# The Role of Types of Anesthesia on Maternal Blood Parameters among Women Underwent Cesarean Section

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## Abstract

**Background:** As the rates of caesarean births have increased, the type of cesarean section has gained importance.

**Objective:** To compare between maternal pre/postoperative hematological parameters (hemoglobin and hematocrit level), in addition to blood transfusion needed among pregnant women that underwent elective cesarean section under spinal and general anesthesia.

**Patients and Methods:** This study was carried out on 110 women underwent cesarean section during the period from the 1st of June 2013 to the 1st of July 2015 at Department of Obstetrics and Gynecology in Al-Noo'man Teaching Hospital in Baghdad. The study participants were randomly divided into two equal groups according to the type of anesthesia performed (55 cases for general anesthesia group and 55 cases for spinal anesthesia group). The changes in the maternal blood parameters including hemoglobin and hematocrit values in addition to blood transfusion needed were reported and compared between the two groups in pre and post-operative cesarean sections.

**Results**: The preoperative hemoglobin and hemaotocrit was insignificantly difference in the two groups. The mean hemoglobin and hematocrit concentrations were significantly reduced in women with general anesthesia compared to spinal anesthesia. Mean hemoglobin and hematocrit concentrations loss in spinal anesthesia group was significantly lower than in general anesthesia group. The requirement of blood transfusion after surgery was significantly higher among women undergone cesarean section under general anesthesia compared to those with spinal anesthesia.

**Conclusion**: Spinal anesthesia is a better choice of anesthesia as it reduces the amount of blood loss (less reduction in hemoglobin and hematocrit concentrations) and requirement of the post-operative blood transfusion.

**Key words:** Cesarean section, spinal anesthesia, general anesthesia, hemoglobin, Hematocrit.

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## Introduction

Even today, despite increasing knowledge and skills, cesarean delivery still carries higher maternal and perinatal mortality and morbidity risks than doe's vaginal delivery [1]. Twenty million cesarean sections (CS) are performed worldwide each year [2-3]. The CS rates have steadily increased worldwide over the past decades [4-6].

Anesthesia for CS is of particular importance because it affects millions of women worldwide. Both spinal anesthesia (SA) and general anesthesia (GA) are commonly used during cesarean delivery, and both have advantages and disadvantages. In many countries, particularly developed countries, SA is the preferred anesthetic method for CS [7]. There are many advantages of regional anesthesia (SA type) compared with those of GA. Spinal anesthetics have been associated with less post-operative pain and nausea. More importantly, SA reduces the incidence of general anesthetic complications and provides an early bonding between the mother and newborn. However, GA is still commonly used in some countries, primarily because of the greater physician familiarity with it [8-11]. Thus, it is important to determine which type of anesthesia is safer for use during CS. To date, only a few studies have been focused on the effect of the type of anesthesia used in CS on obstetric blood loss [11-14].

Thus, this study was carried out to compare maternal pre/postoperative hematological parameters including HB and HTC, in addition to blood transfusion needed among women that underwent elective CS under GA and SA.

## Patients and Methods

This study was conducted in department of obstetrics and gynecology of Al-Noo'man Teaching Hospital in Baghdad and Al-Hayat Al-Rahibat Hospital (private hospital) during the period from the1st of June 2013 to the1st of July 2015.

In addition to the demographic and operative data such as maternal age, gestational age, parity, history of previous CS, complete medical and obstetrical history, clinical assessment, hematological blood investigations and sonography were performed.

The study population comprised healthy pregnant women who were scheduled for elective CS. All the study group had a term uncomplicated singleton pregnancy between 37 and 42 weeks of gestation. The participants were randomly divided into two equal groups: mothers received general anesthesia (GA group) and mothers received spinal anesthesia (SA group). The two groups were matched for gestational age at delivery and type of uterine incision. CSs were all done using the same surgical technique, and within the groups, the same anesthetic procedures were used (either general or spinal). The involved women were informed and consented to be enrolled in this study. The included for this study were women of at least 18 years of age, accepting GA or SA for CS, no medical or surgical conditions requiring special attention and no history of obstetric pathology, est. The excluded from the study were women who were anemic preoperatively (packed cell volume <30%), had history of ante-partum hemorrhage, clotting disorders, pre-eclampais, eclampsia, those with abortia placenta, placenta previa, fetal distress syndrome, spinal deformity, cord prolapsed, < 37 weeks of gestation, contraindication to SA and GA and failed induction of labor. Women with expected surgical difficulties like adhesions were also excluded.

Changes in maternal HB and HCT concentrations at the day of surgery and 24 hours after surgery were checked and analyzed according to the type of anesthesia performed. CS was done under either GA or SA according to the surgical indications and woman's desire. Visual estimation of intra-operative blood loss was also reported and compared between the two groups undergoing CSs.

## Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences software Version 17.0 (SPSS Chicago, IL, USA). Descriptive statistics were stated as the mean, standard deviation, frequency and percentages. Statistical analyses were performed using Student's t test to compare the continuous variables. The paired samples t-test was used to compare between the pre and post-operative values and the Chi-square test was used for categorical variables. P value $p<0.05$ was considered statistically of significance.

