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Original Research Article

Foeto-Maternal Outcome In Severe Pre–Eclampsia Patients Undergoing Emergency Lower Segment Caesarean Section Under Spinal And General Anaesthesia

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Abstract

Background: Pregnancy-induced hypertension constitutes a significant cause of morbidity and mortality in developing nations and complicates about 6-8% of pregnancies. Severe preeclampsia poses a serious dilemma for the anaesthesiologist, especially in emergencies, with respect to difficulty in endotracheal intubation and exaggerated haemodynamic responses due to anaesthetic procedures.

Objective: This study aimed to observe intra-operative haemodynamic, anaesthesia parameters, maternal and foetal complications and indications of the need for postoperative critical care.

Methods: This study included 145 patients with severe pre-eclampsia who underwent emergency caesarean section. Out of 145 patients, 103 patients were administered spinal anaesthesia (SA), and 42 patients received general anaesthesia (GA) based on the consent of the patient, fasting status of the patient, maternal and foetal distress and active respiratory tract infection (RTI). Patients were categorised into two groups: those who received SA as Group S and those who received GA as Group G.

Results: The Mean intra-operative SBP in group S and group G was 129.8±14.23 mmHg and 136.5±17.25 mmHg respectively, with statistically significant differences (p-value of 0.017). Mean intra-operative DBP group S and group G were 79.1±12.64mmHg and 85.4±15.38mmHg, respectively, with statistically significant differences (p-value of 0.012). The most common maternal complication among group S was headache (6.8%), and among the group G was pulmonary oedema (8.3%) ($p<0.001$). 74.8% of patients in group S and 31% in group G were complications-free ($p<0.001$). Out of 103 patients in group S, nine (8.7%) were admitted to ICU and 19 (45.2%) out of 42 patients in group G. The difference was statistically significant (p-value< 0.001).

Conclusion: Spinal anaesthesia is a safer alternative to general anaesthesia in severe preeclampsia, with less postoperative morbidity and mortality for mothers and babies. These findings agreed with many previous studies worldwide.

Keywords: Preeclampsia, spinal anaesthesia, General Anaesthesia, Acute renal Failure - Blood Pressure - Cesarean Section

INTRODUCTION:

Pre-eclampsia is a principal cause of foetal morbidity and mortality, also a leading cause of maternal intensive care unit (ICU) admission[5].In India, the incidence of preeclampsia is 7.6%.[1] Delivery of the infant and placenta is the only effective treatment. However, delivery at an earlier gestational age is associated with an increased risk of adverse neonatal outcomes.[2] Women with preeclampsia have an increased rate of caesarean section consequent upon the high incidence of intrauterine growth restriction, foetal distress, and prematurity.[2]

Hypertensive disorders during pregnancy can exist in four distinct forms – gestational hypertension, pregnancy-induced hypertension (PIH), chronic hypertension, unclassified hypertension, and eclampsia, as classified by the International Society for the Study of Hypertension (ISSHP).[3] PIH complicates around 6–8% of pregnancies. It is a multiorgan disease classified as mild PIH or severe PIH. Severe PIH is defined as the presence of systolic blood pressure (SBP) ≥ 160 mmHg and diastolic blood pressure (DBP) ≥ 110 mmHg, on two occasions sixhours apart, associated with proteinuria > 5 g in 24 h after 20 weeks of gestation. It can be accompanied by symptoms or signs of imminent eclampsia, pulmonary oedema, or HELLP (haemolysis, elevated liver enzymes, and low platelet count) syndrome. [4] Foetal complications include placental abruption, intrauterine growth restriction, premature delivery, and intrauterine foetal death. The incidence of stillbirths and neonatal deaths in mothers who suffered severe preeclampsia was 22.2/1000 and 34.1/1000, respectively, in the United Kingdom (UK), with a higher incidence in developing countries.[5] Young and primigravida women are particularly vulnerable to developing preeclampsia, whereas older women are at greater risk for chronic hypertension with superimposed preeclampsia. [6,7] The incidence of preeclampsia in primigravida populations ranged from 3 to 10% and 1.4 to 4% in multigravida populations.[8]The impact of the disease is felt more severely in developing countries where, unlike other more prevalent causes of maternal mortality (such as haemorrhage and sepsis), medical interventions may be ineffective due to the late presentation of cases. The continued mystery of the aetiology and the unpredictable nature of the disease confounds the problem.[9]

PATIENTS AND METHODS

Methodology

Study Approach: Quantitative descriptive study design approach was used.

