Al-Rafidain J Med Sci. 2024;7(1):93-97.
DOI: https://doi.org/10.54133/ajms.v7i1.1067

A J M S
Online ISSN (2789-3219)

Research Article

Anesthesia Type Outcome in Severe Pre-eclampsia with Caesarean Section

Haitham Bahaa Al Dallal*, Bayan Thuban Al-Jobury
Al-Imam Al-Sajjad Hospital, Al-Najaf Health Directorate, Al-Najaf, Iraq

Received: 30 May 2024; Revised: 4 July 2024; Accepted: 14 July 2024

Abstract

Background: Preeclampsia is a hypertensive disorder during pregnancy with fetomaternal mortality. The choice of anesthesia method for cesarean sections among preeclamptic women is still debated. ***Objective***: To compare the outcomes of spinal and general anesthesia in a cesarean section among preeclamptic women. ***Methods***: A prospective study was conducted at Al-Imam Al-Sajjad Hospital/Al-Najaf Health Directorate from February 2021 to September 2023. Women undergoing cesarean sections due to severe preeclampsia were enrolled in the spinal or general anesthesia group. Data on maternal age, gestational age at delivery, parity, Apgar scores, maternal mortality and perinatal mortality were recorded. The background characteristics and outcomes were compared between both groups. We excluded women with mild preeclampsia, multiple pregnancies, other pregnancy medical disorders, gestational age < 32 weeks, cases of eclampsia, and general anesthesia following spinal anesthesia failure. ***Results***: The general anesthesia group had a significantly lower Apgar score at 1 minute than the spinal anesthesia group (27.3% and 57.4%, *P*=0.006), and at 5 minutes (15.2% and 37.03%, *P*=0.005). The study groups showed no significant difference regarding maternal and perinatal mortality. ***Conclusions***: Maternal and perinatal mortality were not affected by anesthesia type in severe preeclampsia, but general anesthesia caused a higher proportion of birth asphyxia.

Keywords: Cesarean section, General anesthesia, Maternal mortality, Perinatal mortality, Severe pre-eclampsia, Spinal anesthesia.

نتائج نوع التخدير في حالات تسمم الحمل الشديدة مع العملية القيصرية

الخلاصة

الخلفية: تسمم الحمل هو ارتفاع ضغط الدم أثناء الحمل مع مخاطر وفيات الأمهات والجنين. لا يزال اختيار طريقة التخدير للعمليات القيصرية بين النساء المصابات بتسمم الحمل موضع نقاش. **الهدف**: مقارنة نتائج التخدير النخاعي والعام عند اجراء العملية القيصرية للنساء المصابات بتسمم الحمل. **الطريقة**: أجريت دراسة استشرافية في مستشفى الامام السجاد /النجف في الفترة من شباط 2021 الى ايلول 2023. تم تسجيل النساء اللائي يخضعن لعمليات قيصرية بسبب تسمم الحمل الشديد في مجموعة التخدير النخاعي أو العام. وسجلت بيانات عن عمر الأم، وعمر الحمل عند الولادة، والتكافؤ، ودرجات أبغار، ووفيات الأمهات، والوفيات في الفترة المحيطة بالولادة. تمت مقارنة الخصائص الأساسية والنتائج بين كلا المجموعتين. استبعدنا النساء المصابات بتسمم الحمل الخفيف، والحمل المتعدد، واضطرابات الحمل الطبية الأخرى، وعمر الحمل < 32 أسبوعا، وحالات تسمم الحمل الخفيف، والتخدير العام بعد فشل التخدير النخاعي. النتائج: كان لدى مجموعة التخدير العام درجة أبغار أقل بكثير في دقيقة واحدة من مجموعة التخدير الشوكي (27.3٪ و 57.4٪)، وفي 5 دقائق (15.2٪ و 37.03٪)، لم تظهر مجموعات الدراسة أي فرق كبير فيما يتعلق بوفيات الأمهات والوفيات في الفترة المحيطة بالولادة. **الاستنتاجات**: لم تتأثر وفيات الأمهات والفترة المحيطة بالولادة بنوع التخدير في تسمم الحمل الشديد، لكن التخدير العام تسبب في نسبة أعلى من الاختناق عند الولادة.

