ORIGINAL RESEARCH ARTICLE

A comparison of the effect of placental extraction from exteriorized versus non-exteriorized uterus on blood loss during caesarean section in Nigerian women

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Abstract

The purpose of this study was to determine the effect of placenta extraction from exteriorized uterus versus placenta extraction from non- exteriorized uterus on blood loss during caesarean section (CS). It was a randomized control study in which 98 women undergoing caesarean section were allocated randomly to either the placental delivery from exteriorized uterus or placental delivery from non-exteriorized uterus. The main outcome measure was intraoperative blood loss, and Intention to treat analysis was used. More participants in the non-exteriorized placenta removal group had blood loss ≥500mls (P-value <0.001). Logistic regression showed about 5times likelihood of having blood loss of 500mls or more in the non-exteriorized group (P< 0.001; OR: 5.67; 95%CI: 2.38-13.40). The mean estimated blood loss was 54.1mL less in exteriorized placenta removal group (476.12±160.86 versus 530.20±145.18; P-value = 0.084). The mean changes in haemoglobin concentration in exteriorized and non-exteriorized groups were 0.68±0.19g/dL and 0.74±0.20g/dL; *P* = 0.131) respectively. This study showed statistically significant difference in blood loss of 500mls or more in the placenta delivery from non-exteriorized compared to the exteriorized group. However, there was no significant difference in the mean blood loss, duration of surgery, and change in haemoglobin between the two groups. *(Afr J Reprod Health 2023; 27 [9]: 65-75).*

Keywords: Blood loss, caesarean section, exteriorized uterus, non-exteriorized, placental delivery, randomized control study

Résumé

Le but de cette étude était de déterminer l'effet de l'extraction du placenta de l'utérus extériorisé par rapport à l'extraction du placenta de l'utérus non extériorisé sur la perte de sang lors d'une césarienne (CS). Il s'agissait d'une étude contrôlée randomisée dans laquelle 98 femmes subissant une césarienne ont été réparties au hasard entre l'accouchement placentaire à partir d'un utérus extériorisé ou l'accouchement placentaire à partir d'un utérus non extériorisé. Le principal critère de jugement était la perte de sang peropératoire et une analyse en intention de traiter a été utilisée. Un plus grand nombre de participants dans le groupe de retrait du placenta non extériorisé ont présenté une perte de sang ≥ 500 ml (valeur P <0,001). La régression logistique a montré une probabilité environ 5 fois supérieure d'avoir une perte de sang de 500 ml ou plus dans le groupe non extériorisé (P < 0,001 ; OR : 5,67 ; IC à 95 % : 2,38-13,40). La perte de sang moyenne estimée était inférieure de 54,1 ml dans le groupe d'ablation du placenta extériorisé (476,12 ± 160,86 contre 530,20 ± 145,18 ; valeur P = 0,084). Les changements moyens de la concentration d'hémoglobine dans les groupes extériorisés et non extériorisés étaient de 0,68 ± 0,19 g/dL et de 0,74 ± 0,20 g/dL ; P = 0,131) respectivement. Cette étude a montré une différence statistiquement significative dans la perte de sang de 500 ml ou plus lors de l'expulsion du placenta du groupe non extériorisé par rapport au groupe extériorisé. Cependant, il n'y avait pas de différence significative dans la perte de sang moyenne, la durée de l'intervention chirurgicale et la modification du taux d'hémoglobine entre les deux groupes. *(Afr J Reprod Health 2023; 27 [9]: 65-75).*

Mots-clés: Perte de sang, césarienne, utérus extériorisé, non extériorisé, accouchement placentaire, étude contrôlée randomisée

Introduction

Delivery by caesarean section (CS) is one of the most frequently performed obstetric procedures worldwide and the CS rate has increased globally in recent decades[1-3]. Its rate across Nigeria ranges from 20.4% to 42.4%[4,6]. Caesarean section is associated with higher morbidity and mortality compared with vaginal delivery[5,7]. A commonly encountered complications of CS is postpartum haemorrhage (PPH) and it is a leading cause of preventable maternal mortality worldwide[7]. The physiologic hyper perfusion of the gravid uterus at term at a rate of about 500-750 mL/min results in

an average blood loss at caesarean delivery of approximately 1000ml[8]. The blood loss that occurs during CS is approximately twice the blood loss at vaginal delivery, and about 4-6 % of these patients require blood transfusions[8, 9].

Different operational techniques have been devised to reduce blood loss during CS. Some of the variations in surgical techniques of caesarean section include different types of abdominal incision, methods of placenta delivery, single or double layer uterine wound closure, extra abdominal or insitu uterine wound closure, and more recently placenta extraction from exteriorized uterus. The quest for the improvement of these techniques is still in progress[10]. This is with the purpose of reducing perioperative bleeding, shortening the operating time, decreasing the risk of adverse effects, and shortening the duration of hospital stay[10].

