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The Effects Between Spinal and General Anesthesia for Pre-Eclamptic Mothers Underwent Caesarean Delivery in a Tertiary Care Hospital- A Comparative Study

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Abstract

Background: Preeclampsia is a multisystem disorder characterized by new onset of hypertension systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg and proteinuria >300 mg/24 h arising after 20 weeks of gestation in a previously normotensive woman and associated with significant maternal and neonatal morbidity and mortality worldwide. Women with preeclampsia have an increased rate of cesarean section consequent upon the high incidence of intrauterine growth restriction, fetal distress, and prematurity. The aim of this study was to determine and compare maternal & neonatal outcome among pre-eclamptic women following caesarian delivery under general and spinal anesthesia. **Material & Methods:** This was a comparative observational study and was conducted in the Department of Anesthesiology of Holy Family red crescent Medical College Hospital, Dhaka, Bangladesh during the period from February,2020 to February,2023. In this study we included 250 preeclamptic women undergoing cesarean delivery. The patients were randomly divided into two groups – GA group (Patients who were given general anesthesia) & SA group (Patients who were given spinal anesthesia). **Results:** In total 250 patients from both the groups completed the study. In our study we found majority (44.8%) of our patients were aged 28-32 years. The mean age was 27.13 ± 3.76 years. Majority (62.8%) of our patients were cases of emergency caesarean delivery & 37.2% were elective caesarean delivery classes. Most of the students (41.2%) used magnesium sulfate. Intraoperative systolic BP, diastolic BP was significantly lower in SA group than GA group. We found headache, vomiting, fever and wound gaping, postpartum hemorrhage & lower respiratory tract infection was significantly higher in GA group. On contrary, hypotension & pulmonary edema was higher in SA group. Apgar score at 1st, 5th & 10th minutes was significantly higher in GA group than SA group. In GA group, neonatal mortality at 48 h was 10.4% whereas it was 4.8% in SA group. **Conclusion:** In our study, we found intra-operative blood pressure and pulse rate was observed significantly higher in GA group than SA. Severe preeclamptic mothers receiving general anesthesia and their babies required more critical care support. Maternal as well as neonatal mortality was significantly higher with general anesthesia. Therefore, spinal anesthesia is a safer alternative to general anesthesia among women with severe preeclampsia following caesarean delivery with less postoperative morbidity and mortality.

Keywords:- Preeclampsia, Caesarean delivery, Spinal anesthesia, General anesthesia

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INTRODUCTION

Preeclampsia is a multisystem disorder characterized by new onset of hypertension systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg and proteinuria >300 mg/24 h arising after 20 weeks of gestation in a previously normotensive woman and associated with significant maternal and neonatal morbidity and mortality worldwide.[1] Severe preeclampsia is the development of hypertension characterized by systolic blood pressure exceeding 160 mm Hg and/or diastolic blood pressure exceeding 110 mmHg, together with proteinuria >5 gm/24hr after 20 weeks of gestation.[2] Preeclampsia globally affects up to 7.6% of pregnancies, including up to 21% of twin pregnancies.[3] Preeclampsia is the second leading cause of maternal mortality which accounted for 10%e15% of maternal and neonatal death and 15% of preterm deliveries worldwide, and the majority of deaths were from low and middle-income countries.[4,5] A systematic review and meta-analysis showed that the global incidence of preeclampsia was 4.6%, and European, American, and African regions accounted for 17%, 9%, and 4% respectively.[5] A World Health Organization systematic analysis revealed that preeclampsia is the second cause of maternal death following hemorrhage accounted for 14% (343, 000) of global maternal death. It is the major cause of maternal death in developed regions counted for 12.9%(19,000) maternal death while Sub-Saharan Africa, Asia, and Latin America accounted for more than fifty percent of maternal mortality associated with hypertensive disorder of pregnancy.[6] The risk factors for pre-eclampsia include nulliparous which is about 7.6%, ethnic groups, three times common in black compared to Caucasians, twin gestations, chronic hypertension, multi-fetal gestation, high maternal age (>35 years), and obesity were among the common risk for the development of pre-eclampsia.[7] Maternal weight and the risk of pre-eclampsia are progressive and the morbidity is about 4.3% with a body mass index (BMI) < 19.8 and 13.3 with BMI >35 kg/m2.[8]