Study Design: Prospective Observational study was used.

Study Area: The research was carried out at the Obstetric and Gynaecological Department, Government Medical College and Hospital, Srinagar, a major referral hospital in Kashmir.

Study Population

The study population comprised patients who attended the hospital from 2020-2021 and met the inclusion criteria. To be enrolled in the study, patients who spent more than 24 hours in the hospital after the operation as this is the expected time that the patient has fully recovered from anaesthesia.

All patients diagnosed with severe pre-eclampsia were admitted to the labour room for emergency caesarean section. Initial obstetric management was given according to existing hospital protocol. Afterwards, general, physical, abdominal, and pelvic examinations were done. Initial investigations like complete haemogram, absolute platelet count, liver function tests, serum creatinine, and urine dipstick for grading proteinuria were performed after admission and twice weekly. The latest

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reports before the performance of the caesarean section were only included in the study. Foley's catheterisation did for urine output measurement.

All the patients underwent emergency caesarean section under general anaesthesia (GA) or Spinal anaesthesia (SA) based on the following:

- Written informed consent or refusal of the patient for the type of anaesthesia.
- Fasting status of the patient.
- Maternal and Foetal distress.
- Respiratory tract infection.

For SA, an injection of hyperbaric bupivacaine (0.5%),15 mg, was given intrathecally with or without 25 mcg of fentanyl. For GA, an injection of propofol 2mg/kg or sodium thiopentone (5mg/kg) with an injection of Suxamethonium, 2 mg/kg i.v(intravenous) was given for rapid sequence intubation and maintained with isoflurane 0.5 MAC (Minimum Alveolar Concentration). Muscle relaxants were excluded whenever possible, as their effect is unpredictably prolonged with preoperative prophylactic magnesium sulphate ($MgSO_4$) therapy. During intraoperative period injection, Fentanyl 1 mcg/kg i.vwith or without other nonopioid analgesics like paracetamol 1g infusion i.v or diclofenac 75 mg i.v infusion were used for analgesia. In case of failure of SA to provide sufficient anaesthesia, GA was given to the patient, and those patients were not included in the study.

The study included a detailed follow-up of the mothers who underwent emergency caesarean section and their babies till discharge or death during their stay in the hospital. Any admission tothe critical care unit was noted. The newborn babies were observed regarding their condition at delivery and subsequent requirement for any specialised neonatal intensive care. This study did a follow-up of these babies till they were bonded to their mothers or till any neonatal mortality. The mothers were followed up vis-à-vis

- Demographic profile.
- Indication of caesarean section.
- Obstetric parameters.
- Grade of proteinuria.
- Perioperative use of $MgSO_4$.

Apart from the type of anaesthesia administered, the study also observed the perioperative use of intravenous fluids during surgery.

For seizure prophylaxis, $MgSO_4$ was given to all patients diagnosed with severe preeclampsia as per hospital protocol. An injection of labetalol was shown to control BP (Blood Pressure) in emergency cases. In case of any deterioration in the mother's general condition, they were shifted to the intensive care unit for better management and were followed up. Length of stay was noted in all patients who survived.

After the delivery of the baby, initial resuscitation was done. Newborn babies were assessed regarding:

- The gestational age.
- Apgar scored at 1 and 5 minutes.
- Heart and respiratory rate after resuscitation.

Babies were sent to the neonatal care unit for close observation, monitoring of vital parameters and supportive management for the first 24 hrs.