The studies on placenta delivery techniques have generally focused on manual or controlled cord traction[11,12] rather than delivery from exteriorized or non-exteriorized uterus. Kükrer and Pepekal Kükrer[13] in a study of effect of placenta removal method at caesarean delivery on perioperative haemorrhage reported that blood loss at caesarean delivery was greater in manual placenta delivery group than the spontaneous placenta delivery group (done by controlled cord traction). However, Altraigey *et al*[14] reported no significant difference in blood loss during caesarean section between the two techniques of placental delivery**.**

Recently, researchers have developed interest on the potential benefit of placenta delivery from an exteriorized uterus[15,16]. It is presumed that removing the placenta after the uterus has been exteriorized minimizes the time in which heavy bleeding can occur from the vascular placenta bed. Separation of the placenta leads to the avulsion of the vessels and the denuded placental implantation site can contribute to major blood loss during CS. In this recent technique, the uterus with intact placenta is lifted through the abdominal incision and placed on the anterior abdominal wall, above the level of the heart while the patient is in a supine position. There is also compression and traction on the uterine vessels, which limit arterial pressure and blood flow to the bleeding site[13]. Additionally, an exteriorized uterus allows more effective uterine massage, thus improves uterine contraction, decreases the chance of uterine atony and enhances placental extraction.

In a randomized controlled study, Xiao *et al*[15] found that exteriorizing the uterus prior to placenta delivery during CS may lessen intraoperative and immediate postoperative bleeding. They found that the mean decrease in haemoglobin concentration was 22% less in women who had placental extraction from an exteriorized uterus than in those who had conventional placental extraction. Conversely, Kaya *et al*[16] did not observe any difference in mean operative haemoglobin loss or intraoperative estimated blood loss. The findings from both studies remain inconclusive, and the best method to remove the placenta with regard to blood loss is still uncertain. The critical question, therefore, is whether there is sufficient evidence to recommend the practice of exteriorizing the uterus before removal of the placenta at CS.

This research was conducted to assess the effect of placenta delivery from an exteriorized uterus as against the standard technique of delivering the placenta before exteriorizing the uterus. It compared differences in preoperative and postoperative haemoglobin concentrations, intraoperative blood loss, and duration of surgery in the two groups of patients in two tertiary hospitals in Delta State.

To the best of our knowledge, there is paucity of studies on this topic, and the findings from the very few studies, which were done in developed countries were countradictory. The findings from our study would further provide evidence to support or dissuade the practice of placenta extraction from an exteriorized uterus.

Methods

Hypothesis

Null Hypothesis (HØ): There is no statistically significant difference in estimated blood loss in patients who had placenta delivery from exteriorized uterus compared with patients who had placenta delivery from non-exteriorized uterus during caesarean section.

Study design

This was a superiority design randomized controlled trial (RCT) on the effect of placenta

delivery on blood loss during CS between two groups of participants. The first group(exteriorization group), placenta was delivered from an exteriorized uterus while the second group (non-exteriorized group), the placenta, was removed from an in situ uterus. The participants were randomly allocated to either the exteriorization or the non-exteriorization group.

Study setting

This study was conducted at the department of Obstetrics and Gynaecology, Delta State University Teaching Hospital (DELSUTH), Oghara, and Central Hospital, Warri, both in Delta State. These two closely affiliated tertiary hospitals serve as major referral centres to Delta State and neighboring towns in Edo, Rivers and Bayelsa States. They collaborate in the training of medical students and resident doctors, and have similar clinical management protocols. The hospitals have a combined average of 4560 deliveries every year with a caesarean section rate of about 20%.

Study population

The study population consisted of consenting pregnant women who presented to DELSUTH, Oghara and Central Hospital, Warri, and had indications for primary CS. The RCT was conducted from July 1st , 2017 to December 31st , 2017.

Inclusion criteria

The inclusion criteria were women with pregnancies of gestational age greater than or equal to 34weeks that had primary CS according to the obstetric indications and gave consent to participate in the study.

Exclusion criteria

Exclusion criteria included previous caesarean section, placenta praevia, multiple gestation, preeclampsia, hydramnios, uterine anomalies like didelphys, bicornis and huge uterine leiomyomata, bleeding disorder.

Sample size calculation

The minimum sample size was determined using the formula for calculating sample sizes of comparative intervention studies with quantitative outcome[17].

$$N = \frac{\left(r + {}^{1}/_{r}\right)\sigma^{2}\left(Z_{\alpha} + Z_{\beta}\right)^{2}}{\delta^{2}}$$

The study aimed to detect a haemoglobin change of 3.7g/L at 80% power and 5% level of significance. A sample size of 49 was calculated after adding a 10 % attrition rate. The sample size of 49 was therefore used for each group giving a total sample size of 98.

Randomization

Consenting patients were preoperatively randomized, using numerically ordered cards in sealed envelopes. Ninety-eight 4cm x 4cm blue cards were numbered 01 to 98, and each was sealed in identical opaque envelopes. The envelopes were secured and placed in the labour ward theatre of the two centres, and they were drawn serially just before the procedure until the study was completed. The participants with even and odd numbers were allocated to non-exteriorized and exteriorized groups, respectively. The group to which the patient was allocated is only known after the envelope has been opened.

Study interventions

All patients had preoperative preparation done by their managing unit. Participants received prophylactic intravenous antibiotics consisting of ceftriaxone 1g approximately 60 minutes before skin incision (elective CS) or at induction of anaesthesia (Emergency CS). Caesarean deliveries were performed by senior registrars or consultants. Each participating surgeon had done up to 5 cases of placenta delivery from exteriorized uterus before recruitment started.