Cesarean delivery can be performed as either elective or as an emergency. Globally, there is an increasing proportion of women giving birth by cesarean delivery in both developed and developing countries which is either done by the woman's request or as a result of complications.[9] Women with preeclampsia have an increased rate of cesarean section consequent upon the high incidence of intrauterine growth restriction, fetal distress, and prematurity.[10] Cesarean section on the other hand increases the risk of cardiopulmonary morbidity associated with preeclampsia.[11] This is due to the altered hemodynamics in women with preeclampsia, particularly in an emergent situation.

Anesthesia for cesarean delivery can be achieved either through general anesthesia (GA) or regional anesthesia (RA) such as spinal anesthesia (SA), epidural anesthesia (EA), or combined spinal-epidural anesthesia (CSE). Regional anesthesia especially spinal anesthesia has been favored as the best choice for elective uncomplicated cesarean delivery due to its avoidance of the airway, less risk of aspiration of gastric content, and easy to perform.[12,13] Regional anesthesia is safe and effective, but it does have complications such as hypotension, local anesthetic toxicity, post-dural puncture headache (PDPH), and nerve damage.

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However, general anesthesia is still used especially when regional anesthesia is contraindicated or failed.[12,14] The risk of general anesthesia (GA) is significantly increased in obstetric population. The incidence of failed intubation and aspiration are eight times higher than no obstetrical patient.[15] Other associated risks are systemic and pulmonary hypertension, which may be deleterious in this group of patients.[11] This risk is present with both spinal and general anesthesia and continues to challenge anesthetists worldwide. Recent evidence showed that spinal anesthesia is associated with better maternal and neonatal outcomes as compared to general anesthesia.[16,17,18,19,20] However, spinal anesthesia is associated with hypotension, nausea and vomiting, and cardiac arrest.[21,22] Observational studies showed that the hemodynamic impacts of spinal anesthesia are well tolerated in preeclamptic parturient as compared to none preeclamptic parturient.[17,19,20] Therefore, in this study we aimed to compare the effects of general and spinal anesthesia among women with preeclampsia.

Objective of the study

The main objective of the study was to determine and compare maternal & neonatal outcome among pre-eclamptic women following caesarian delivery under general and spinal anesthesia in a tertiary care hospital.

MATERIAL AND METHODS

This was a comparative observational study and was conducted in the Department of Anesthesiology of Holy Family red crescent Medical College Hospital, Dhaka, Bangladesh during the period from February,2020 to February,2023. In this study we included 250 preeclamptic women undergoing cesarean delivery. The patients were randomly divided into two groups – GA group (Patients who were given general anesthesia) & SA group (Patients who were given spinal anesthesia).

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged 18-45 years; b)Patients with preeclampsia; c) Patients undergoing emergency cesarean section; d) Patients with 34 or more weeks of gestational age; e) Patients who were willing to participate were included in the study And a) Patients with uncontrolled DM, b) Patients with Coagulopathy ; c) Patients with previous surgical history; d) Patients with known allergy to anesthetic drugs; e) Patients with any history acute illness (e.g., renal or pancreatic diseases, ischemic heart disease etc.); f) Patients with platelet count less than 80,000/cm3 were excluded from our study.

