

## Original Article

# Safety of uneventful cesarean section in terms of hemorrhage

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**Abstract:** Objective: Hemorrhage still continues to be reported as one of the leading causes of maternal mortality and morbidity. Intraoperative estimation of the blood loss seems to be complex and misleading as it is impaired by the amount of amniotic fluid and blood from the placenta. The present study was aimed to investigate the safety of intraoperative deciding on an uneventful cesarean section in a low risk patient population. Material and methods: One hundred patients free from hemorrhage risks and experienced an uneventful elective cesarean section, were included to the study. The decline in hemoglobin and hematocrit values, calculated blood loss, transfusion rate and presence of hemorrhage related symptoms and signs were accepted as the main outcomes of the study. Results: The average preoperative and postoperative hemoglobin values were detected as  $12.09 \pm 0.18$  g/dl and  $10.72 \pm 1.39$  g/dl, respectively. The average decrease in hemoglobin was  $1.36 \pm 1.06$  g/dl. The observed decrease in hemoglobin values were less than 10% in 34.4% of the patients. The average blood loss was calculated to be  $517.06 \pm 417.55$  ml. There were no patients with signs and symptoms of hemorrhage. Cross match transfusion ratio, transfusion probability and transfusion index was calculated as zero. Conclusion: The decision of uneventful cesarean section provides obstetricians a safe postoperative and postpartum period after following standardized surgical procedures in terms of hemorrhage and related complications.

**Keywords:** Cesarean section, surgical blood loss, postpartum hemorrhage, blood transfusion

## Introduction

Hemorrhage still continues to be reported as one of the leading causes of maternal mortality and morbidity [1]. The blood loss greater than 500 mL after vaginal delivery and 750 mL after cesarean section (CS) has traditionally been accepted as postpartum hemorrhage [2]. Routine hematocrit (Hct) and hemoglobin (Hb) testing after CS are one of the very common features of postoperative care. The following risk factors were adopted as the possible risk factors contributing to hemorrhage; prolonged labor, augmented labor, rapid labor, history of postpartum hemorrhage, episiotomy, pre-eclampsia, over distended uterus, ethnicity, chorioamnionitis [3]. Intraoperative estimation of the blood loss seems to be complex and misleading as it is impaired by the amount of amniotic fluid and blood from the placenta. In the

present study, we investigated a more subjective but at the same time more practical clinical observation or sense: safety of deciding uneventful SC. The postoperative hemorrhage related symptoms, transfusion rate and postoperative Hb/Hct drop, calculated blood loss were accepted as the main outcome measures of the study.

## Materials and methods

This study conforms to the provisions of the revised Declaration of Helsinki. Before initiation of the study the institutional ethics committee approval was obtained from Haydarpasa Training Hospital. A detailed chart review of CSs was conducted to assess intra-operative factors and analyze postoperative-postpartum period. Demographic data, pre- and postoperative Hb and Hct levels, the number of blood

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**Table 1.** Demographic characteristics and main outcome measures

Characteristics	Mean $\pm$ SD	Range
Age (years)	29.93 $\pm$ 3.41	21.00-35.00
Parite (n)	1.72 $\pm$ 0.69	1-3
Gestational age at delivery (week)	38.51 $\pm$ 0.69	37.00-40.00
Body mass index (kg/m <sup>2</sup> )	28.25 $\pm$ 4.15	19.38-29.79
Birth weight (g)	3339.55 $\pm$ 408.67	2450-4050

units cross matched and transfused and the type of anesthesia were all recorded.

Hemorrhage was defined as decrease in Hb/Htc levels of 30% and 10% or greater, respectively, or calculated blood loss greater than 1500 ml, or any need of packed red cell transfusion [4]. Estimated blood loss was calculated according to a model which was found to be useful in indirect measurement of blood loss by Popovic et al. in obstetric patient population [5].

$Hb(\text{postop}) = Hb(\text{preop}) \cdot e^{(V/BV)}$

(BV: preop blood volume, V: Blood loss volume)

$V = BV \cdot \ln(Hb_{\text{preop}}/Hb_{\text{postop}})$

$BV = 0.356/H3 + 0.0308 BW + 0.1830/L$

H: Height; BW: Weight L: was taken from the anesthesia reports of the patient charts.

