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Research Article

Comparing General versus Spinal Anesthesia for Cesarean Section in a Severely Pre-eclamptic Parturients

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Abstract

Background: Preeclampsia poses a high challenge during anesthesia. Both spinal anesthesia (SA) and general anesthesia (GA) are commonly used for the operative management of severe preeclampsia. The study aimed to assess feto-maternal outcomes among severely preeclamptic parturients scheduled for emergency cesarean section (C/S) delivery under GA or SA.

Methods: A total of 80 parturients were enrolled into two equal groups, one group received SA and the other GA. Vital parameters were recorded before starting and during the procedure. The Chi-square test was used for analysis. A *P*-value of ≤0.05 was considered significant.

Results: Both groups were similar in age, weight, parity, gestational age, and duration of surgery. An intraoperative need for vasopressors was higher in spinal anesthesia (*P*-value 0.013). Significant intraoperative decreases in blood pressure were observed in SA. The rate of intensive care unit (ICU) admission was higher in GA (11 vs 4 patients, *P*-value 0.0463).

Conclusion: Assuming no contraindication, SA is the first choice for cesarean section delivery in a severely preeclamptic parturient.

Keywords: anesthesia, cesarean section, pregnancy hypertensive disorders, severe preeclampsia

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1. Introduction

Pregnant women are more likely to suffer from hypertensive disorders than nonpregnant women. There are many deaths and morbidities associated with preeclampsia for both fetus and mother. The condition also identifies people at high risk for cardiac diseases. Appropriate treatment and measures have the potential to significantly reduce hypertension-related complications in cases of severe preeclampsia.[1–3]

Preeclampsia is a prevalent syndrome usually distinguished by the development of high blood pressure and proteinuria during pregnancy. It is represented by the incapacity of the trophoblast to penetrate the uterine arteries, impairing remodeling of placental perfusion, and inadequate nutrient transport. It consists of two phases of the disease mechanism. In the first phase, the placenta fails to implant successfully in the uterine wall. In the second phase, the arteries supplying the fetus are compromised due to hypoxia from decreased oxygen reserve.[4–6] Preeclampsia can also occur frequently in parturients with essential hypertension in three to five folds higher in contrast to normotensive ladies at fertilization.[7] One of the cardinal aspects of optimal antenatal care during pregnancy is detecting elevated blood pressure. The American College of Obstetricians and Gynecologists and the Society for Maternal-Fetal Medicine suggest delivery after 34 weeks of gestation in severe preeclampsia.[8] It was hypothesized that SA is better than GA with reference to stable vital parameters amongst severe preeclamptic parturients going through caesarean section (C/S). We aimed to evaluate feto-maternal consequences in patients with severe preeclampsia experiencing emergency C/S and receiving general anesthesia (GA) or spinal anesthesia (SA). The mean arterial pressure (MAP) was used as the primary objective. The secondary objective was to assess anesthesia-related complications in cesarean section in severe preeclampsia.

2. Materials and Methods

This cross-sectional, comparative, retrospective, hospital-based interpretation was carried out from February 2022 to April 2022 at Omdurman Obstetrics Teaching Hospital (OMTH), Khartoum State, Sudan. Following the ethical approval from the Sudan Medical Specialization Board and permission from OMTH authority, the reports of a total of 80 parturients presented for an urgent cesarean section with severe preeclampsia were included in our study. Patients' reports of cardiac problems, chronic hypertension, diabetes mellitus, epilepsy, thyroid dysfunction, sepsis, neurological problems, severe allergic reactions, antepartum hemorrhage, and pulmonary edema were excluded from the study group. Also, patients with a history of failure to receive regional anesthesia leading to conversion to GA were excluded. Patients were assigned to one of two equal groups, the GA or SA group. For the calculation of sample size, the MAP was considered as the primary outcome. A total of 80 patients (40 in each group) is sufficient to rack up a two-sided type 1 error of 0.05% with a power of 80%. The Statistical Package for Social Sciences (version 21.0) was adapted for data entry and analysis. Categorical variables are presented as numbers and proportions, while quantitative variables are presented as means and standard deviations. The Chi-square test was used. A *P*-value ≤ 0.05 was regarded as significant.