## Results

A total of 110 pregnant women undergoing elective CS were included in this study. Their age ranged from 15-42 years with a mean age of 31± 3.6 years. GA was conducted for 55 women and the other 55 women asked for SA. The mean age of women in the GA group was 25± 4.6 and in the SA group were 26±1.3 years old. Twenty three pregnant women had no history of previous CS, while the others had 1-3 previous CS. In general, the operative time ranged from 30- 45 minutes, with a mean of 25± 8.3 minutes. The mean duration of operation in the GA group was 27± 2.3 and in the SA was 26± 3.5 minutes. This difference was also not statistically of significance. From other side; there was no significant difference between the two groups with respect to the mean subject age, gravidity, parity, number of nulliparous women, or number of previous CSs. The two groups were similar in terms of indications for CS.

As shown in table [1], the mean preoperative HB concentration was 11.857± 0.5569 in the GA group and 11.837±0.4986 in the SA group. There was no significant difference in the preoperative HB concentrations between the two groups (P=0.8431). The mean postoperative HB was 11.037± 0.6515 in the GA group and 11.313±0.5131 in the SA group. The postoperative HB concentration was significantly lower in the GA group than in the SA group (P=0.0151). Thus, significantly lower operative blood loss was achieved using SA during elective CS compared with that using GA. The mean difference between the preoperative and postoperative HB concentration in the GA group was 0.72± 0.0495. The mean difference between the preoperative and postoperative HB concentration in the SA group was 0.5233± 0.0507. The difference between the preoperative and postoperative HB was statistically significant (P=0.0001). These findings showed that the GA group had a significantly higher HB loss compared to the SA group .The mean pre and post-operative HB among women underwent GA were 11.857 ± 0.5569 and 11.037± 0.6515 g/dl, respectively. This difference was statistically significant (P=0.0151).The mean pre and post-operative HB among women underwent SA were 11.837± 0.4986 and 11.313 ± 0.5131 g/dl, respectively. The difference was also of statistically significant (P=0.0001) (table1).

Concerning HCT levels, Table (2) showed that the mean pre and post-operative HCT in GA group were 35.683± 1.6634 and 33.85 ± 1.935, respectively. This difference was found to be statistically of significance (P=0.0001). The mean pre and post-operative

HCT level among women underwent SA were 35.50 ± 1.4081 and 34.33± 1.539, respectively. This difference was statistically significant (P=0.0001). The mean preoperative HCT was 35.683± 1.6634 in the GA group and 35.50 ± 1.4081 in the SA group. This difference was not statistically significant (P=0.5348). The mean postoperative HCT was 33.85± 1.935 in the GA group and 34.33 ± 1.539 in the SA group. The postoperative HCT concentration was significantly lower in the GA group than in the SA group (P=0.0001). Thus, a significantly lower operative blood loss was achieved using SA during elective CS compared with that using GA. Generally, these findings demonstrated that GA group had a significantly higher drop in HCT compared to the SA group (1.833± 1.523 vs. 1.166± 0.1734), respectively (P=0.0017) (table 2).

Table [3] showed the distribution of pregnant women undergoing general and spinal anesthesia according to the need of blood transfusion. It was found that (9/55 cases) 16.4% of pregnant women who were given GA received blood transfusion, while only (2/55 cases) 3.6% of pregnant women who were given SA received blood transfusion. This difference was found to be statistically of significance (P=0.0261) (table 3).

**Table (1):** Hemoglobin levels among pregnant women underwent cesarean section under general and spinal anesthesia.

| Cesarean Section under | HB level | | | | | Mean difference HB loss | P Value |
|---|---|---|---|---|---|---|---|
| | No | Pre-operative | | Post-operative | | | |
| | | Mean ± SD | SE | Mean ± SD | SE | | |
| **GA** | 55 | 11.86 ± 0.55 | 0.10 | 11.14 ± 0.652 | 0.12 | 0.72 ± 0.05 | t=6.230 P=0.0001 |
| **SA** | 55 | 11.84 ± 0.50 | 0.09 | 11.31 ± 0.51 | 0.09 | 0.52 ± 0.05 | t=5.4316 P=0.0001 |
| **Total** | 110 | t= 0.1984 P=0.8431 | | t=1.5739 P=0.1184 | | t=20.5874 P=0.0001 | |

**Table (2):** Hematocrit levels among pregnant women underwent cesarean section under general and spinal anesthesia.

| Cesarean Section under | HCT levels | | | | | Mean difference HCT loss | P Value |
|---|---|---|---|---|---|---|---|
| | No | Pre-operative | | Post-operative | | | |
| | | Mean ± SD | SE | Mean ± SD | SE | | |
| **GA** | 55 | 35.68 ± 1.66 | 0.30 | 33.85 ± 0.353 | 1.93 | 1.83 ± 1.52 | t=5.3274 P=0.0001 |
| **SA** | 55 | 35.50 ± 1.41 | 0.26 | 34.33 ± 0.281 | 1.539 | 1.16 ± 0.17 | t=4.1597 P=0.0001 |
| **Total** | 110 | t=0.6227 P=0.1898 | | t=7.8898 P=0.0001 | | t=3.2271 P=0.0017 | |