Women with any risk factors associated with increased risk of postpartum hemorrhage, such as excessive uterine distension, antepartum hemorrhage, abnormal hemostasis profile, systemic diseases, anemia (Hb <8 g), pregnancy specific diseases, history of a prior postpartum hemorrhage, obesity (BMI >30) were all excluded from the study. Only the planned and uneventful CSs were included in the study. The uneventful SC was defined as the absence of any bladder, ureteral or intestinal injury, uterine artery injury, uterine atonia, or taking no longer than 45 minutes.

### Statistics

In order to detect at least 10% difference in preoperative and postoperative hemoglobin concentrations which corresponds to 1.2 g/dl in a patient with a preoperative hemoglobin level of 12 g/dl, a total sample size of 45

patients was calculated to reach 80% power with a 5% alpha-error in population with standard deviation of 2 g/dl. The number of patients required for meeting statistical significance was calculated according to type of anesthesia. Patient recruitment was ceased with the first case meeting 50 patients in each group.

Collected data were analyzed by Statistical Package for Social Sciences version 15.0 (SPSS Inc., Chicago, IL, USA, 2006). Continuous variables were expressed as mean  $\pm$  standard deviation. Kolmogorov-Smirnov Goodness of Fit test was used to test the distribution of data. Student's T test was used to compare continuous variables between the independent groups. Paired Samples T test was used to compare the preoperative and postoperative measurements. Binary logistic regression analysis (Enter Method) was used for the comparison of the postoperative outcomes (blood loss, Hb and Htc difference) between first and repeat CSs as well as spinal and general anesthesia. Two-tailed P value less than 0.05 was accepted to be statistically significant.

### Results

A total of 960 women were delivered during the study period among whom 281 of them (29.2%) underwent CS. The first 100 cases meeting the study requirements were recruited to general and spinal anesthesia group equally (n = 50 vs n = 50) (Table 1).

The mean preoperative and postoperative Hb levels were 12.09 $\pm$ 1.18 g/dl and 10.72 $\pm$ 1.39 g/dl, respectively (P<0.001). The Hb levels were detected to decrease in 93.0% whereas to elevate in 6.0% of the cases. The mean delta Hb was 1.36 $\pm$ 1.06 g/dl. There was no statistical difference between the postoperative Hb and Htc levels and delta Hb levels of the previous CS group and first CS group (10.72 $\pm$ 1.30 g/dl vs 10.73 $\pm$ 1.51 g/dl), (31.32 $\pm$ 3.83% vs 30.75 $\pm$ 3.74%), (1.32 $\pm$ 0.94 g/dl vs 1.40 $\pm$ 1.20 g/dl) (Table 2). There was statistical difference between postoperative Hb, Htc and delta Hb levels of the spinal and general anesthesia group (11.22 $\pm$ 1.53 g/dl vs 10.22 $\pm$ 1.03 g/dl), (32.14 $\pm$ 4.08% vs 29.97 $\pm$ 3.14%), (1.00 $\pm$ 1.06 g/dl vs 1.72 $\pm$ 0.94 g/dl) (Table 3).

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**Table 2.** Comparison of postoperative hemoglobin and hematocrit levels according to number of cesarean sections

	Preoperative Hemoglobin	Postoperative Hemoglobin	P <sup>1</sup>	Mean Drop Hemoglobin	Preoperative Hematocrit	Postoperative Hematocrit	P <sup>2</sup>	Mean Drop Hematocrit
First CS (n = 46)	12.13±1.32	10.73±1.51	P<0.001*	1.40±1.20	34.68±3.27	30.75±3.74	P<0.001*	3.92±3.30
Repeated CS (n = 54)	12.05±1.06	10.72±1.30	P<0.001*	1.32±0.94	34.24±2.96	31.32±3.83	P<0.001*	3.01±3.32
P <sup>3</sup>	0.724	0.978		0.721**	0.590	0.456		0.175**

\*P<sup>1</sup>, P<sup>2</sup> = Paired Samples T-Test; \*\*P<sup>3</sup> = Student's T-Test.