3. Results

A total number of 80 parturients, with severe preeclampsia, who underwent emergency C/S were included in the trial. They are allocated into either the GA or SA group. The age, maternal weight, parity, gestational age, use of antihypertensive agents, indication of C/S, and total surgical duration (mins) were evaluated and compared between GA and SA without statistically significant results (Table 1). The use of intraoperative vasopressors was higher in SA (24 patients) compared to 12 in the GA group with a significant statistical difference (*P*-value 0.013; Table 1).

The two groups showed no statistical differences in the base heart rate and events during the rest of the surgery. The mean of SBP, DBP, and MAP showed significant decreases in the SA group compared to the GA group, mostly during the early part of the procedures (Table 2).

Group GA showed a higher percentage of acute kidney injury (AKI), pulmonary edema, and congestive heart failure (CHF) compared to SA (*P*-value 0.0078). Eleven patients in the GA group were admitted to ICU compared to 4 patients in the SA group with a significant difference (*P*-value 0.0463; Table 3).

Table 1: The demographic character, parity, gestational age, antihypertensive agents, indication of surgery, intraoperative, vasopressors, and duration of surgery.

Character	GA (n = 40)	SA (n = 40)	P-value
	n (%)	N (%)	
Age (yrs)			
<30	19 (47.5%)	17 (42.5%)	0.655
>30	21 (52.5%)	23 (57.5%)	
Weight (kg)			
50–60	5 (12.5%)	2 (5%)	0.238
61–70	14 (35.0%)	10 (25.0%)	
71–80	15 (37.5%)	21 (52.5%)	
81–90	6 (15.5%)	7 (7.5%)	
90–100	0	0	
>100	0	0	
Parity			
1–3	18 (45.5%)	15 (37.5%)	
>3	12 (30%)	25 (62.5%)	
Gestational age (yrs)			
<40	10 (25.0%)	7 (17.5%)	
>40	20 (50%)	33 (82.5%)	
Antihypertensive agents			
Hydralazine	19 (47.5%)	21 (52.5%)	
Methyldopa	17 (42.5%)	15 (37.5%)	
Labetalol	4 (10%)	4 (10%)	
Indications of C/S			
Fetal distress	14 (35.0%)	12 (30%)	
Diminished fetal movements	6 (15%)	8 (20%)	

Table 1: Continued.

Character	GA (n = 40)	SA (n = 40)	P-value
	n (%)	N (%)	
Contracted pelvis	3 (7.5%)	2 (5%)	
Previous cesarean section	12 (30%)	15 (37.5%)	
Failure of induction	3 (7.5%)	3 (7.5%)	
Obstructed labor	2 (5%)	0	
Intraoperative vasopressors			
Yes	12 (30%)	24 (60%)	0.0074*
No	28 (70%)	16 (40%)	
Duration of surgery (mins)			
40	6 (15%)	10 (25%)	
50	30 (75%)	29 (72.5%)	
60	4 (10%)	1 (2.5%)	
>60	0	0	

C/S, cesarean section; Chi-squared test; *P*-value ≤0.05 (significant)

Table 2: The heart rate and blood pressure parameters.

Character	GA (n = 40)	SA (n = 40)	P-value
	Mean ± Std	Mean ± Std	
Heart rate (beats per minute)			
Basal	96.0 ± 12.5	94.5 ± 11.0	0.942
Immediate after anesthesia	103.20 ± 10.6	92.83 ±12.3	0.0001*
5 after anesthesia	98.97 ± 7.5	95.66 ± 8.9	0.0759
10 after anesthesia	96.7 ± 15.2	94.5 ± 13.3	0.784
20 after anesthesia	96.7 ± 9.9	96.0 ± 11.4	0.831
30 after anesthesia	90.0 ± 8.1	88.0 ± 8.8	0.655
40 after anesthesia	88.0 ± 8.2	88.7 ± 7.5	0.684
50 after anesthesia	86.5 ± 6.9	88.0 ± 9.1	0.58
Systolic blood pressure (mmHg)			
Basal	140.2 ± 16.6	135.0 ± 19.8	0.503
Immediate after anesthesia	145.50 ± 11.9	133.60 ± 13.0	0.0001*
5 after anesthesia	141.70 ± 9.2	130.70 ± 10.6	0.0001*
10 after anesthesia	119.2 ± 8.5	113.2 ± 11.4	0.082
20 after anesthesia	125.0 ± 9.6	116.7 ± 10.4	0.025*
30 after anesthesia	123.0 ± 11.8	115.5 ± 10.8	0.061
40 after anesthesia	127.0 ± 9.8	122.2 ± 11.6	0.068
50 after anesthesia	120.9 ± 19.6	124.7 ± 8.4	0.737
Diastolic blood pressure (mmHg)			
Basal	81.2 ± 12.4	76.5 ± 14.7	0.188
Immediate after anesthesia	85.50 ± 6.3	75.07 ± 8.6	0.0001*

Table 2: Continued.