* ***Corresponding author***: Haitham B. Al Dallal, Al-Imam Al-Sajjad Hospital, Al-Najaf Health Directorate, Al-Najaf, Iraq; Email: haithambahaa8@gmail.com

Article citation: Al Dallal HB, Al-Jobury BT. Anesthesia Type Outcome in Severe Pre-eclampsia with Caesarean Section. *Al-Rafidain J Med Sci*. 2024;7(1):93-97. doi: https://doi.org/10.54133/ajms.v7i1.1067

INTRODUCTION

Preeclampsia (PE) is a pregnancy disorder characterized by hypertension. Worldwide, around 10% of pregnancies are affected by PE [1]. PE prominently causes maternal and perinatal mortality all over the world [2, 3], and it is manifested in the later gestational stages by hypertension and proteinuria [4, 5]. PE may be presented with insidious onset or fulminant onset. This is because some pregnant women may be free of symptoms at the beginning, even following hypertension and proteinuria occurrences, while other women may face severe PE symptoms from the start [4]. Pregnant women frequently experience hypertensive disorders, which are associated with increased maternal and fetal sequelae. These hypertensive disorders include chronic hypertension, PE, PE superimposed on chronic hypertension, and gestational hypertension. They have variable etiologies and pathologies. Therefore, PE diagnosis gets easier when the doctor can differentiate it from other pregnancy-related hypertensive disorders. In chronic hypertension, the high blood pressure may

precede the pregnancy, occur before 20 gestational weeks, or else be found 12 weeks after labor. PE, however, presents after 20 weeks of gestation with high blood pressure and proteinuria [4]. Conditions leading to microvascular disease, such as chronic hypertension, diabetes mellitus, vascular and connective tissue diseases, nephropathy, and antiphospholipid syndrome, all have the potential to cause PE [4]. However, there is still no agreement on the exact etiology of PE [6]. Complications of PE include antepartum and postpartum bleeding, seizures, acute renal failure, liver failure, heart failure, stroke, placental abruption, multiorgan failures, and a syndrome known as hemolysis, elevated liver enzymes and low platelet syndrome [2]. The sequence of events causing PE is hypothesized to start with a limited trophoblast invasion ending with decreased remodeling of the spiral artery that decreases the perfusion of the placenta; hence, placental ischemia happens. This ischemia releases materials that interact with the endothelium, contributing to the constriction of peripheral vessels, chronic and oxidative stress, and immune activation. Studies on females suffering from PE and on animal samples used to assess mediators of a PE phenotype in pregnancy have revealed an imbalance in proinflammatory and anti-inflammatory cell types [1]. PE has no treatment other than the delivery of the fetus and the placenta [1]. Delivery can end many symptoms and signs; however, PE might continue after delivery and even develop de novo in the postpartum period. De novo, or persistent postpartum PE, is a risk factor for peripartum morbidity [6]. Women suffering from PE are more likely to undergo cesarean section due to fetal distress, intrauterine growth restriction, and prematurity [7]. However, cesarean section itself brings a risk of cardiopulmonary morbidity among PE patients [8]. This is attributed to the altered hemodynamics in women with PE [9]. In addition to that, the inflammatory-immune reactions and the neuroendocrine-metabolic recovery following major surgery can imply bad consequences for the recovery period in PE patients [8]. The choice of anesthesia method for cesarean section among women with PE is still debated, and no individual technique has been proven to be superior regarding overall neonatal outcome. Spinal anesthesia (SA) was safer when compared to general anesthesia (GA) [10], while other studies demonstrated no significant differences in outcomes when SA was compared with epidural or GA [11,12]. Taking into consideration that PE causes maternal mortality, and furthermore, bearing in mind that maternal mortality is related to the sustainable development goals of the world, with a target to minimize the maternal mortality in the world to < 70 per 100,000 live births by 2030 [2], more attention should be paid to the causes of maternal mortality, among which is PE, to achieve this target and identify the ways of ensuring maternal death prevention. Hence, this study aimed to compare the outcome of a cesarean section for PE among mothers and babies using SA and GA.

