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Research Article

To Evaluate the Maternal and Foetal Outcome in Parturients Undergoing Caesarean Section for Pre-Eclampsia Under Spinal and General Anaesthesia: A Randomised Prospective Study

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ABSTRACT

Background: Pre-eclampsia has always been a challenge to the anaesthesiologist, in terms of choosing which type of anaesthesia to prefer. This present study was done to evaluate the maternal and foetal outcome in patients of caesarean section for pre-eclampsia under spinal and general anaesthesia.

Methods: This prospective study was conducted in 60 parturients, ASA 1 and 2 who underwent caesarean section for pre-eclampsia. These parturients were randomly and divided into two groups, Group S receiving spinal anesthesia and Group G receiving general anesthesia. For maternal outcome, the parturients were monitored for Blood Pressure, Heart Rate, Oxygen Saturation. Post-operative ICU admissions, convulsions, and pulmonary edema chances were seen. For fetal outcome, APGAR score was noted at 1 minute and 5 minutes after birth of child.

Results: The systolic blood pressure, diastolic blood pressure, mean arterial pressure, and heart rate were comparable in both the groups in the pre-operative period and at induction. However, intraoperatively, these parameters were significantly lower in the spinal anaesthesia group as compared to general anesthesia group ($p<0.05$). The Apgar Score was also found to be significantly higher in the newborns in spinal anaesthesia group as compared to general anaesthesia group. Post-operatively, more number of ICU admissions were seen in general anaesthesia group as compared to spinal anaesthesia group ($p<0.05$).

Conclusion: Spinal Anaesthesia can be considered as a first choice of anaesthesia in parturients undergoing caesarean section for preeclampsia with better hemodynamic control in intra-operative period and lesser chances of post-operative morbidity and mortality.

Introduction

The term "Eclampsia" was coined by Hippocrates in 4th Century B.C. It literally means "sudden development". The anaesthetist and obstetrician both should be alert regarding the management and complications of the same. Selection of mode of anaesthesia in parturients undergoing caesarean section has always been a topic of controversy. Earlier thoughts propagated General Anaesthesia (GA) as being more favourable than Regional Anaesthesia [1]. In-fact, in 1985, Williams Textbook of Obstetrics stated that regional anaesthesia should not be given in pre-eclampsia patients, because of incidence of sudden and severe hypotension, and the immediate dangers of high-volume fluid resuscitation and vasopressors used to correct the hypotension. However, in recent years, many studies

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have indicated as Regional Anaesthesia being comparable, if not superior to general anaesthesia in cases of parturients undergoing caesarean section for pre-eclampsia [2]. After, the introduction of APGAR score, it was found that APGAR of neonates born to mother with general anaesthesia was comparatively lower as compared to neonates born without anaesthesia [3-4].

Pre-eclampsia is a multisystemic disorder in which abnormal genetic and immunological mechanisms occur that cause endothelial cell dysfunction [5]. Clinically, pre-eclampsia can be defined as blood pressure(BP)>140/90 after 20 weeks in previously normotensive women, along with proteinuria≥300mg/d or protein: creatinine ratio≥0.3 or dipstick 2+, along with thrombocytopenia, renal insufficiency, renal involvement, cerebral symptoms and pulmonary edema [6]. Immune system is activated, which causes increase in production of inflammatory mediators. These mediators are thought to be responsible for generalized vasculitis and endothelial cell dysfunction [7].

Pre-eclampsia is described as two stage disorder [8]. In pre-eclampsia, there is a functional imbalance occurring between endogenous vasodilators and vasoconstrictors. Hence, intense vasoconstriction occurs, causing organ hypoperfusion and ischemic damage that affects nearly all major organ systems [9].

Foetal complications due to pre-eclampsia in mother includes, intra uterine growth retardation, prematurity with respiratory distress, intracranial haemorrhage, small for gestational age neonate and aspiration of meconium. Pre-eclampsia causes about 40% of all iatrogenic premature deliveries and 20–30% of perinatal mortality [10].