Routine preoperative preparation was done by skin scrubbing with Chlorhexidine and methylated spirit. Appropriate anaesthesia was administered, and a lower abdominal incision was used to the level of parietal peritoneum, which was entered and extended bluntly with fingers. Abdominal mops and suctions were used to dry operative field. The vesico–uterine fold was identified, incised, and extended transversely with scissors. The bladder was dissected off the lower uterine segment and was protected using Doyen's retractor. The lower uterine segment was incised transversely at the centre and the transverse

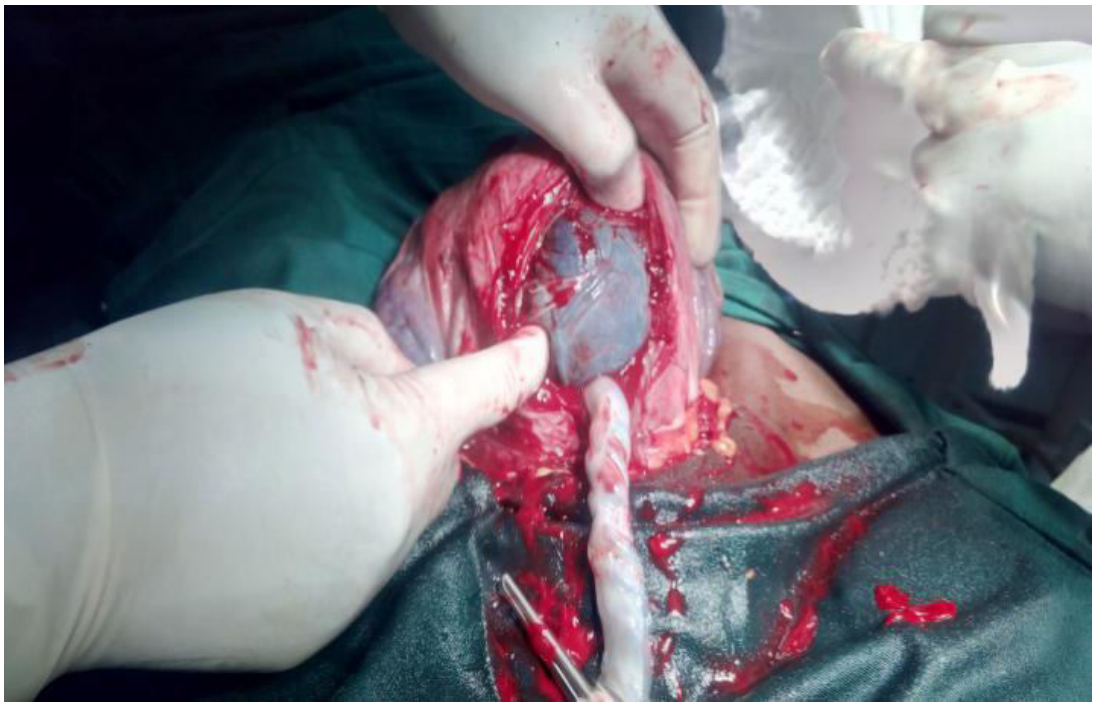

Figure 1: An exteriorized uterus with placenta insitu with minimal bleeding

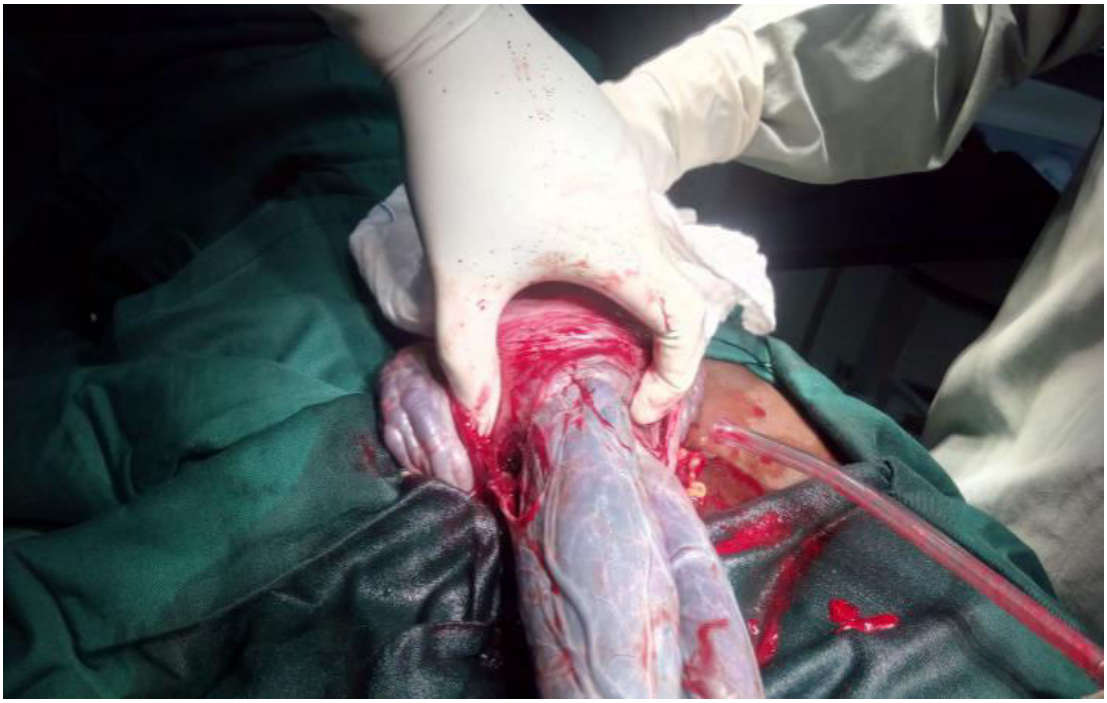

Figure 2: Uterus during placenta removal with minimal bleeding

incision extended bluntly. After the delivery of the baby, two distinct procedures were performed. In the study group, the uterus containing the placenta, was pulled out from the abdominal cavity and exteriorization procedure as described by Kaya *et al*[16] was performed as follows: two fingers of the surgeon's right hand were placed to the interior side of the anterior wall of the uterus and externalization of the uterus was attempted. When this manoeuvre was not successful, the fundus was