METHODS

Study design and setting

The current study is a prospective cross-sectional one. The study period extended from February 2021 to September 2023. The current study uses a convenience sample because the study period was relatively limited, which naturally resulted in a small sample size given the number of female patients attending the hospital.

Inclusion and exclusion criteria

In this study, we included women who attended Al-Imam Al-Sajjad hospital and had a cesarean section done for them due to severe PE. We excluded women with incomplete medical records, mild PE, other medical conditions in pregnancy, less than 32 weeks of gestational age, multiple pregnancies, eclampsia, and GA following failed SA.

Ethical considerations

This study was conducted in compliance with the ethical principles outlined in the Declaration of Helsinki. The goal of this study was verbally communicated with the sample patients, and analytical approval was obtained before any sample was taken. The researcher clearly described the purpose and process of the survey to the patients and gave standard instructions and guidance for completing the questionnaire. The study protocol, subject information, and consent form were reviewed and approved by a local Ethics Committee 243 on January 17, 2021.

Outcome measurements

The study involved data collection regarding maternal age, gestational age at delivery, parity, Apgar scores, maternal mortality and perinatal mortality. The patients recruited in the study were classified into two groups based on the anesthesia technique they would be receiving: the SA group and the GA group. The SA technique is usually done by using bupivacaine (0.5%). GA is rapidly induced using Sellick's maneuver and a relaxant technique. Two drugs, sodium thiopentone (4-6 mg/kg) and suxamethonium (1-2 mg/kg), are used for induction of anesthesia and endotracheal intubation. Anesthesia maintenance is then accomplished by pancuronium, halothane and oxygen/nitrous oxide. The data was entered into the computer.

Statistical analysis

We used SPSS version 25.0 to compare the study groups based on the subjects' backgrounds and what happened to the mothers and babies during and after surgery and anesthesia. We did this by using $\chi 2$, the Fischer exact test, and the Student *t*-test, as needed. The differences between variables and groups were considered significant at $p<0.05$. A patient with severe PE has a systolic blood pressure of less than 160 mmHg and/or a diastolic blood pressure of less than 110 mmHg, along

with a proteinuria score of at least 2 on a Dipstix urinalysis.

RESULTS

A total of 87 women underwent cesarean section procedures that were performed during the current study period for severe PE cases. Thirty-three (84.8%) women were found in the SA Group and 54 (75.9%) women were found in the GA Group. Twenty-one (63.6%) women in the SA group were cases with elective cesarean sections, and 12 (36.4%) women were cases with emergency cesarean sections. The relevant figures in the GA group were 35 (64.8%) women and 19 (35.2%) women, respectively. The difference between both groups showed no statistical significance (*P*=0.9). These results are shown in Table 1.

Table 1: Distribution of study patients by anesthesia type and cesarean section type

Indication	SA (n=33)	GA (n=54)	Total (n=87)
Elective Cesarean section	21(63.6)	35(64.8%)	56(64.4)
Emergency Cesarean section	12(36.4)	19(35.2%)	31(35.6)
Total	33(84.8)	54(75.9)	87(100)

Values are expressed as frequencies and percentage.

The reasons for the cesarean section were severe PE with any of the following conditions: an unfavorable cervix, a previous cesarean section, a poor obstetric history, fetal distress, and intrauterine growth restriction. Table 2 demonstrates these results. The mean age of the women in the SA group was 30±1.2 years (range: 21–36 years), while the GA group was 28±1.7 years (range: 20–37 years), with a statistically significant difference (*P*<0.001).

Table 2: Indications for cesarean section among the study patients

Indication	SA (n=33	GA (n=54)	Total (n=87)
Severe PE with unfavorable cervix	28(84.8)	41(75.9)	69(79.3)
Severe PE with previous C/S	3(9.1)	6(11.1)	9(10.3)
Severe PE with bad obstetric history	1(3.0)	4(7.4)	5(5.7)
Severe PE with fetal distress	0(0.0)	3(5.6)	3(3.4)
Severe PE with IUGR	1(3.0)	0(0.0)	1(1.1)
Total	33	54	87

Values are expressed as frequencies and percentage.