Apgar Score

APGAR Score is a scoring system in order to access the immediate physical condition of the new born. It was devised by Dr. Virginia Apgar in 1953 [11]. It was made to quickly assess the clinical status of the new-born (Table 1) [12-13].

It is a sum of five parameters with scoring graded as 0, 1 or 2, for each parameter. Parameters included in Apgar score are heart rate, respiratory efforts, muscle tone, color of child and reflex response. It is accessed at 1 minute and 5 minutes of birth. Score of 9-10 is considered as a good score, while lower score 4-6 is considered moderately abnormal and 0-3 scores are considered low in the term infant [14]. Lower scores indicate a depressed child who needs care and resuscitation [15].

Table 1- Apgar Scoring

Sign	1	2	3
Colour	Blue or Pale	Acrocynatic	Completely Pink
Heart Rate	Absent	<100/min	>100/min
Reflex Irritability	No Response	Grimace	Cry or Active Withdrawal
Muscle Tone	Limp	Some Flexion	Active Motion
Respiration	Absent	Weak Cry	Good Cry

Methods

After obtaining clearance from the Institutional Ethics Review Committee, this prospective randomised study was conducted at MM medical college and hospital, Mullana, Ambala in the department of anaesthesia over a period of two years (March 2020-March 2022). Preoperatively, informed written consent of the patient was taken.

Patients were randomly allocated and a total of 60 patients were divided into 2 groups:

Group 1: Receiving spinal anaesthesia and Group 2: Receiving general anaesthesia

Inclusion criteria are Booked cases, Parturients with blood pressure more than 140/90mmHg, Proteinuria more than 3g/24h less than 5g/24h.

Patient's who refused for the surgery, Patients with eclampsia, patients with Antepartum Hemorrhage and with Pre-existing cardiovascular and pulmonary disease, preexisting chronic hypertension, diabetes, chronic renal failure, Severe hemorrhage, Coagulopathy, anticipated difficult airway, Twin pregnancy and with <34 weeks' gestation were not included in the study.

All parturients went through a pre anaesthetic check-up. Routine investigations were sent. All old anti-hypertensive drugs were continued in the pre-operative period. Nil per oral period was maintained for minimum eight hours before taking for caesarean section. All parturients were given intravenous ranitidine 50mg and intravenous metoclopramide 10mg, half an hour before surgery. After taking informed consent, every patient was given 5-10ml/kg of intravenous crystalloids before anaesthesia and SBP, DBP, MAP and HR was recorded before giving anaesthesia. Group 1 (Spinal Anaesthesia) was given sub arachnoid block with Heavy Bupivacaine 0.5% 8-12mg intrathecally in L3-L4 space using Quincke's needle 25G. Patients were given oxygen supplementation via face mask at 6-8L/min. In Group 2 (General Anaesthesia), the parturient was induced using propofol 2mg/kg and succinylcholine 1.5mg/kg. They were intubated via indirect laryngoscopy. Maintenance of anaesthesia was done using oxygen 50% with nitrous oxide 50%, isoflurane and 0.5mg/kg atracurium. Intraoperatively, analgesia was given using midazolam 0.01mg/kg, fentanyl 1-2mcg/kg, with or without other non-opioid analgesics like paracetamol 1gm or diclofenac 75mg. Patient was extubated fully awake with full dose reversal of atracurium using 0.01mg/kg of glycopyrrolate and 0.05mg/kg of neostigmine.

Systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate and Oxygen Saturation were monitored. They were recorded before induction, after

induction and every five minutes, till the end of surgery for both the groups. APGAR Score of new born was assessed at one minute and five minutes of birth and values were recorded. Number of parturients requiring ICU admission was noted. Morbidity parameters included were- Peri-operative hypertension or hypotension, delayed recovery from anesthesia.