held by the left hand and rotated anti-clockwise until the uterine corni came to the median line. The uterus (containing placenta) was manoeuvred out of the abdominal cavity and then the placenta was gently removed by controlled cord traction aided by uterine massage. In the control group, the placenta was delivered by the same method while the uterus was still inside the abdominal cavity after delivery of the fetus. Thereafter, the uterus was exteriorized. In both groups, all the debris and clots were sponged off; 10 IU of oxytocin was administered. The uterine incision was repaired in two layers. The uterus was then returned to the abdominal cavity. Then 20 IU of oxytocin was administered in 500 mL of normal saline at a rate of 125 mL/h, and continued for 4 hours following delivery. The rectus sheet was approximated with number 2 vicryl and the skin closed with either sub-cuticular closure with vicryl 2/0 or intermittent mattress with nylon 2/0.

Estimation of blood loss

The primary outcome measure was the intraoperative blood loss. This was estimated by measuring blood collected in the suction apparatus, blood in abdominal mops, spill onto the drapes and floor, by anaesthetic team; each 18"x18" (45cmx45cm) cotton laparotomy sponge in use at the study centres is estimated to contain about 100 mL of blood at full saturation[18-21]. Also the difference between pre- and 48 hours postoperative haemoglobin was used as a measure of the intraoperative blood loss. The secondary outcome measure was operative time. The duration of surgery was estimated in minutes starting from skin incision to placement of the last skin stitch.

Post-operative events

Post-operative events included post-operative blood transfusion, total blood transfusion, post-operative haemoglobin in g/dL, haemoglobin changes and the length of hospital admission. Post-operative haemoglobin estimation in g/dL was at 48 hours after surgery. Haemoglobin change was estimated as the difference between the preoperative and post-operative values. The length of hospital stay was the time from the start of CS until discharge from the hospital.

All participants were given postoperative antibiotics in the form of intravenous ceftriaxone and metronidazole for 48 hours, after which they received oral co-amoxiclav and metronidazole for five days; and appropriate postoperative analgesia. Liquid diet was commenced within 6 hours post-operation. Urethral catheter was removed after 24 hours.

Patients were considered for discharge from the fifth day after surgery if they satisfy discharge criteria which were: good general condition, normal vital signs, post-operative haemoglobin ≥8g/dL, and absence of complications. Those discharged were seen in clinic after 6weeks.

Data analysis

Data was analyzed using Statistical Package for Social Sciences version 22 (IBM ® Inc, Il Chicago. USA). Comparisons of patients' characteristics and outcome measures between the two placenta removal methods was conducted using the Chi Square tests (with Fisher's Exact test where variables were small) for categorical variables, and the Student's t test for continuous variables. Analysis was by intention to treat.. The effects of confounding variables were determined using logistic regression model. Level of significance was set at $p < 0.05$.

Ethical approval

Permission to carry out this trial was sought and obtained from the Research and Ethics Committees of the Delta State University Teaching Hospital, Oghara, Delta State(Reference number, HREC/PAN/2017/017/0218; dated 24thApril, 2017) and Central Hospital, Warri, Delta State (Reference number, CHW/ECC VOL1/119, dated 13th April, 2017). Informed and written consent was obtained from the women.

Results

Over the study period of six months, 403 patients were assessed for eligibility into the study. Two hundred and ninety-six patients did not meet the inclusion criteria. Nine patients declined to participate. Ninety-eight patients were randomised, 49 patients into each arm of the study. Two patients in the exteriorized group could not have the uterus with placenta exteriorized because of difficulty encountered by the surgeon. See the Consort flow