For Spinal Anesthesia, inj. hyperbaric bupivacaine (0.5%), 10 to 15 mg was given intrathecally with or without 20 to 25 mcg of fentanyl. For General Anesthesia, inj. propofol 1.5 to 2.5 mg·kg−1 with inj. suxamethonium, 1 to 2 mg·kg−1 i.v. was given for rapid sequence intubation and maintained with isoflurane 0.3 to 1.5 MAC as required. Muscle relaxants were excluded whenever possible, as their effect is unpredictably prolonged with preoperative magnesium sulphate (MgSO4) therapy. The intraoperative analgesics varied from fentanyl 1 to 2 mcg·kg−1 i.v. with or without other nonopioid analgesics like paracetamol 1 g infusion i.v. or diclofenac 75 mg as i.v. infusion. In case of failure of SA to provide sufficient anesthesia, GA was given to the patient.[23]

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Statistical Analysis: All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS 21 (Statistical Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of Holy Family red crescent Medical College Hospital, Dhaka, Bangladesh.

RESULTS

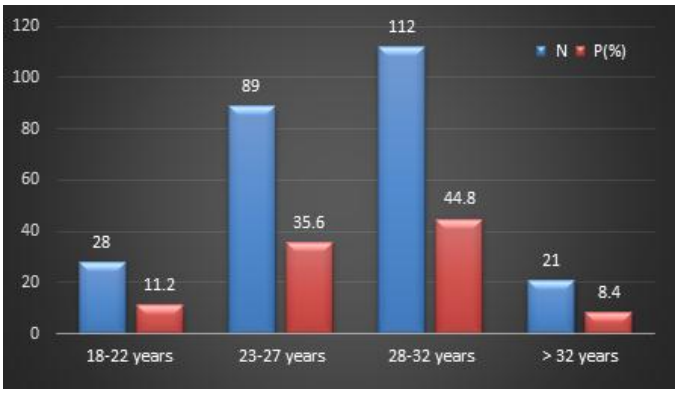

Figure 1: Age distribution of our study patients

[Figure 1] shows that majority (44.8%) of our patients were aged 28-32 years, followed by 35.6% were aged 23-27 years. Among all patients, only 11.2% & 8.4% were aged 18-22 years & more than 32 years respectively.

[Table 1] shows the baseline characteristics of our patients. We found the mean age was 27.13 ± 3.76 years and BMI was 35.67±6.24 kg/m2 . Majority (62.8%) of our patients were cases of emergency caesarean delivery and 37.2% were elective caesarean delivery classes. Most of the students (41.2%) used magnesium sulfate, followed by 31.2% used hydralazine & 14% used labetalol for preeclamptic mothers before operation.

[Table 2] shows intraoperative systolic BP, diastolic BP was significantly lower in SA group than GA group. There were no significant differences in surgery duration for both groups. The duration of anesthesia was significantly higher in spinal anesthesia group.

[Table 3] shows the maternal complications after operation. We found headache, vomiting, fever and wound gaping, postpartum hemorrhage & lower respiratory tract infection was significantly higher in GA group. On contrary, hypotension & pulmonary edema was higher in SA group. No complication was found 28.8% in GA group which is lower than SA group (31.2%).

[Table 4] shows the neonatal outcome in both groups. Apgar score at 1st, 5th & 10th minutes was significantly higher in GA group than SA group. In GA group, neonatal mortality at 48 h was 10.4% whereas it was 4.8% in SA group.

Table 1: Baseline characteristics of our study patients

Baseline characteristics	N	P (%)
Mean age (years)	27.13 ± 3.76	
Weight (kg)	67.53 ± 8.45	
Height (cm)	161.34 ± 3.82	
Para	1.49 ± 1.28	
Gravid	2.58 ± 1.45	

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BMI (kg/m2)	35.67±6.24	
Heart Rate (per minute)	89 ± 17	
Systolic blood pressure (mm Hg)	131.24 ± 10.78	
Diastolic blood pressure (mm Hg)	81.94 ± 10.69	
Type of C/S		
Elective	93	37.2
Emergency	157	62.8
Antihypertensive drugs used for preeclampsia before the operation		
Hydralazine	78	31.2
Labetalol	35	14
Nifedipine	6	2.4
Methyldopa	19	7.6
Magnesium sulfate	103	41.2
Diazepam	9	3.6

Table 2: Intraoperative hemodynamic, operative, and anesthesia parameters.