Statistical Analysis

The data collected from the above study was systematically recorded on the prescribed proforma, compiled, and statistically analyzed to draw relevant conclusions. Data were described in terms of range; mean ±standard deviation (± SD), median, frequencies (number of cases) and relative frequencies (percentages) as appropriate. To determine whether the data were normally distributed, a Kolmogorov-Smirnov test was used. Comparison of quantitative variables between the study groups was done using Student t-test and Mann Whitney U test for independent samples for parametric and non-parametric data respectively. For comparing categorical data, Chi square ($\chi 2$) test was performed and exact test was used when the expected frequency is less than 5. A probability value (P value) less than 0.05 was considered statistically significant. All statistical calculations were done using (Statistical Package for the Social Science) SPSS 21version (SPSS Inc., Chicago, IL, USA) statistical program for Microsoft Windows.

Results

A total of 60 parturients were included in the study. They were randomly allocated into two groups containing equal parturients, Group G for General Anesthesia and Group S for Spinal Anesthesia.

Table 2- demographic data of the patients

	Group G	Group S
Age	24.63	25.20
Weight	63.67	63.77
American society of anaesthesiologist category II	30	30

Mean Arterial Pressure

The Mean Arterial Pressure was checked pre-operatively, at induction and every 5 minutes, till post-operatively. As we can see here, the mean of Mean Arterial Pressure at Pre-op period was comparable between the two groups. After induction, the spinal anesthesia group had mean arterial pressure significantly lower than the general anesthesia group as shown in (Figure 1).

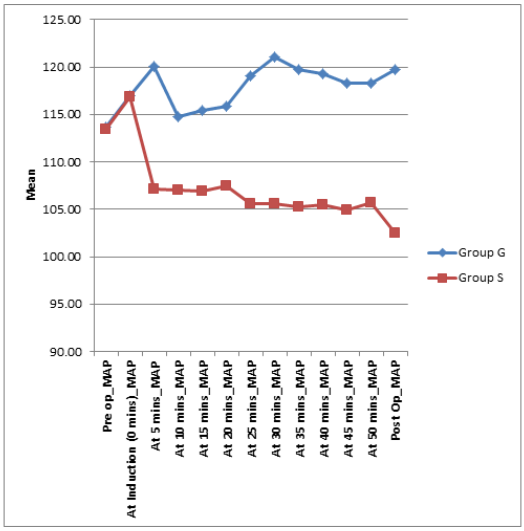

Figure 1- Mean Arterial Pressure

Heart Rate

The Heart Rate was recorded pre-operatively, at induction and every 5 minutes, till post-operatively. As we can see here, the mean of Heart Rate at Pre-op, was comparable between the two groups. After induction, the spinal anesthesia group had systolic blood pressure significantly lower than the general anesthesia group as shown in (Figure 2).

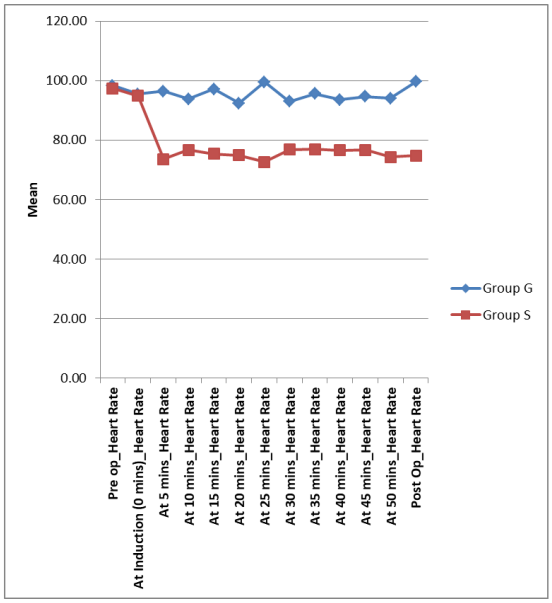

Figure 2- Heart Rate

The Apgar Score

The APGAR SCORE was recorded at 1 minute and 5 minutes after birth of the child. As we can see here, the mean of APGAR Scores at 1min, was significantly lower in the general anesthesia group as compared to spinal anesthesia group. However, the APGAR score at 5 mins was similar in both the groups as shown in (Figure 3).