Character	GA (n = 40)	SA (n = 40)	P-value
	Mean ± Std	Mean ± Std	
Diastolic blood pressure (mmHg)			
5 after anesthesia	82.18 ± 9.7	67.63 ± 8.4	0.0001*
10 after anesthesia	70.0 ± 10.8	64.5 ± 7.8	0.019*
20 after anesthesia	68.2 ± 8.4	63.5 ± 7.3	0.14
30 after anesthesia	69.5 ± 6.7	66.7 ± 7.9	0.269
40 after anesthesia	70.7 ± 6.9	66.7 ± 7.6	0.112
50 after anesthesia	65.5 ± 7.4	62.5 ± 6.6	0.196
Mean arterial blood pressure (mmHg)			
Basal	101.9 ± 12.7	95.6 ± 15.7	0.153
Immediate after anesthesia	103 ± 10.1	96.6 ± 12.3	0.0130*
5 after anesthesia	104 ± 12.5	90.6 ± 8.3	0.0001*
10 after anesthesia	86.1 ± 7.3	80.3 ± 7.5	0.167
20 after anesthesia	87.0 ± 5.4	82.6 ± 6.7	0.007*
30 after anesthesia	87.0 ± 5.9	84.8 ± 6.3	0.061
40 after anesthesia	88.9 ± 5.4	86.8 ± 5.9	0.083
50 after anesthesia	84.6 ± 6.3	86.8 ± 6.0	0.438

Chi-squared; P-value ≤ 0.05 (significant)

Table 3: Maternal complications, fetal Apgar score, ICU admission.

Character	GA (n = 40)	SA (n = 40)	P-value
	n (%)	n (%)	
Maternal complications			
AKI	4 (10%)	0 (0%)	0.0414*
CHF	3 (7.5%)	0 (0%)	0.0794
Pulmonary edema	7 (17.5%)	4 (10%)	0.0528
HELLP syndrome	1 (2.5%)	0 (0%)	0.3173
Headache	0 (0%)	7 (17.5%)	0.0059*
Pain at the site of the spinal	0 (0%)	11 (27.5%)	0.0004*
Fetal Apgar score at 1 min (<7)			
	9 (22.5%)	10 (25.0%)	0.794
Fetal Apgar score at 5 min (<7)			
	3 (7.5%)	3 (7.5%)	1
ICU admission			
Yes	11 (27.5%)	4 (10%)	0.0463*
No	29	36	

4. Discussion

Severe preeclampsia is described as the new commencement of severely elevated blood pressure (systolic > 160 mmHg or diastolic > 110 mmHg), paired with proteinuria (>5 gr per 24 hrs) after the 20th week of pregnancy. It can be attended with manifestations of impending eclampsia, oliguria < 400 ml per 24 hrs, pulmonary edema, epigastric or right upper quadrant discomfort (liver capsule distension), or HELLP (hemolysis, elevated liver enzymes, and low platelets) syndrome [9, 10].

In our study, the records of 80 patients with severe preeclampsia (half of whom were operated under SA and the other half were operated using GA) scheduled for emergency C/S delivery were reviewed. Both SA and GA were similar in the demographic determinants. In the preoperative or prior to the administration of anesthesia, the mean pulse rate, systolic, diastolic, and mean arterial blood pressure had no significant differences (*P*-value $\leq$ 0.05).

A total number of 80 parturients, with severe preeclampsia, who underwent emergency C/S were included in the trial. They were allocated into either the GA or SA group. Age, maternal weight, number of parity, gestational age, use of antihypertensive agents, indication of C/S, and total surgical duration (mins) were evaluated and compared between the GA and SA with no statistically significant results. The use of intraoperative vasopressors was higher in SA (24 patients) compared to those in the GA group (12) with a significant statistical difference (*P*-value 0.013). The two groups showed no difference in the base heart rate and events during the rest of the surgeries. The mean of SBP, DBP, and MAP showed significant decreases in the SA group compared to the GA group, mostly during the early part of the procedures. Group GA had a higher percentage of AKI, pulmonary edema, and CHF compared to the SA (*P*-value 0.0078). Eleven patients in the GA group were admitted to ICU compared to 4 patients in the SA group with a significant difference (*P*-value 0.0463).