The mean gestational age of women at delivery was 36±1.6 weeks (range: 34–39 weeks) for the SA group and 36±1.2 weeks (range: 34–40 weeks) for the GA group. The difference was not statistically significant (*P*=1.0). Thirteen (35.1%) women in the SA group were nulliparous. The relevant figure in the GA group was 22 (37.3%) women. The difference showed no statistical significance (*P*=0.8). Table 3 demonstrates the background characteristics of the study groups. Nine (27.3%) babies in the SA group achieved Apgar scores less than 7 at 1 minute, compared to 31 (57.4) babies in the GA group, with a statistically significant difference.

Table 3: The background characteristics of study patients

Characteristics	SA (n=33)	GA (n=54)	*p*
Mean maternal age	30±1.2	28±1.7	<0.001
Mean gestational age at delivery	36±1.5	36±1.2	1.0
Null parity	11(35.1)	19(37.3)	0.86

Values are expressed as frequencies, percentage, and mean±SD.

Five (15.2%) babies in the SA group and 20 (37.03%) babies in the GA group achieved Apgar scores less than 7 at 5 minutes, with a statistically significant difference. Perinatal deaths were 1 (3.03%) case in the SA group and 6 (11.11%) cases in the GA group. The difference showed no statistical significance (*P* =0.17). Maternal deaths were two (6.06%) cases in the SA group and eight (14.81%) cases in the GA group; the difference showed no statistical significance (*P* =0.21). From the two maternal death cases in the SA group, 1 (3.03%) case was attributed to anesthetic complications, and from the 8 maternal death cases in the GA group, 6 (11.11%) cases were attributed to anesthetic complications; the difference showed no statistical significance (Table 4).

Table 4: The outcome of delivery in the study patients

Outcome	SA (n=33)	GA (n=54)	*p*
Apgar score <7 at 1 minute	9(27.3)	31(57.4)	0.006
Apgar score <7 at 5 minute	5(15.2)	20(37.03)	0.005
Perinatal mortality	1(3.03)	6(11.11)	0.17
Maternal mortality	2(6.06)	8(14.81)	0.21
Maternal deaths from anesthetic complications	1(3.03)	6(11.11)	0.17

Values are expressed as frequencies and percentages.

DISCUSSION

PE is a condition that continues to spread globally, posing a significant public health concern in both developing and developed countries. However, its incidence and impact are higher in developing countries compared to those in developed countries. The World Health Organization has reported that PE incidence ranges from 2% to 10% of pregnancies worldwide. About 1.8–16.7% of the PE cases are found in developing countries, while in developed countries, the PE rate is about 0.4% [2,13]. The reason behind the increased incidence and impact of PE in developing countries might be attributed to the late detection of cases and ineffective treatment [2]. SA is the favorable modality in elective and emergency caesarean sections. It is thought that better maternal and neonatal outcomes are attained in caesarean sections under SA, but some clinical trials revealed varying figures for neonatal sequelae with SA and some with GA. However, a meta-analysis for both elective and emergency caesarean sections revealed no evidence for the success of SA over GA [14]. During GA, achieving equilibrium can be