**Table 3.** Comparison of postoperative hemoglobin and hematocrit levels between different modes of anesthesia

	Preoperative Hemoglobin	Postoperative Hemoglobin	P <sup>1</sup>	Mean Drop Hemoglobin	Preoperative Hematocrit	Postoperative Hematocrit	P <sup>2</sup>	Mean Drop Hematocrit
General (n = 50)	11.95±1.19	10.22±1.03	P<0.001*	1.72±0.94	34.06±2.94	29.97±3.14	P<0.001*	4.09±2.79
Spinal (n = 50)	12.22±1.17	11.22±1.53	P<0.001*	1.00±1.06	34.93±3.24	32.14±4.08	P<0.001*	2.78±3.70
P <sup>3</sup>	0.257	0.0000		<0.001**	0.165	0.004		0.049**

\*P<sup>1</sup>, P<sup>2</sup> = Paired Samples T-Test; \*\*P<sup>3</sup> = Student's T-Test.

**Table 4.** Comparison of the postoperative outcomes between spinal and general anesthesia

	O.R.	95% C.I		P*
		Lower	Upper	
Blood Loss	4.57	1.96	10.646	P<0.001
Hb Difference	3.62	1.59	8.418	P = 0.003
Htc Difference	1.92	0.865	4.290	P>0.05

\*P = Binary Logistic Regression (Enter Method).

The calculated blood loss, during CSs, was determined to be 517.06±417.55 ml for all CSs. There was also a statistically significant difference between spinal and general anesthesia group (667.26±372.59 ml vs. 366.86±409.138 ml, P<0.001), whereas the difference between previous CS and first CS group was not significant (535.60±475.23 ml vs. 501.24±365.20 ml, P = 0.684). There were two patients with a calculated blood volume more than 1500 ml. Postoperative close follow up period were uneventful for those cases and none of them did demonstrate any signs of transfusions.

Patients who underwent CS under general anesthesia were 4.5 times more likely to experience a serious hemorrhage, that was defined as the blood loss exceeding 500 ml, (OR = 4.57, 95% C.I. 1.96-10.646, P<0.001) and 3.6 times more prone to have a pre-postoperative hemoglobin difference over 10% (OR = 3.62, 95% CI 1.59-8.418, P = 0.003) compared to those who underwent cesarean under spinal anesthesia. Similarly delta Hb value was more prominent in general anesthesia group (OR = 1.92, 95% CI 0.865-4.290, P>0.05) (Table 4).

The analyses of our cohort revealed that 17 patients would have been sufficient to meet statistical significance rather than estimated 45 patients. There was no blood transfusion.

### Discussion

Cesarean section is one of the major obstetric surgeries, in which a change of 4-4.2% in Htc levels was expected according to existing literature [6]. As consistent with literature, we detected a change of 3.43±3.32 in Htc and 1.36±1.06 g/dl in Hb levels.

It has been reported that in cases of CS under spinal anesthesia, maternal hemorrhage risk is lower than that of general anesthesia [7]. All these findings seem to be associated with two potential effects of anesthetic agents; first, inhibitory effects on uterine contractions and second, disruptive effects on platelet functions and hemostasis. Our findings indicate that CS under general anesthesia result in a more explicit and profound blood loss.

This study showed no difference between the primary cesarean patients and those with a prior cesarean in terms of hemorrhage. This finding might have stemmed from selective measures to have taken against uterine atony which is the most important reason of intraoperative hemorrhage, by exclusion of grand multiparity, polyhydramnios, fetal macrosomia, prolonged labor and multiple gestations. In some studies, uterine scar formation is indicat-

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ed to affect contraction and to increase significantly intraoperative bleeding [8], whereas some others express previous SC to be of no clinical significance for postoperative period [9].

We detected the frequency of blood transfusion to be 0%. This rate has usually been reported as 3% in studies reporting cesarean-related transfusion rates [10]. Our results indicate that the probability of transfusion is much lower in patients of low risk group after an uneventful SC.