**Table (3):** Distribution of pregnant women underwent cesarean section under general and spinal anesthesia according to the need of blood transfusion.

| Blood Transfusion | GA Group | | SA Group | | Total | |
|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % |
| Yes | 9 | 16.4 | 2 | 3.6 | 11 | 10 |
| No | 46 | 83.6 | 53 | 96.4 | 99 | 90 |
| Total | 55 | 100 | 55 | 100 | 110 | 100 |
| $X^2$ =4.9495 P=0.0261 | | | | | | |

## Discussion

Cesarean sections still represent a global public health problem. Obstetric hemorrhage remains a leading cause of maternal morbidity and mortality in both developed and developing countries. Therefore, the prevention of maternal mortality and morbidity due to obstetric hemorrhage will necessarily involve the use of a safe and effective anesthetic technique that causes less bleeding among other life-saving measures, and it is unfortunately always underestimated and consequently inadequately replaced [15-16]. Unfortunately, despite improving outcomes, the poor and minorities still lose pregnant lives due to hemorrhage and the subsequent problems. Among the diseases underlying postpartum hemorrhage, GA and SA have also been mentioned [17]. Cesarean sections is one of the most common surgeries in women. The option of GA or SA for SC depends on the mother's desire and maternal-fetal condition [18].

Spinal anesthesia is the most common type of epidural anesthesia used in CS, although it is noticed that GA is desired by the patients because of the fear of being awaked during the surgery, but the SA is preferred by the anesthesiologist because of its safety towards the patients and their babies [19].

Over recent years, most physicians believe that in most cases, GA is more reliable for a rapid anesthesia for CS but others reported an increase in the number of cases of regional (spinal) anesthesia as an alternative to GA to all mothers [20].

In this study, different blood parameters have been used as variables to estimate blood loss including HB and HCT measurement, in addition to number of units transfused needed.

Analysis of our results revealed that the mean HB concentration and HCT level in both groups of GA and SA were significantly dropped as compared with those before surgery. The results of this study also showed that HB concentrations and HCT level loss after CS in women receiving GA were higher than in women receiving SA. These indicated that both the type surgery and postoperative hemorrhage had an impact on the loss of HB and HCT after surgery, since750-1000 ml of blood loss is usually lost during performing CS [21]. Our findings were in agreement with studies conducted in Iran by Javadi *et al* [22], Marzouni *et al*.[23], Zamani *et al.* [24]. In Pakistan by Najam and Riaz Dar[25], in Korea by Kim *et al*.[26], and Eunkim *et al.* [27], and in Turkey by Aksoy *et al*.[16] . In Nigeria, Anzaku *et al.* [28] reported that 96.6% of the women had a drop in HCT level postoperatively. On the other hand, our findings are inconsistent with many reports of insignificant difference in blood loss between women with GA and SA [13][29-

30]. However, in a comparative study carried out by Hong and his colleagues [31] in south Korea about the effect of GA and SA on hemodynamic and amount of blood loss in pregnant women, they found insignificant differences between the two groups in term of blood loss including both HB and HCT concentrations, These differences may be related to the differences in the study protocols and the possible biases resulting from selection of the cases, sample size calculation, and unequal number of the comparison groups, and faulty randomized scheme [16].

The reduction of HB and HCT levels after surgery in the two groups of GA and SA, with a higher drop among women underwent GA compared to SA may be due to the halogenated anesthetic agents that used to supplement nitrous oxide during balanced general anesthesia for cesarean delivery to decrease maternal awareness, since these agents can interfere with uterine contractility that have the potential risk for increased blood loss at the time of cesarean section under GA compared with pregnant women underwent CS under SA [12][16][32]. Regarding to postoperative BT needed, our findings revealed a significantly lesser number of women required BT in the group of women receiving SA compared to those receiving GA. This agrees with study that reported by Najman and Riadzar [25] who found that 14.6% of women in GA group received BT, while 3.2% of the women who were given SA received BT. Our finding was also consistent with a report by Afolabi *et al.* [33] who found that women undergoing CS under GA are at a higher risk of blood loss, HTC and need for BT compared to those with SA. Our result was also in agreement with Aksoy *et al*.[16] and Kim *et al* [26]. Who reported that more women who received GA required BT than those who received SA. In contrast, other studies found no significant difference between the two groups with respect to blood loss and requirement of BT two days after surgery, or none of the women undergoing CS under GA needed for BT [10][28].

In conclusion, the amount of blood loss represented by HB and HCT concentrations was reduced among women undergone CS under SA which demonstrated that the postoperative HB and HCT was found to be better in those women; in addition to that lesser number of the women who received SA required BT. However, the SA should be the better and safer type of anesthesia in pregnant women underwent CS. Although our finding is consistent with many previous studies, the clinical relevance of this difference in operative blood loss is unclear. Therefore, there is an obvious requirement for well-designed, large –scale, prospective, and homogenous studies of all of the anesthetic techniques used in obstetric surgery and their effect of operative blood loss.

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