While mothers of these babies were kept in separate wards for observation. In situations with any subsequent requirement of neonatal critical care, the cause of the admission and mortality was recorded.

Statistical Analysis

The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to the data editor of SPSS Version 23.0 (SPSS Inc., Chicago,Illinois, USA). Statistical software SPSS and Microsoft Excel were used to carry out the statistical analysis of data. Unpaired Student's t-test was used to compare continuous data between two groups, and categorical data were evaluated using Chi-square or Fisher's exact test, as appropriate. All tests were two-tailed, and a "P-value" of less than 0.05 was considered statistically significant.

Conflict of interest: Nil

Funding: Nil

RESULTS

This study included 145 patients with severe pre-eclampsia who underwent emergency caesarean section. Out of 145 patients, 103 were administered SA, and 42 received GA based on the patient's consent, fasting status, maternal and foetal distress, and active RTI. Patients were categorised into two groups, patients who received SA as Group S and GA as Group G. were comparable in demographic profile (Table 1).

Table 1: Demographic profile of the study population:

Variables	Group GA n=42	Group S n=103	P value
Age	23.1±3.07	24.2±2.03	0.071
Weight	63.5±4.59	64.2±3.54	0.282
Duration of surgery	35.2±4.23	35.5±7.52	0.785

Of the various indications, a very high percentage of patients underwent GA due to foetal distress (73.8 versus 8.7%; p<0.001) (Table 2).

Table 2: Indications for caesarean section in two groups

Indications for caesarean section	Group S		Group G		P value
	No	% age	No	%age	
Severe Preeclampsia	47	45.6	6	14.3	<0.001*
Foetal distress	9	8.7	31	73.8	<0.001*
Failed induction of labour	32	31.1	2	4.8	<0.001*
Poor progression of labour	8	7.8	2	4.8	0.724
Breech presentation	4	3.9	1	2.4	1.000
Contracted pelvis	2	1.9	0	0.0	1.000
Obstructed labour	1	1.0	0	0.0	1.000

The most common maternal complication among group S was headache (6.8%), and among the group G was pulmonary oedema (8.3%) (p<0.001). 74.8% of patients in group S and 31% in group G were complications-free (p<0.001) (Table3).

Table 3: Comparison based on maternal complications in two groups

Maternal Complications	Group S		Group G		P value
	No.	%age	No.	%age	
Headache	7	6.8	0	0.0	0.193
Vomiting(intraoperative)	3	2.9	0	0.0	0.556
High blood pressure(post-operative)	4	3.9	6	14.3	0.035*
Paresthesia(post-operative)	2	1.9	0	0.0	1.000
Convulsion	2	1.9	2	4.8	0.579
Wound gaping	1	1.0	0	0.0	1.000
Acute renal failure	3	2.9	3	7.1	0.356

Pulmonary edema(post-operative)	2	1.9	10	23.8	<0.001*
PPH	1	1.0	2	4.8	0.201
DIC	1	1.0	3	7.1	0.073
CCF	0	0.0	1	2.4	0.289
HELLP Syndrome	0	0.0	2	4.8	0.083
Total	26	25.2	29	69.0	<0.001*

Out of 103 patients in group S, nine (8.7%) were admitted to ICU and 19 (45.2%) out of 42 patients in group G. The difference was statistically significant (p-value< 0.001) (Table 4).

Table 4: Table showing postoperative maternal admission to the intensive care unit (ICU) in two groups

Admission to ICU	Group S		Group G		P value
	No.	%age	No.	%age	
Yes	9	8.7	19	45.2	<0.001*
No	No	94	91.3	23	
Total	Total	103	100	42	

Overall, 10 (23.8%) patients died out of 42 patients in group G and two patients (1.9%) out of 103 in group S. There was a statistically significant difference in maternal mortality (p-value<0.001), more in group G (Table 5).