Intraoperative parameters	**GA**	**SA**	**P-value**
Intraoperative systolic BP	133.19 ± 10.16	128.36 ± 12.27	0.034
Intraoperative diastolic BP	84.52 ± 9.7	78.55 ± 10.9	0.025
Intraoperative IV RL bottles	2.48 ± 0.51	3.01 ± 0.49	0.141
Skin incision to delivery (minute)	4.22 ± 1.46	4.58 ± 1.43	0.412
Uterine incision to delivery (sec)	61.56 ± 17.98	55.96 ± 5.93	0.013
Duration of surgery (minute)	49.54 ± 6.72	49.15 ± 7.03	0.648
Duration of anesthesia (minute)	56.64 ± 14.21	59.63 ± 7.2	0.141
Oxytocin in unit	13.89 ± 2.12	13.32 ± 2.51	0.214

Table 3: Comparison of maternal complications in two groups.

Complications	**GA**		**SA**		**P-value**
	N=125	**P(%)**	**N=125**	**P(%)**	
Headache	47	37.6	39	31.2	0.031
Vomiting	68	54.4	61	48.8	0.041
Fever and wound gaping	38	30.4	21	16.8	0.023
Hypotension	58	46.4	64	51.2	0.213
Pain at spinal injection side	74	59.2	78	62.4	0.514
HELLP syndrome	42	33.6	38	30.4	0.034
Pulmonary edema	38	30.4	44	35.2	0.621
Postpartum hemorrhage (PPH)	24	19.2	21	16.8	0.040
Disseminated intravascular coagulation (DIC)	19	15.2	17	13.6	0.036
Lower respiratory tract infection (LRTI)	31	24.8	28	22.4	0.021
Postpartum endometritis	22	17.6	20	16	0.044
No complications	36	28.8	39	31.2	0.004

Table 4: Comparison of neonatal outcome between groups

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Neonatal outcome	GA		SA		P-value
	N=125	P(%)	N=125	P(%)	
Neonatal APGAR score					
APGAR 1st minute	7.76 ± 0.46		7.33 ± 1.32		0.034
APGAR 5th minute	8.71 ± 1.18		8.29 ± 1.35		0.041
APGAR 10th minute	9.57 ± 1.22		9.23 ± 1.45		0.051
Neonatal mortality at 48 h					
Yes	13	10.4	6	4.8	0.031
No	112	89.6	119	95.2	

DISCUSSION

In our study the mean age was 27.13 ± 3.76 years and BMI was 35.67±6.24 kg/m2. Majority (62.8%) of our patients were cases of emergency caesarean delivery. Most of the students (41.2%) used magnesium sulfate, followed by 31.2% used hydralazine & 14% used labetalol to control blood pressure before operation. [Table 1] Aregawi A. et al found the mean age of the study subjects was 28.18 ± 4.66 years. Most of the CS were performed as emergency. Magnesium sulfate was the most frequently used drug to control blood pressure for pre-eclamptic mothers.[14] Chattopadhyay S. et al found blood pressure of 51.4% mothers was controlled with methyldopa alone, while 48.6% required a further dose of inj. labetalol. More patients in the GA group required inj. labetalol to control blood pressure perioperatively and all patients received magnesium sulphate as antiseizure prophylaxis.[23] In this study intraoperative systolic BP, diastolic BP was significantly lower in SA group than GA group. There were no significant differences in surgery duration for both groups. The duration of anesthesia was significantly higher in spinal anesthesia group. [Table 2] Chttopadhyay S. et al found the overall duration of surgery and duration of anesthesia were comparable for spinal and general anesthesia. Oxytocin requirements were also similar in both groups.[23] The Similar result was observed in the study comparing spinal versus general anesthesia for severely preeclamptic patients demonstrating spinal anesthesia providing better hemodynamic profile with respect to both blood pressure control and heart rate.[24] The same result was also reported by Bashar MA et al., where spinal anesthesia was reported safe and effective in controlling hemodynamic status.[25] The result of a study by Neme D. et al also showed spinal anesthesia reduced systolic and diastolic blood pressure in the first hours follow up compared to those in the general anesthesia group.[26] A similar result was reported in the study done on severe preeclamptic patients where spinal anesthesia was shown to reduce the rise in diastolic and systolic blood pressure.[27] We found headache, vomiting, fever and wound gaping, postpartum hemorrhage & lower respiratory tract infection was significantly higher in GA group. On contrary, hypotension & pulmonary edema was higher in SA group. [Table 3] Chttopadhyay S. et al found maternal complications which required critical care support were pulmonary edema, acute renal failure, convulsion, DIC, headache, postpartum hemorrhage, HELLP syndrome, visual disturbance, lower respiratory tract infection, and congestive