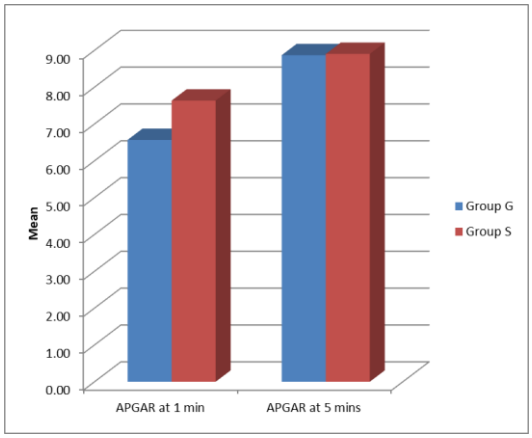

Figure 3- APGAR Score

Post Operative Icu Admission

As we can see from the table 3, the incidence of ICU admission was significantly higher in the general anesthesia group as compared to spinal anesthesia group.

The chance of convulsion and pulmonary edema was found to be higher in the general anesthesia group than the spinal anesthesia group, however the difference was insignificant (p=0.301) as shown in (Table 4 and 5) respectively.

Delayed Recovery from Anaesthesia

The chance of delayed recovery from anesthesia was found to be higher in the general anesthesia group as shown in (Table 6).

Table 3- Comparison of postoperative ICU admissions in general and spinal anaesthesia group

ICU Admission	Group G	Group G	Group S	Group S	Total	Chi-square value	P value
NO	14	47%	26	87%	40	10.800	0.002
YES	16	53%	4	13%	20		
Total	30	100%	30	100%	60		

Table 4- Comparison of convulsion in spinal and general anaesthesia group.

Convulsions	Group G		Group S		Total	Chi-square value	P value
NO	27	90%	29	97%	56		
YES	3	10%	1	3%	4	1.071	0.301
Total	30	100%	30	100%	60		

Table 5- pulmonary edema in spinal and general anaesthesia group.

Pulmonary Oedema	Group G		Group S		Total	Chi-square value	P value
NO	28	93%	30	100%	58		
YES	2	7%	0	0%	2	2.069	0.150
Total	30	100%	30	100%	60		

Table 6- Delayed recovery from Anaesthesia

Delayed Recovery	Group G		Group S		Total	Chi-square value	P value
NO	25	83%	30	5.455	0.052		
YES	5	17%	0	YES	5	2.069	0.150
Total	30	100%	30	Total	30		

Discussion

GA can be risky in pregnant females due to presence of difficult airway and because of the hemodynamic changes and consequences of laryngoscopy and tracheal intubation, for which they are more sensitive. The stress response to laryngoscopy and intubation is usually more exaggerated in parturients than in general population.6 Risk of aspiration is 8 times more likely in pregnant women than in non-obstetric patients [16].

Spinal anaesthesia (SA) has been recognized as an alternative in operative management in pre-eclampsia parturients because it is more practical and has a faster onset of action with comparatively fewer complications [17].

Over time, there was change from general anesthesia as a mainstay of anesthetic technique to neuraxial blocks, namely spinal or epidural anesthesia [18]. Now, since the early 2000s, with the start of use of low dose spinal anesthesia or combined use of spinal-epidural anesthesia, there has been again a shift from the use of general to spinal anesthesia [19].

The primary objectives of our study was to evaluate the perioperative hemodynamic changes in spinal and general anesthesia, to observe the occurrence of associated maternal complications in perioperative period (Eclampsia, chronic cardiac failure, oliguria) and to evaluate the fetal outcome by Apgar score at 1 and 5 minutes.

Perioperative Blood Pressure

In our study, we found mean arterial pressure being comparable in both the groups, in the pre-operative period and just before induction. However, after induction, starting from the 5 minute reading, mean arterial pressure was significantly lower in the spinal anaesthesia group as compared to the general anaesthesia group, with the p value being significant ($p<0.05$).