Appendix 1

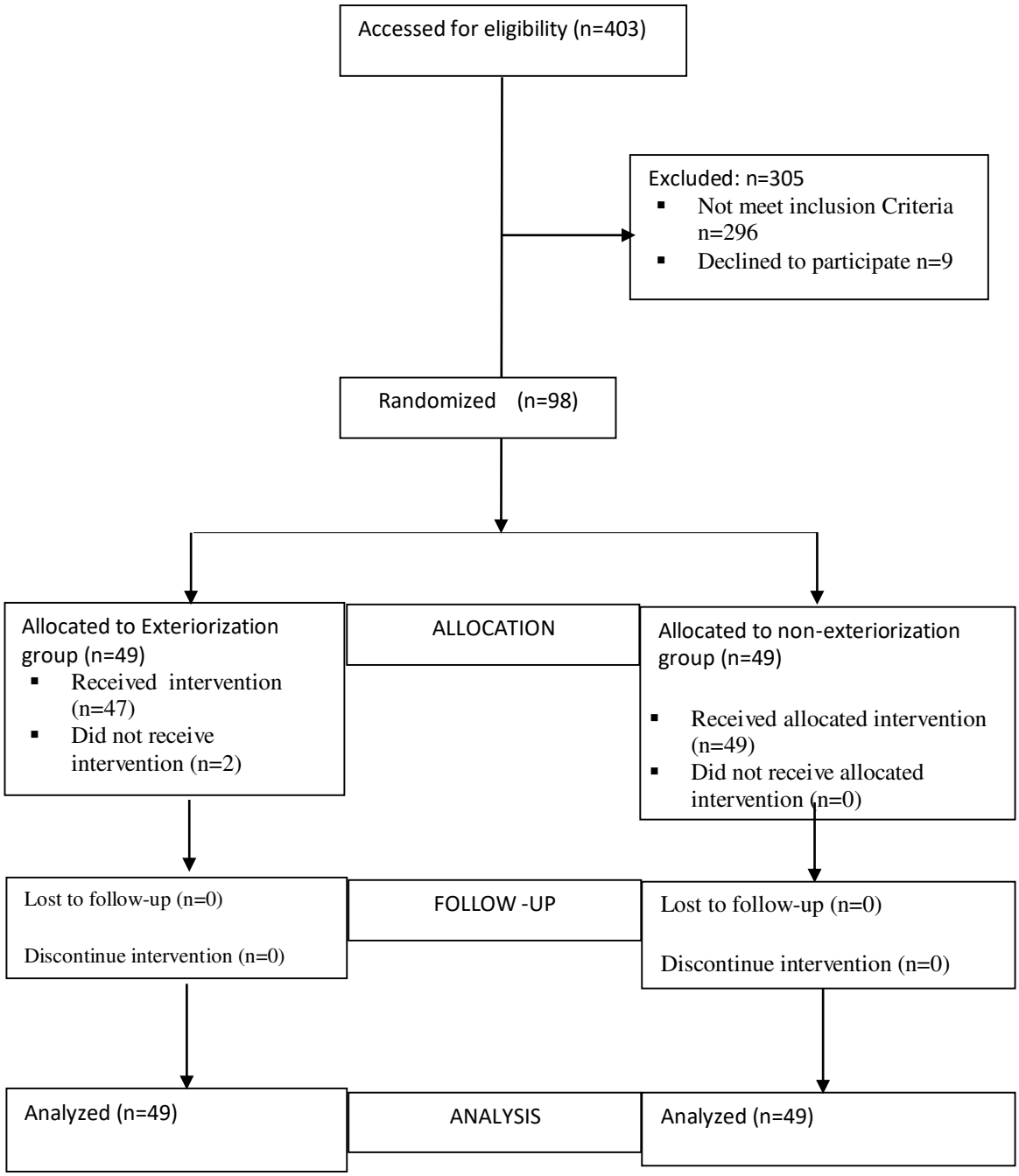

chart of the patients through the study (Appendix 1).

The Comparison of the baseline demographics, clinical, anthropometric indices /preoperative haemoglobin among study participants were similar in the two groups (Table 1). The majority of the women in both groups were within the 25-35 years of age, and were multiparous (Para 2-4). Only 26.5% of the exteriorized group and 24.5% of the non-exteriorized group were primigravid patients while 8.2% of the exteriorized group and 6.1% of the non- exteriorized group were grandmultipara. There were no statistically significant differences in the distribution of indications for CS between the two groups. There were also no statistically

Table 1: Comparison of the baseline demographics, clinical, anthropometric indices and preoperative haemoglobin among study participants

Variable	Categories	Placental type Frequency (%) Exteriorization	Non-exteriorization	test statistics	p-value
Age group (in years)	**<25**	7(14.3)	7 (14.3)	$X^2 = 0.223$	*0.958*
	25-35	30(68.2)	28(57.1)		
	>35	12(24.5)	14(28.6)		
	Mean ± SD	*29.96 ± 5.38*	*30.37 ± 5.85*	*t=0.593*	*0.555*
Gravidity	**Primigravida**	13 (26.5)	12 (24.5)	$X^2 = 0.316$;	*0.897[a]*
	Gravida 2-4	*32 (65.3)*	*40 (69.4)*		
	Gravida 5& above	4 (8.2)	3(6.1)		
Parity	**Nullipara**	*16(32.7)*	*13(26.5)*	*$X^2 = 1.528$;*	*0.814[a]*
	Primipara	*14(28.6)*	*13(26.5)*		
	Multipara	*19(38.8)*	*22(44.9)*		
	Grandmultipara	*0(0.0)*	*1(2.0)*		
Gestational age (Wks.)	**34-37**	*4(8.2)*	*6(12.2)*	*$X^2 = 3.543$;*	*0.814[a]*
	37-40	*35(71.4)*	*26(53.1)*		
	>40	*10(20.4)*	*17(34.7)*		
	Mean ± SD	*39.57± 1.69*	*38.90 ± 1.69*	*t=0.963*	*0.338*
Indication for CS	**Cervical dystocia**	5(10.2)	7(14.3)	*$X^2 = 2.690$;*	*0.961[a]*
	Maternal HIV	*1(2.0)*	*2(4.1)*		
	Fetal distress	*17(34.7)*	*17(34.7)*		
	Cord prolapse	*3(6.1)*	*2(4.1)*		
	Malpresentation	*9(18.4)*	*11(22.4)*		
	'Precious baby' pregnancy	*2(4.1)*	*1(2.0)*		
	Contracted pelvis/CPD	*10(20.4)*	*8(16.3)*		
	Maternal request	*2(4.1)*	*1(2.0)*		
Maternal Wt.(kg):		*68.57±5.78*	*69.71±6.34*	*0.928*	*0.356*
Maternal Ht.(m)		*1.58± 0.51*	*1.60±0.53*	*0.215*	*0.830*
BMI(Kg/m^2)		*26.87±1.68*	*27.27±1.85*	*1.111*	*0.269*
Preoperative Hb(g/dl):		10.96±0.57	11.17±0.69	1.649	0.101

