood loss in surgeries done by the consultants could be as a result of anticipated difficult surgeries causing more haemorrhage, usually left for the consultants to perform. The experience of the surgeon may play a significant role at determining the quantity of blood loss at surgery^[7]. The study showed that level of the

surgeons did not significantly affect the blood loss and pcv of the women.

The mean blood loss was significantly less in women who did not have closure of the pelvic peritoneum than in those who did. Non closure of peritoneum was associated with reduced operating time. This means that the more time spent on repairing the peritoneum will lead to more blood loss. These findings are in keeping with systematic reviews done by Bamigboye et al^[28].

A large number of women (102) had blunt dissection of the uterus after an initial incision and only two had sharp dissection. This is not a good figure for comparison. Nevertheless, the women with blunt dissection had a significant less blood loss and higher postoperative PCV than those with sharp dissection. Sharp dissection involves cutting through the blood vessels in the myometrium resulting in increased blood loss as seen in the study. This is in keeping with the study done by Magann et al^[16] but not in keeping with the 1st study on these two methods by Rodriguez et al^[23]. They found out that both methods were interchangeable as there was no significant difference between the two techniques regarding the blood loss and uterine tears.

More blood was lost following manual removal of placenta than controlled cord traction (CCT) though the difference was not significant. This also reflected on the mean postoperative PCV which was less with manual removal of placenta. The findings are in keeping with the study done by Ramadani H et al^[25] where they noted more blood loss and reduced postoperative PCV levels associated with manual removal of placenta.

Conclusion

Prevalence of anaemia following elective C/S during the study period was apparently high (54.8%), due to the number of women with preoperative anaemia. Blood loss at caesarean section was significantly affected by closure of peritoneum and sharp dissection.

Recommendations

Caesarean section is a common obstetric operation and needs to be made as safe as possible. Booked parturients for elective caesarean section should not be anaemic prior to the surgery because the anaemia will worsen postoperatively with its consequences. Anaemia should be corrected during antenatal visits. The surgeons should be aware of the various techniques aimed at reducing blood loss at caesarean section and strictly adhere to them to reduce morbidity and mortality associated with the operation.

Consent: It is not applicable.

Ethical Approval: Ethical approval was given by the Hospital's Ethics committee.

Competing Interests: Authors have declared that no competing interests exist.

References

1. Ebeigbe PN, Ilesanmi AO. Caesarean section. In: Okpere E. (Ed). Clinical Obstetrics. University of Benin Press, Nigeria, 2005; 404-413.
2. Jaiyesimi RAK, Ojo OE. Caesarean section. In: Okonofua F, Odunsi K (Eds). Contemporary obstetrics and gynaecology for developing countries. Women's Health and Action Research Centre, Nigeria, 2005; 592-619.
3. Anzaku AS, Edem BE, Ngwam SD, Galadima SJ. Do patients require routine haematocrit testing following uncomplicated caesarean delivery? Afri J Med Health Sci, 2015; 14: 24-28.
4. O'Donoghue K. Physiological changes in pregnancy. In: Baker PN, Kenny LC, editors. Obstetrics by Ten Teachers. 19th ed. London: Book Power Publishers; 2011. p. 20-37.
5. Api O, Unal O, Api M, Dogance U, Balcik O, Kara O, et al. Do asymptomatic patients require routine hemoglobin testing following uneventful, unplanned cesarean