Monitoring of Hb/Htc levels has become a settled clinical practice for many years to have an idea postoperatively about blood loss in patients or to identify any possibility of hemorrhage development and to provide an opportunity of treating anemia at the early stages. But it was previously found unnecessary to follow Hb/Htc levels in low-risk patient population [11]. As a support of this finding, in our cohort any of the patients demonstrated transfusion requirement, either respect to Hb/Htc levels or clinical signs of hemorrhage. At this point, we would like to emphasize that our cohort consisted low risk parturients who experienced an uneventful standardized surgical procedure, so our results could not be interpreted to general obstetric population.

Standardization of intraoperative procedures is crucial for obtaining a steady achievement, because some techniques or even used materials might have potential effects on patient outcomes. Traditionally, SC begins through a Pfannenstiel incision, but in a 2013 review Joel-Cohen incision was found to be superior to Pfannenstiel incision in terms of postoperative outcomes [12]. Performing a bladder flap was found to be associated with greater (1 g/dl vs 0.5 g/dl) change in Hb levels compared with direct incision 1 cm above the bladder fold [13]. In a recent study, with a level of evidence 1, omission of the bladder flap was associated with non-significant change in hemoglobin levels [14]. In our CSs, bladder flap was formed when seemed necessary especially in previous CSs. Previous CS was not found to be one of the confounding factors of postpartum hemorrhage.

We prefer to use transverse incision in the lower uterine segment as it is usually recom-

mended in obstetrics [15]. The low vertical incision and classical incision have been associated with increased blood loss compared with the low transverse incision [16]. The expansion of uterine incision is generally recommended to be performed bluntly, which is associated with less maternal blood loss [17]. In the CORONIS study, conducted on randomized 15,935 women, intervention pairs, such as blunt versus sharp entry, exteriorization versus intra-abdominal repair of the uterus, single-layer versus double-layer closure of the uterus, closure versus non-closure of the peritoneum and chromic catgut versus polyglactin-910 for uterine repair, were compared and no statistically significant differences within any of the intervention pairs were determined [18].

Prevention of uterine atony has not been studied for cesarean delivery and also optimal infusion rate for oxytocin at CS is still unclear. In a recent randomized study infusion of 30 units of oxytocin in addition to five units of bolus may provide additional benefit in elective CSs [19]. In our practice, 20 units of oxytocin in 500 ml crystalloid and infusion at a rate of 125 ml/h have been routinely performed preceding the removal of the placenta.

Placental removal options of either spontaneous or manual at CS have been studied in 15 randomized trials including over 4600 women [20]. Spontaneous placental removal was found to be associated less blood loss. After spontaneous removal of placenta, the uterus was repaired after exteriorization while performing uterine massage. The exteriorization is associated with similar outcomes, including bleeding compared with leaving the uterus intra-abdominally for uterine incision repair [21]. The myometrial incision closed in a double layer suturing fashion with a polyglycolic acid (Vicryl-Ethicon) 1-0 continuous suture. There was no difference noticed between closure of uterine incision with one layer of suture and two layers in terms of blood loss [22].

Although our results have shown a statistically significant more bleeding in cases performed under general anesthesia, we want to underline that it was still safe as none of the patients have demonstrated clinical signs and symptoms of hemorrhage and none of them received transfusion.

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In general speaking for a low risk SC population we found a blood loss level around 500 ml, which was slightly below the Class I hemorrhage defined by American College of Surgeons [23]. Class I hemorrhage represents a blood loss up to 750 ml in which minimal physiological changes occur. The body can compensate well for this degree of hemorrhage. This situation is mimicked by a blood donation. So we could conclude that it could be reasonable to feel confidence after an uneventful SC.

### Conclusion

Obstetricians should keep in mind that the anesthesia type here found to be one of the associated factors related with intraoperative hemorrhage. The cases operated under general anesthesia were more likely to bleed than the cases operated under spinal anesthesia. The results of this study also indicate that having an intraoperative decision of an uneventful cesarean section was enough to feel safe in terms of hemorrhage regardless of type of anesthesia.

### Disclosure of conflict of interest

None.

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