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cardiac failure. These findings were similar to an Indian study performed by Singhal et al.[28] In our study we found Apgar score at 1st, 5th & 10th minutes was significantly higher in GA group than SA group. In GA group, neonatal mortality at 48 h was 10.4% whereas it was 4.8% in SA group. [Table 4] The result of the study by Neme D et al showed spinal anesthesia had a lower 1st minute Apgar score of 7.33 ± 1.32 compared to 7.76 ± 0.46 in the general anesthesia group. The difference between groups regarding neonatal Apgar score at 1st, 5th, and 10th minutes were not different statistically.[26] In the contrary study by Oreef MA et al. showed spinal anesthesia was associated with increased Apgar score in the first and 5th minutes.[29] Similarly, a combined spinal-epidural anesthesia compared with general anesthesia also showed an increased Apgar score at the early time compared to general anesthesia.[30] Another study also showed spinal anesthesia demonstrated an improved Apgar score compared to general anesthesia.[31] The maternal and neonatal mortality among preeclamptic women was very high. Anesthesia-related maternal mortality among preeclamptic women accounted for 20%.[4] Observational studies showed that spinal anesthesia is better tolerated in stable preeclamptic women as compared to normotensive parturient who underwent cesarean section under spinal anesthesia. But there was no high-quality evidence supporting the superiority of hemodynamic stability in preeclamptic to normotensive women under Spinal Anesthesia.[32,33,34,35] Chttopadhyay S. et al found patients in the general anesthesia group had more incidence of fetal distress and had significantly lower gestational age. This may have ultimately led to poorer outcome in neonates in the general anesthesia group.[23] While other study found both anesthetic techniques are reliable and well-tolerated for cesarean delivery. However, regional anesthesia emerged as a better option for elective cesarean delivery.[12]

Limitations of the study

Our study was a single centre study. We took a small sample size due to our short study period and limited resources. There are more adverse effects of general & spinal anesthesia in preeclamptic women like paresthesia, convulsion, visual disturbance, acute renal failure, cerebrovascular accident, congestive cardiac failure needs to be evaluated. We only used APGAR score to assess the neonatal outcome. After evaluating once those patients we did not follow them up for a long term and have not known other possible interference that may happen in the long term with these patients.

CONCLUSIONS

In our study, we found intra-operative blood pressure and pulse rate was observed significantly higher in GA group than SA. Severe preeclamptic mothers receiving general anesthesia and their babies required more critical care support. Maternal as well as neonatal mortality was significantly higher with general anesthesia. Therefore, spinal anesthesia is a safer alternative to general anesthesia among women with severe preeclampsia following caesarean delivery with less postoperative morbidity and mortality.
Further study with a prospective and longitudinal study design including larger sample size needs to be done to identify more

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adverse effects of spinal & general anesthesia in preeclamptic women undergoing CS to reduce maternal & neonate mortality.

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