Table 5: Table showing comparison based on maternal mortality in two groups

Maternal Mortality	Group S		Group G		P value
	No.	%age	No.	%age	
Yes	2	1.9	10	23.8	<0.001*
No	101	98.1	32	76.2	
Total	103	100	42	100	

The mean Apgar Score among group S and group G babies at 1 minute and 5 minutes after birth was 7.29±1.56 versus 6.41±1.64 and 8.62±1.67 v 7.64±1.71 respectively, and the difference were statistically significant with a p-valueof 0.003 and 0.002 at 1 minute and 5 minutes respectively (Fig 1).

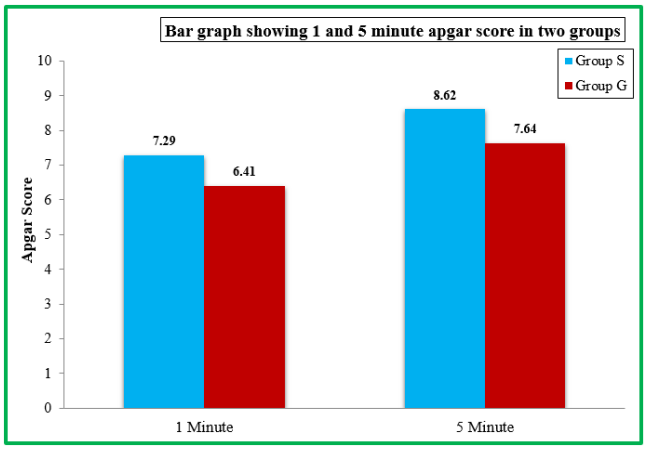

Fig. 1:

Twenty (19.4%) neonates from group S and 15 (35.7%) neonates from group G were admitted to NICU after birth (Fig 2).

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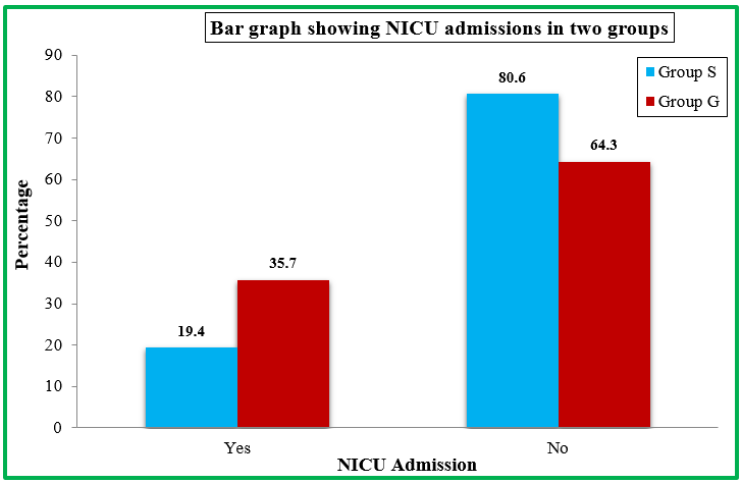

Fig. 2:

Ten (9.75%) neonates in group S and twelve (28.6%) neonates in group G died. The neonatal mortality rate was higher in neonates born to mothers in group G as compared to group S with a statistically significant difference (p-value<0.001) (Fig 2).

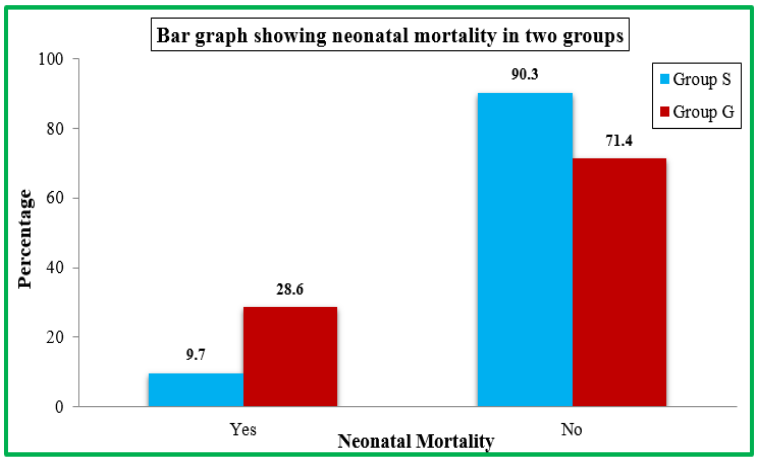

Fig. 3:

The mean duration of hospital stay in both groups was comparable, with 5.1±3.95 days in group S and 6.4±5.23 days in group G. There was a statistically significant difference (Fig 4).

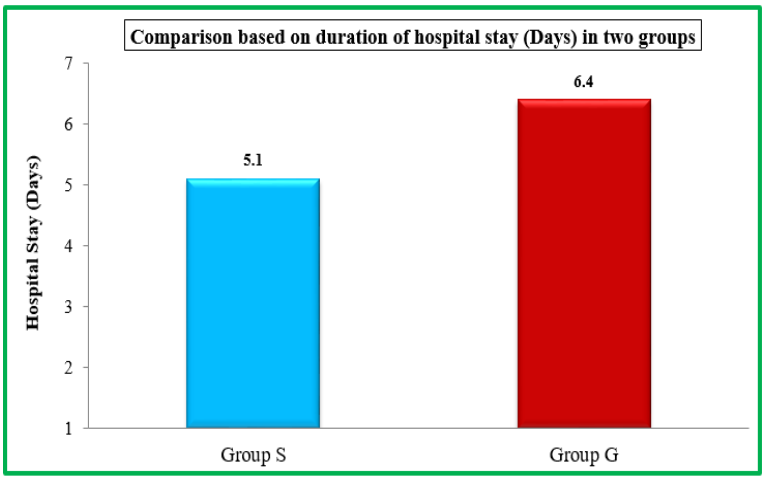

Fig. 4:

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DISCUSSION:

Preeclampsia occurs more frequently in nulliparous women and most commonly presents during the third trimester, often near term. Women with early-onset disease (before 34 weeks gestation) have worse outcomes than women with late-onset disease. The disease typically regresses rapidly after delivery, with resolution of symptoms within 48 hours. However, preeclampsia can also manifest postpartum with hypertension, proteinuria, or the occurrence of seizures (eclampsia). Postpartum preeclampsia usually presents within 7 days of delivery.[10] Disease manifestations of severe preeclampsia occur in all body systems as the result of widespread endothelial dysfunction.

On the other hand, Caesarean section increases the risk of cardiopulmonary morbidity associated with preeclampsia.[11]This is due to the altered haemodynamics in women with preeclampsia, particularly in an emergency. This risk is present with spinal and general anaesthesia and continues to challenge anaesthetists worldwide, but the risk of general anaesthesia (GA) is significantly increased in the obstetric population. The failed intubation and aspiration incidence is eight times higher than in non-obstetrical patients.[12] Other associated risks are systemic and pulmonary hypertension, which may be deleterious in this group of patients.[11] Moreover, the universal use of magnesium sulphate in severe pre-eclamptic patients prolongs the duration of muscle relaxants, making the duration and recovery from GA in these patients unpredictable.[2]Spinal anaesthesia (SA) is generally chosen, especially if anaesthetic resources are limited, as in developing countries. The quality of anaesthesia can be superior with SA and requires less equipment and training than epidural anaesthesia. However, some recent studies have highlighted an increased incidence of foetal acidosis with SA, mainly using vasopressors to treat hypotension. [13]In severe pre-eclampsia, particularly with a DBP $\geq$ 110mmHg, the foetus is compromised due to a more significant neonatal base deficit. [14]GA and regional anaesthesia are acceptable and safe methods for conducting caesarean deliveries in preeclampsia if steps are taken to ensure a careful approach to either technique. The hemodynamic alterations produced by SA are comparable with that in GA in severe preeclampsia.[15]

In our study, the indications for caesarean section in two groups were in the following order, in group S most common indication was severe pre-eclampsia (45.6%) with significant statistical difference followed by failed induction of labour (31.1%),foetal distress (7.8%),poor progression of labour (7.8%), breech presentation (3.9%), contracted pelvis (1.9%), obstructed labour (1%). In group G,foetal distress (73.8%) was the most common indication with a statistically significant difference ($p<0.001$), followed by severe pre-eclampsia (14.3%), failed induction of labour and poor progression of labour (4.8% each), breech presentation (2.4%).