challenging, which not only prevents the mother from becoming aware but also reduces neonatal risk in a fetus with prior risk. The anesthesia team invariably keeps the mother under adequate anesthesia, which may cause anesthetic drugs to pass through the placenta and affect the neonatal outcome [14]. With the exception of the mean maternal age, no significant difference was shown in the background characteristics among the current study participants. The exclusion criteria we implemented facilitated the elimination of the confounding factors in the analysis. Significantly, a higher proportion of babies with Apgar scores less than 7 at 1 and 5 minutes was found in the GA group than those in the SA group. This finding is similar to that found by Jordaan *et al*. [15] and Keerath *et al*. [16]. Dyer et al. [17] also found that the Apgar score was lower in GA at 1 minute, but there was no difference between the two groups regarding the Apgar score at 5 minutes. This difference might be attributed to a difference in the health care level or a difference in the sample chosen. The current study found that the study groups were not different regarding the perinatal mortality, which is a finding similar to that found by Thangaswamy *et al*. [14], but different from that by Jordaan *et al*. [15], Keerath *et al*. [16], and Chumpathong *et al*. [18], who found a difference in the perinatal mortality in their studies. The reason behind the differences in findings among different studies could be attributed to the different sample sizes, different study types, different levels of healthcare and other factors not addressed in different studies. The current study found that maternal mortality was not different between both groups. This finding is similar to that found by Keerath *et al*. [15], but different from the finding by Chumpathong *et al*. [18], Neme *et al*. [19], and Aregawi *et al*. [20], who found that SA is safer than GA regarding maternal mortality. The reason behind this difference in the findings could be attributed to the different sample size, different study type, different levels of healthcare in different study places, and other factors not addressed in different studies. The study groups were not different regarding maternal deaths from anesthetic complications. This finding is different from that found by Okafor *et al*. [21], who found a difference between the study groups. It is worth noting that there is some debate about SA in patients with severe PE because of concerns about a significant fall in blood pressure following sympathectomy [15]. A study by Aya et al. [22] compared the hemodynamics of SA in treated and fluid-replete patients with severe PE and those with normal blood pressure. All of the patients had a Caesarean section, and the results showed that the normal blood pressure group had a higher risk of hypotension and needed more vasopressors. Furthermore, it is important to note that the main challenges encountered during SA include conducting the procedure on a patient who is not cooperative, performing a dural puncture on a patient who has elevated intracranial pressure, the risk of developing an epidural hematoma, and the potential delay in cases of fetal bradycardia. However, women with no hemorrhage or comorbidities are unlikely to develop hypotension [15]. In hypertensive women with airway trauma following a seizure, SA could be safer if there is no condition contraindicating the regional anesthesia [15].

Study limitations

The limitations of this study are the relatively small sample size, and being a single-centre study.

Conclusions

The findings in this study support the findings of other studies worldwide, which showed no significant difference in the maternal and perinatal mortality outcomes of cesarean delivery between women with severe PE who had SA and those who had GA. However, there was a significantly higher proportion of birth asphyxia among babies of women who received GA, which means that SA is safer than GA for babies.

Conflict of interests

No conflict of interests was declared by the authors.

Funding source

The authors did not receive any source of fund.

Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

REFERENCES

1. Campbell NE, Deer EM, Herrock OT, LaMarca BB. The Role of Different Lymphoid Cell Populations in Preeclampsia Pathophysiology. *Kidney360*. 2022;3(10):1785-1794. doi: 10.34067/KID.0001282022.
2. Padhan SC, Pradhan P, Panda B, Pradhan SK, Mishra SK. Risk Factors of Pre-eclampsia: A Hospital-Based Case-Control Study. *Cureus*. 2023;15(7):e42543. doi: 10.7759/cureus.42543.
3. Pridjian G, Puschett JB. Preeclampsia. Part 1: clinical and pathophysiologic considerations. *Obstet Gynecol Surv*. 2002;57(9):598-618. doi: 10.1097/00006254-200209000-00023.
4. Portelli M, Baron B. Clinical Presentation of Preeclampsia and the Diagnostic Value of Proteins and Their Methylation Products as Biomarkers in Pregnant Women with Preeclampsia and Their Newborns. *J Pregnancy*. 2018;2018:2632637. doi: 10.1155/2018/2632637.
5. Lambert G, Brichant JF, Hartstein G, Bonhomme V, Dewandre PY. Preeclampsia: an update. *Acta Anaesthesiol Belg*. 2014;65(4):137-149. PMID: 25622379.
6. Rana S, Lemoine E, Granger JP, Karumanchi SA. Preeclampsia: Pathophysiology, Challenges, and Perspectives. *Circ Res*. 2020;126(1):e8. doi: 10.1161/CIRCRESAHA.118.313276.
7. Gofton E, Capewell V, Natale R, Gratton R. Obstetric intervention rates and maternal and neonatal outcomes of women with gestational hypertension. *Am J Obstet Gynecol*. 2001;185:798-803. doi: 10.1067/mob.2001.117314.
8. Unal BS, Dennis AT. Perioperative Complications in Patients with Preeclampsia Undergoing Caesarean Section Surgery. J Clin Med. 2023;12(22):7050. doi: 10.3390/jcm12227050.
9. Tihtonen K, Kööbi T, Yli-Hankala A, Huhtala H, Uotila J. Maternal haemodynamics in pre-eclampsia compared with