CPD=Cephalopelvic disproportion; CS= Caesarean section; HIV= Human ImmunodeficiencyVirus; Wks. = weeks; a= Fischer's exact; Wt= Weight; Ht = Height; BMI= Body Mass Index; SD= Standard Deviation; Hb= Haemoglobin; t= T-test.

Table 2: Intraoperative and postoperative parameters among study

Variable	Exteriorization (mean ± SD)	Non-exteriorization (mean ± SD)	t-test	p-value
Duration of surgery(minutes) Range	37.24±10.80 24 - 72	39.39±9.64 25 – 75	1.036	0.303
Estimated blood loss(mL) Range	476.12±160.86 300 - 1060	530.20±145.18 320 – 1070	1.747	0.084
Postoperative Hb(g/dl)	10.28±0.52	10.43±0.72	1.152	0.252
Hb difference(pre-postoperative Hb) g/Dl	0.68±0.19	0.74±0.20	1.524	0.131
Birth weight(kg)	3.073±0.42	3.198±0.42	1.472	0.144
Duration of admission (Days)	5±0.71	5±0.74	0.000	1.000

significant differences in the anthropometric indices and preoperative haemoglobin in the two groups.

Table 2 showed the results of the intraoperative and postoperative parameters among study participants. The mean estimated blood loss

Table 3: Factors associated with blood loss greater than 500ml

Variable	Categories	Volume of blood loss during CS Frequency (%)		X^2	p-value
		>500ml	≤500ml		
Caesarean section	Elective	9 (36.0)	16 (64.0)	3.030	*0.082*
	Emergency	41(56.2)	32 (43.8)		
Cadre of anesthetist	Consultant	0 (0.0)	2 (100.0)	2.127	*0.237*[a]
	Senior registrar	50 (52.1)	46 (47.9)		
Type of anaesthesia	Spinal	37 (46.8)	42 (53.2)	2.856	0.091
	General	13 (68.4)	6 (31.6)		
Cadre of surgeon	Consultant	*4(33.3)*	*8(66.7)*	*1.712*	*0.191*
	Senior registrar	*46(53.5)*	*40(36.5)*		
Abdominal incision	Pfannenstiel	*46 (49.5)*	*47(50.5)*	1.771	*0.362* [a]
	Midline incision	*4 (80.0)*	*1 (20.0)*		
Uterine incision	Low transverse	*50 (51.5)*	*47 (48.5)*	1.052	*0.362* [a]
	Low vertical	*0 (0.0)*	*1 (100.0)*		
Placenta delivery	Exteriorization	*15 (30.6)*	*34 (69.4)*	*6.333*	*<0.001*
	Non-exteriorization	*35 (71.4)*	*14 (28.6)*		
Duration	≤29	*8 (38.1)*	*13(61.8)*	*6.830	*0.033*
	30-59	*38 (52.1)*	*35 (47.9)*		
	60-89	*4 (100.0)*	*0 (0.0)*		

*LR chi-square; a: Fischer's exact

Table 4: Logistic regression analysis for blood loss

Variables	Crude OR	Adjusted OR	p-value	95% C.I. for Adjusted OR	
				Lower	Upper
Blood loss >500mL					
Placenta delivery method	5.667	5.667	<0.001	2.379	13.497
Blood loss >1000mL					
Duration of surgery	N/A	1.224	0.480	0.698	2.147

OR: Odd Ratio; CI: Confidence Interval: N/A: not applicable

was 54.1mL less in exteriorized compared to non-exteriorized placenta removal group (476.12±160.86; range 300-1060mL versus 530.20±145.18; range 320-1070 ; P- value = 0.084). The mean duration of surgery in minutes in the exteriorized placenta removal group was 37.24±10.80 and 39.39±9.64 for the non-exteriorized placental removal group (P = 0.303). The difference in pre- and post operative naemoglobin was sligthly bigger in the non-exteriorised placenta removal group. There was an 8% reduction in the difference between pre- and postoperative haemoglobin concentration when comparing the changes in haemoglobin concentration in exteriorized and non-exteriorized placenta removal group, however this difference was not statistically significant, 0.68±0.19g/dL versus 0.74±0.20g/dL; P = 0.131). There were no statistically significant differences in birth weight and postoperative hospital stay between the two groups. The results of the factors associated with blood loss ≥500ml are shown in Table 3. More participants in the non-exteriorized placenta removal group had blood loss ≥500mL and it was statistically significant (<0.001).