Chattopadhyay et.al. [8] in 2014, also observed that the blood pressure in the spinal group was significantly lower than the general anaesthesia group. Moreover, they observed that the spinal group required more fluid resuscitation and vasopressor support as compared to general anaesthesia.

Atanas et.al. in 2015, in a similar study found that the mean arterial pressure was significantly lower in the spinal group as compared to general anaesthesia group.

Ravi et.al. [13] in 2016 and shamsundar giri in 2018, also found similar result of spinal anaesthesia having significantly lower systolic blood pressure. They also found the diastolic blood pressure to be lower in spinal anaesthesia as compared to general anaesthesia, but the difference they found was statistically insignificant.

Heart Rate

In our study, the heart rate in pre-operative period and just before induction was comparable in both the group. However, after induction, from the 5 minute reading onwards, the heart rate was significantly lower in the spinal anaesthesia group as compared to the general anaesthesia group, with the p value being significant ($p<0.05$). Even in the post-operative period, heart rate was significantly lower in the spinal group than in the general anaesthesia group.

Chattopadhyay et.al. [8] in 2014 in their study to assess the fetomaternal outcome in women undergoing caesarean section for pre-eclampsia, found that the heart rate was considerably lower in the intra-operative and post-operative period in spinal anaesthesia as compared to general anaesthesia. Ravi et.al. [13] in 2016 and Shamsundar G. Giri et.al., in their respective studies also found similar result. The heart rate was better controlled in case of spinal anaesthesia as compared to general anaesthesia. Atanas et.al. in 2015, in a similar study found that the heart rate was significantly lower in the spinal group as compared to general anaesthesia group. Aregawi et.al in 2018 in their study also found similar results with the heart rate being higher in the post-operative period in general anaesthesia as compared to spinal anaesthesia.

Apgar Score

In our study, the APGAR SCORE at 1 minute and 5 minutes was measured to assess the foetal outcome. We found that the APGAR score at 1minute was significantly lower in the general anaesthesia group as compared to the spinal anaesthesia group ($p<0.05$). However, the APGAR at 5 minutes was comparable in both the groups. This means that children born to mothers undergoing general anaesthesia required more resuscitation after birth as compared to general anaesthesia.

This finding was similar to the study done by Subhankar Dasgupta et.al. [19] in 2012. He found that APGAR score at 1 minute was lower in general anaesthesia group, but at 5 minute APGAR score was comparable. Atanas et.al in 2015 and Christopher et.al in 2015, also found similar results of higher APGAR score with spinal anaesthesia as compared to general anaesthesia at 1 minute with similar APGAR score at 5 minutes. They both concluded that spinal anaesthesia was better for immediate foetal outcome but overall, the mode of anaesthesia did not affect the foetal morbidity and mortality.

Post Operative Complications

In our study, we found that the incidence of post-operative hypertension was significantly higher in general anaesthesia group as compared to spinal anaesthesia group with a significant p value of <0.05.

We also found that spinal anaesthesia was related to more chances of hypotension than in general anaesthesia, however the difference was significant ($p=0.237$).

We also noticed increased cases of pulmonary oedema and convulsions related to general anaesthesia, however the values were insignificant for both ($p>0.05$). Chances of delayed recovery from anaesthesia and ICU admissions was found to be higher in general anaesthesia cases. These observations were similar to the findings of Ravi et.al. Chattopadhyay et.al in 2014 also found similar results for post-operative maternal outcomes in view of ICU admission and Post-operative hypertension.

Limitation of the study was some of the data that was studied in present study was statistically not significant which may need to be studied on a larger study population.

Conclusion

So, our study has concluded that spinal anaesthesia is better than general anaesthesia in view of the maternal and foetal outcomes based on the following: Better hemodynamic control of vitals for mother, Lesser requirement of fetal resuscitation after birth, Lower chances of ICU admission, Better post-operative hemodynamic control with lower chances of hypertension, Better recovery from anaesthesia, Lesser chances of post-operative complications like pulmonary oedema and convulsions.

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