normal pregnancy during caesarean delivery. *BJOG*. 2006;113(6):657-663. doi: 10.1111/j.1471-0528.2006.00931.x.
10. Cheng C, Liao AHW, Chen CY, Lin YC, Kang YN. A systematic review with network meta-analysis on mono strategy of anaesthesia for preeclampsia in caesarean section. *Sci Rep*. 2021;11:5630. doi: 10.1038/s41598-021-85179-5.
11. Ramkumar J, Sharma N. Anesthesia in severe preeclampsia. *Open Access J Trans Med Res*. 2018;2(5):134–136. doi: 10.15406/oajtmr.2018.02.0005.
12. Goddard J, Wee MYK, Vinayakarao L. Update on hypertensive disorders in pregnancy. *BJA Educ*. 2020;20(12):411-416. doi: 10.1016/j.bjae.2020.07.007.
13. Khan B, Allah Yar R, Khakwani AK, Karim S, Arslan Ali H. Preeclampsia Incidence and Its Maternal and Neonatal Outcomes With Associated Risk Factors. *Cureus*. 2022;14(11):e31143. doi: 10.7759/cureus.31143.
14. Thangaswamy CR, Kundra P, Velayudhan S, Aswini LN, Veena P. Influence of anaesthetic technique on maternal and foetal outcome in category 1 caesarean sections - A prospective single-centre observational study. *Indian J Anaesth*. 2018;62(11):844-850. doi: 10.4103/ija.IJA_406_18.
15. Jordaan M, Reed AR, Cloete E, Dyer RA. A retrospective audit of anaesthesia for caesarean section in parturients with eclampsia at a tertiary referral hospital in Cape Town. *South Afr J Anaesth Analg*. 2020;26(4):192-197.
16. Keerath K, Cronje L. Observational study of choice of anaesthesia and outcome in patients with severe preeclampsia who present for emergency Caesarean section. *South Afr J Anaesth Analg*. 2012;18(4):206-212.
17. Dyer RA, Els I, Farbas J, Torr GJ, Schoeman LK, James MF. Prospective, randomized trial comparing general with spinal anesthesia for cesarean delivery in preeclamptic patients with a nonreassuring fetal heart trace. *Anesthesiology*. 2003;99(3):561-566A. doi: 10.1097/00000542-200309000-00010.
18. Chumpathong S, Sirithanetbhol S, Salakij B, Visalyaputra S, Parakkamodom S, Wataganara T. Maternal and neonatal outcomes in women with severe pre-eclampsia undergoing cesarean section: a 10-year retrospective study from a single tertiary care center: anesthetic point of view. *J Matern Fetal Neonatal Med*. 2016;29(24):4096-4100. doi: 10.3109/14767058.2016.1159674.
19. Neme D, Aweke Z, Jemal B, Mulgeta H, Regasa T, Garolla G, et al. Effect of anesthesia choice on hemodynamic stability and fetomaternal outcome of the preeclamptic patient undergoing cesarean section. *Ann Med Surg (Lond)*. 2022;77:103654. doi: 10.1016/j.amsu.2022.103654.
20. Aregawi A, Terefe T, Admasu W, Akalu L. Comparing the Effect of Spinal and General Anaesthesia for Pre-Eclamptic Mothers Who Underwent Caesarean Delivery in A Tertiary, Addis Ababa, Ethiopia. *Ethiop J Health Sci*. 2018;28(4):443-450. doi: 10.4314/ejhs.v28i4.10.
21. Okafor UV, Okezie O. Maternal and fetal outcome of anaesthesia for caesarean delivery in preeclampsia/eclampsia in Enugu, Nigeria: a retrospective observational study. *Int J Obstet Anesth*. 2005;14(2):108-113. doi: 10.1016/j.ijoa.2004.10.011.
22. Aya AGM, Mangin R, Vialles N, Ferrer JM, Robert C, Ripart J, et al. Patients with severe preeclampsia experience less hypotension during spinal anesthesia for elective cesarean delivery than healthy parturients: a prospective cohort comparison. *Anesth Analg*. 2003;97(3):867-872. doi: 10.1213/01.ANE.0000073610.23885.F2.