Table 4 showed the logistic regression for blood loss greater than 500mL and 1000mL, respectively. After regression analysis, the duration of surgery was not a significant determinant/predictor of blood loss of 1000ml or more (P-Value=0.480; OR: 1.224; 95% CI: 0.698-2.147). The likelihood of losing ≥500mL of blood during caesarean section is about five times more in non-exteriorized than exteriorized placenta removal group ((P< 0.001; OR: 5.67; 95%CI: 2.38-13.40).

Discussion

Worldwide, the rate of caesarean section is increasing, and despite the increasing knowledge and skills, caesarean delivery still carries higher maternal morbidity and mortality than vaginal delivery. In our study, the mean estimated blood loss (mL) in the exteriorized and non-exteriorized groups were 476.12±160.86 and 530.20±145.18 respectively. These values are lower than the 531± 184.1 in exteriorized and 691.1± 222.2 in non-exteriorized group reported by Xiao et al[15] as well as the 608±121in exteriorized and 570±140 in non-exteriorized group reported by Kaya *et al*[16]. The lower mean estimated blood loss recorded in our study may have been accounted by the studied population which were only women for primary CS contrary to the above two studies where participants were both those with primary and repeat CS. It has been documented that repeat CS may be associated with increased blood loss due to likelihood of adhesions and increased surgery time[22]. A further explanation for the lower mean blood volume loss in our study could be attributed to the timing of oxytocin administration. Contrary to the study by Kaya *et al*[16], in which oxytocin was administered after the delivery of the placenta, and Xiao *et al*[15], in which intramuscular oxytocin was administered after cord clamping & collection of cord blood for PH assay; immediately after the delivery of the baby, we administered intravenous bolus oxytocin whose onset of action is immediate thus producing early contraction of the uterus, facilitating placenta separation and limiting bleeding from the dilated sinuses.

When comparing the changes in haemoglobin concentration in the exteriorized and non-exteriorized placenta removal group, there was an 8% reduction in the difference between pre- and postoperative haemoglobin concentration; nevertheless, it was not statistically significant. This is similar to the finding by Kaya *et al*[16] but contrary to the findings by Xiao *et al*[15] which showed a statistically significant 22% reduction in the difference between preoperative and postoperative haemoglobin concentrations in the exteriorized group. It is thought that removing the placenta from exteriorized uterus reduces the time in which heavy bleeding from placenta bed can occur. This is because exteriorizing the uterus compresses and puts traction on the uterine vessels, which limit blood flow to the bleeding site[15]. The technique didn't offer any statistically significant benefit as regards blood loss in our study.

There are different methods of determining the amount of blood loss during CS, including visual estimation, volumetric measurement, gravitational measurement, haemodilutional spectrophotometric assays, and radiochromium labeled red blood cell assays[18,23]. Some of these methods require special equipments that are lacking in our institution, and not practical for clinical use. In our study, anaesthetists measured intraoperative blood loss by addition of volume of blood in the suction canisters; spill onto the drapes, surgical gown, and floor; and estimation from surgical mops. Each surgical mop in use at the study centers estimated to contain about 100 mL of blood at full saturation[18-21,24]. This method is easy, and we believe it is accurate enough because it has been shown that intra-operative blood loss estimates by anaesthetists correlated better with actual blood loss[25]. Although the estimation of blood loss was subjective in our study, the reduced estimated blood loss in the exteriorized group was nevertheless consistent with our finding of a reduced change in haemoglobin concentration in the placental removal from exteriorized uterus group.

There was a statistically significant association between placenta delivery method and blood loss of 500mL or more. And logistic regression showed about five times likelihood of having blood loss of 500mls or more with the non-exteriorized group. However, this finding is mainly of statistical importance rather than any clinical importance because clinically significant blood loss during caesarean section (PPH) is in excess of 1000mL[8].

This study is not without limitations. Visual estimation of blood loss, abdominal mop counting and volumetric measurement (suction bottle) used in our study are standard ways of estimating blood loss during CS although limited by amount of liquor and blood splash on drapes and on the floor. But we expect that the impact of errors in blood loss estimation may be minimal since the same method was used for both groups of participants. Furthermore, the researchers and anaesthetists were not blinded to the allocation arms. Nonetheless, the design of the study-prospective randomised study, lends credence to

the strength of the evidence obtained from this study.

Conclusion

This study showed statistically significant difference in blood loss of 500mls or more in the placenta delivery from non-exteriorized group compared to the exteriorized group. More participants in the non-exteriorized placenta removal group had blood loss ≥500mls (P-value <0.001). There was no significant difference in the mean blood loss, duration of surgery, and change in haemoglobin between the two groups. Therefore, based on our study, exteriorizing the uterus before placenta removal does significantly reduce blood loss during caesarean section. We,however, recommend more studies on this subject.