- sections? Arch Gynecol Obstet 2010; 281: 195-9.
6. Nonye-Enyidah EI, Eli S. Influence of blunt versus sharp expansion of uterine incision on degree of intraoperative blood loss at caesarean section. Greener journal of medical sciences, 2018; 8 (2): 019-026.
 7. Eyalade OR, Adesina AO, Adewole IF, and Adebowale SA. Blood transfusion requirements during caesarean delivery: risk factors. Annals of Ibadan postgraduate medicine, 2015; 13 (1): 29-35.
 8. Akinola OI, Fabamwo AO, Tayo AO, et al. Evaluation of blood reservation and use for Caesarean sections in a tertiary maternity unit in South-western Nigeria. BMC Pregnancy and Childbirth 2010; 10: 57 (doi: 10.1186/1471-239310-57).
 9. World Health Organization. Vitamin and Mineral Nutrition Information System. Department of Reproductive Health and Research, WHO; Geneva: 2011. Haemoglobin concentrations for the diagnosis of anemia and assessment of severity.
 10. Singh B, Adhikari N, Ghimire S, Dhital S. Post-operative drop in hemoglobin and need of blood transfusion in cesarean section at Dhulikhel Hospital, Kathmandu University Hospital. Kathmandu Univ Med J (KUMJ) 2013; 11: 144-6.
 11. Madhusudan D, Vanamail P. Blood loss and risk of blood transfusion in patients undergoing Caesarean section. Int J Biomed Adv Res (IJBAR) 2013; 4: 425-9.
 12. Adesina O, Akinyemi O, Oladokun A. Anemia in pregnancy at two levels of health care in Ibadan, South West Nigeria. Ann Afr Med 2011; 10 (4): 272-277.
 13. Jadon A, Bagai R. Blood transfusion practices in obstetric anaesthesia. Indian J Anaesth 2014; 58(5):629-636.
 14. Scrutton M, Gardner I. Maternal critical care in the United Kingdom: developing the service. Int J Obstet Anesth 2012; 21:291-293.
 15. Harrison KA. Anaemia in pregnancy. In Lawson JB, Harrison KA, Bergstrom S. (Eds). Maternity Care in Developing Countries. 1st Edition. Cromwell Press Limited, Trowbridge, 2001; 112-128.
 16. Magann EF, Chauhan SP, Bufkin L, Field K, Roberts WE, Martin JN Jr. Intraoperative haemorrhage by blunt versus sharp expansion of the uterine incision at caesarean delivery; a randomized clinical trial. British Journal of Obstetrics and Gynaecology, 2002; 109(4): 448-452.
 17. Khan FA, Khan M, Ali A, Chohan U. Estimation of blood loss during caesarean section audit. Journal of Pakistan Medical Association. 2006; 56: 572;1-8.
 18. Morgan Jr GE, Mikhail MS, Murray MJ. Fluid management and transfusion.. In: Strauss M, Lebowitz H, Boyle PJ (Eds). Clinical anaesthesiology, 4th Edition. Mc GrawHill companies USA. 2006; 690-707.
 19. Yoong W, Karavolos S, Damodaram M, Madgwick K, Milestone N, Al- Habib A, et al. Observer accuracy and reproducibility of visual estimation of blood loss in obstetrics: How accurate and consistent are health- care professionals? Arch Gynecol Obstet, 2010; 281: 207- 13.
 20. Adkins AR, Lee D, Woody DJ, White WA Jr. Accuracy of blood loss estimations among anesthesia providers. AANA J 2014; 82: 300- 6.
 21. Mathai M, Hofmeyr GJ. Abdominal surgical incisions for caesarean section. Cochrane Database of Systematic Reviews. 2007, Issue 1. Art No.: CD004453.D01:10.1002/14651858. CD004453. pub. 2 (KB220).
 22. Schorn MN. Measurement of blood loss: Review of the literature. J Midwifery Womens Health, 2010; 55: 20- 7.

23. Subramanyam KL, Murthy MS. Emergency cesarean section and blood transfusions in patients with severe anemia-our experience. J NTR Univ Health Sci. 2013; 2: 255-60.
24. Smith JF, Hernandez C, Wax JR. Foetal laceration injury at caesarean delivery. British Journal of Obstetrics and Gynaecology, 2002; 109 (4): 448-452.
25. Ramadani H. Caesarean section intraoperative blood loss and mode of placental separation. International Journal of Gynaecology and Obstetrics, 2004; 87: 114-118.
26. Butwick AJ, Walsh EM, Kuzniewicz M, Li SX, Escobar GJ. Patterns and predictors of severe postpartum anaemia after caesarean section. Transfusion, 2017; 57 (1): 36-44.
27. Afolabi BB, Lesi FEA, Merah NA. Regional versus general anaesthesia for caesarean section. Cochrane Database of Systematic Reviews 2006, Issue 4. Art. No.: CD004350.D01:10.1002/14651858.CD004350.pub2.
28. Bamigboye AA, Hofmeyr GJ. Closure versus non closure of the peritoneum at caesarean section. Cochrane Database of Systematic Reviews 2003, Issue 4. Art.No.:CD000163.DOI:10.1002/14651858.CD000163.
29. Mutahir JT, Daru PH, Ujah IAO. Elective caesarean sections at the Jos University Teaching Hospital. Tropical Journal of Obstetrics and Gynaecology, 2005; 22(1): 39-41.
30. Johnson UU, Obasuyi BI. A comparative study of blood loss during caesarean myomectomy and caesarean section. Port Harcourt medical journal, 2018; 12 (1): 30-33.