Our Trial showed that SA tends to decrease the high levels of vital parameters toward the normal range. The mean heart rate following SA is lower than following GA despite insignificant statistical differences. A study conducted by Adugna *et al.* in Ethiopia showed a statistical difference in the decreases of the mean heart rate among women who received SA compared to those who received GA [11]. On comparing the SA group to the GA group, decreases in SBP, DBP, and MAP were noticed and found to be significant. This finding is similar to old studies carried out in different countries and districts of the world such as Nigeria, India, Ethiopia, and South Africa [9–14]. SA causes systemic vasodilatation due to sympathetic blockade leading to the collection and stagnation of blood in the venous system and a decrease in systemic vascular resistance. It has been considered the principal tool for the reduction in blood pressure [11].

Headache and pain at the sites of spinal needle injections were demonstrated in the spinal group. They were self-limiting or required simple interventions. The serious maternal complications mandating intensive care unit (ICU) admissions were AKI, pulmonary edema, HELLP syndrome, and heart pump failure. The results of the current study are corresponding to previous studies [10, 14]. However, Obi and Umeora have demonstrated no differences in maternal morbidity and mortality [15].

In addition to avoiding airway manipulation, regional anesthesia offers the benefit of not requiring the polypharmacy that is used in GA. In cases of no contraindication, SA seems to be the first choice of anesthesia for cesarean delivery. In pregnant parturients, GA is associated with an increased risk of pulmonary aspiration, hypoxia, and airway obstruction than in nonpregnant women. These hazardous complications are not only minimized during SA but other advantages including delivering supreme postoperative pain management, which extenuates the hypertensive reaction to pain, a decrease in the levels of disseminating catecholamines and stress-reacted hormones, and probable enhancement of

intervillous blood supply could be offered [10]. An increase in the use of intravenous vasopressor drugs such as ephedrine and phenylephrine were reported in the SA group. Sivevski *et al.* found that the frequency and extremity of spinal-produced hypotension in preeclamptic parturients are less than that in healthy women [16].

Neonatal outcomes are affected by many factors during cesarean section delivery in cases of severe preeclampsia, which includes not only maternal and neonatal illness but also complications in anesthetic and surgical management. There is no doubt that fetal growth and maturation are correlated with fetal age and uteroplacental circulation. In our study, we observed that no statistical difference in Apgar scores of <7 at the first and fifth minutes between the two groups (*P*-value 0.794 and 1.000). The finding is similar to Dyer *et al.*'s who compared GA with SA for C/S delivery in preeclamptic parturients with a non-reassuring cardiotocography (fetal heart rate) in Cape Town, South Africa [12]. However, Edipoglu *et al.* found that the one-minute Apgar scores were significantly lower for cases with GA compared to those with SA during the emergency cesarean section for fetal distress [17]. A previous retrospective observational study by Okafor and Okezie in Enugu, Nigeria revealed a high maternal and fetal mortality in patients with preeclampsia or eclampsia presented for C/S [18].

5. Limitations

Small sample size due to insufficient data in hospital records. This study was conducted at a single hospital.

6. Conclusion

Both SA and GA could be used for cesarean section delivery in a severely preeclamptic patient. Whenever there is no contraindication, SA could be a good choice with less postoperative feto-maternal morbidity and mortality. However, it should be noted that regardless of the type of anesthesia, severe preeclampsia needs optimal perioperative management for better outcomes for mothers and newborns.

Declarations

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Ethical Considerations

Ethical approval was obtained from the Sudan Medical Specialization Board the OMTH authority.

Competing Interests

None.

Availability of Data and Material

The data and materials supporting this study are available within the published article.

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None.

Abbreviations and Symbols

AKI: Acute kidney injury

CHF: Congestive heart failure

CS: Cesarean section

DBP: Diastolic blood pressure

HELLP: Hemolysis, Elevated liver Enzymes, and Low platelet count

HR: Heart rate

GA: General anesthesia

ICU: Intensive care unit

MAP: Mean arterial blood pressure

SA: Spinal anesthesia

SBP: Systolic blood pressure

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