Acknowledgement

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References

1. Isah AD, Adewole N and Zaman J. A five-year survey of caesarean delivery at a Nigerian tertiary hospital. Trop J Obstet Gynaecol 2018;35:14-7
2. Tadevosyan M , Ghazaryan A, Harutyunyan A , Petrosyan V , Atherly A and Hekimian K. Factors contributing to rapidly increasing rates of caesarean section in Armenia: a partially mixed concurrent quantitative-qualitative equal status study. . BMC Pregnancy and Childbirth 2019;19(2): 1-10
3. Betran AP, Ye J, Moller AB, Zhang J, Gulmezoglu AM and Torloni MR. The Increasing trend in caesarean section rates: global, regional and national estimates: 1990–2014. PLoS ONE. 2016;11(2):e0148343
4. Ismail WO, Bello IS, Olowookere SA, Ibrahim AO, Agbesanwa TA and Adekunle WA. Caesarean delivery rate and indications at a secondary healthcare facility in Ibadan, South Western Nigeria: a five-year review. Afri Health Sci. 2021; 21(1):320-6.
5. Rukewe A, Fatiregun A and Adebayo K. Anaesthesia for caesarean deliveries and maternal complications in a Nigerian teaching hospital. Afr. J. Med. med. Sci. 2014:43: 5-10
6. Allagoa DO, Oriji PC, Tekenah ES, Obagah L, Ohaeri OS, Mbah KM, Ikoro C, Wagio TJ, Nwanze NC and Atemie G. Caesarean Section in a Tertiary Hospital in South-South, Nigeria: A 3-year Review. European Journal of Medical and Health Sciences.2021: 3(2): 122-6.
7. Pettersen S, Falk RS , Vangen S and Nyfløt LT. Exploring trends of severe postpartum haemorrhage: a hospital-based study: BMC Pregnancy and Childbirth.2023;23:363
8. Gari A, Hussein K, Daghestani M, Aljuhani S, Bukhari M, Alqahtani A and Almarwani M. Estimating blood loss during cesarean delivery: A comparison of methods. J Taibah Univ. Med Sc. 2022; 17(5):732e736.
9. Gungorduk K, Yıldırım G, Asıcıoglu O, Gungorduk OC, Sudolmus S and Ark C. Efficacy of Intravenous Tranexamic Acid in Reducing Blood Loss after Elective Cesarean Section: A Prospective, Randomized, Double-blind, Placebo-Controlled Study. American Journal of Perinatology. 2011; 28:233-9.
10. Dahlke J D, Mendez-Figueroa H, Maggio L, Sperling JD, Chauhan PS and Rouse JD. The Case for Standardizing Cesarean Delivery Technique. Seeing the Forest for the Trees. Obstet Gynecol 2020;136:972–80
11. Kanwal S, Naseer Awan S and Sadiqa Batool S. Efficacy of different placental removal methods in terms of blood loss during caesarean section. Pak Armed Forces Med J 2020; 70:578-83.
12. Ashraf S, Awan AS, Tabassum H, Ashraf O, Fatima T and Shadab W. Comparison of blood loss in manual and spontaneous removal of placenta in caesarean section. Journal Rawalpindi Medical College 2020;24:80-4
13. Kükrer S and Kükrer AP. Delivery method of the placenta in cesarean deliveries and the effect of uterine incision repair area on morbidity: A randomized controlled study. Turk J Obstet Gynecol 2021;18:92-102
14. Altraigey A, Ellaithy M, Atia H, Ali I, Kolkailah M and Abbas A. How can methods of placental delivery in cesarean section affect perioperative blood loss? A randomized controlled trial of controlled cord traction versus manual removal of placenta. J. Obstet. Gynaecol. Res. 2018
15. Xiao CW, Climan AB and Abenhaim HA. The Effect on Perioperative Bleeding of Placental Extraction From an Exteriorized Uterus During Caesarean Section.J Obstet Gynaecol Can 2014;36(5):384–390.
16. Kaya B, Guralp O, Daglar K, Tuten A, Demirol A, Yayci E, Atacag T and Dogan A. Extra-abdominal removal of placenta during cesarean section : a prospective randomized controlled trial of a novel technique. *J Perinat Med*. 2016.
17. Charan J and Biswas T. How to calculate sample size for different study designs in medical research. *Indian Journal of Psychological Medicine.* 2013;35(2):121.
18. Doctorvaladan VS, Jelks TA, Hsieh EW, Thurer LR, Zakowski MI and Lagrew DC. Accuracy of Blood

Loss Measurement during Cesarean Delivery. Am J Perinatol Rep 2017; 7:e93–e100

19. American society of Anaesthesiologists. Practice Guidelines for Perioperative Blood Management. Anesthesiology. 2015;122(2):241-75.
20. Matchuporn S, Wicharn C, Nathpong INA, Pattama P and Pratak OP. Increase Accuracy of Visual Estimation of Blood Loss from Education Programme. *J Med Assoc Thai*. 2006;89(Suppl 4):S54-9.
21. Ashleigh RA, Doohee L, Delilah JW and William AWJ. Accuracy of Blood Loss Estimations Among Anesthesia Providers. *AANA Journal*. 2014;82(4):300-6
22. Gasim T, Al Jama FE, Rahman MS and Rahman J. mulltiple repeat caesarean section: operative difficulties, maternal complications and outcome.*J Reprod Med*. 2013;58(7-8):312-8.
23. Schorn MN. Measurement of blood loss: review of the literature.J Midwifery Womens Health 2010;55(1):20-7.
24. Yusuf MM, Nwasor EO and Mohammed RI. Is 5 IU bolus of oxytocin as effective as 10 IU bolus for control of bleeding during caesarean section under spinal anesthesia?*Arch Med Surg*. 2017;2(1):7-11.
25. Jagun OE , Akadri AA , Shorunmu TO , Sotunsa JO and Popoola M. Accuracy of blood loss estimation at caesarean delivery. Res. J. of Health Sci. 2016; 4(2):141-7.