We observed and compared the maternal complications among these patients in our study. In group S, the most common complication was headache (6.8%), high blood pressure(post-operative) (3.9%), acute renal failure, vomiting (intraoperative)(2.9%), paresthesia(post-operative) and convulsion (1.9%),PPH,DIC and wound gaping (1%). In group G, the most common complication was pulmonary oedema (23.8%) with a statistically significant difference ($p<0.001$), followed by high blood pressure (14.3%) with a statistically significant difference ($p<0.035$), ARF and DIC (7.1%), Convulsion, HELLP syndrome and PPH (4.8%), CCF (2.4%). Headache, vomiting, wound site gaping, and paresthesia was only seen in group S. 74.7% of patients in group S and 31% in group G were complications-free ($p<0.001$).

In the study by **Suman Chattopadhyayet al.,[16]**22.2% of patients with GA developed pulmonary oedema, 14.8% had uncontrolled hypertension, andthere were fewerpostoperative complications in the SA group patients as compared to GA,which is in concordance with our study. Another study by **Tarek Mohamed Ramadan et al.[17]**observed statistically significant higher post-operative high

BP among the GA group compared with the SA group. Another study by **T. Ravi et al. [18]** observed more postoperative complications in the GA group. **Muhammad Ahsan-ul-Haq [19] also** observed that postoperative complications were significantly more common in the GA group than in the SA group.
80.7% of patients were shifted to general wards postoperatively, and 19.3% required postoperative ICU admission.8.7% of patients from group S and 45.2% from group G required post-operative ICU admission, whereas 91.3% from group S and 54.8% from group G were shifted directly towards. There was a significant statistical difference ($p<0.001$). The study conducted by **Suman Chattopadhyayet al.[16]**observedthat overall,13.3%of patients required post-operative critical care,particularly the general anaesthesia group. The study by **T. Ravi et al.[18]** reported more ICU admissions in the GA group. **Muhammad Ahsan-ul-Haq [19]** conducted astudy in which postoperative ICU admissions were significantly more common in the GA group than inthe SA group. On the contrary, the study by **Keerath K et al. [20]** and **Adugna Aregawi1 et al. [21]** observed no difference in post-operative ICU admissions in the two groups.

In our study, overall maternal mortality was 8.3%; in group S it was 1.9% and significantly higher in group G (23.8% with $p<0.001$). **Pacharla Indira et al.[22]Muhammad Ahsan-ul-Haq [19]** reported better maternal outcomes in patients under SA. The maternal mortality was higher in the GA group than in the SA group in the study done by **Muhammad Ahsan-ul-Haq [19]**. The results in our study are in concordance with **Suman Chattopadhyayet al. [16]** reporting high maternal mortality in the GA group as compared to SA (25.9% versus 1.4%; $p<0.001$)

We also observed causes of maternal mortality, the most common cause was ARF and DIC, with 50% in group S and 30% in group G, followed by HELLP syndrome (20%), CCF and sepsis (10%) in group G. There was no statistical significance. The mean weight of neonates in our study was 2.55±0.48 kg and 2.36±0.57 kg in groups S and G, respectively. **Martin TCet al.[23]** demonstrated results with babies having no difference in birth weight (mean 3.2±38 versus 3.2±58 kg). **Keerath K et al.[20],** on the contrary, observed thatneonates in the general anaesthesia group had significantly lower birth weights and gestational ages. The possible reason for low birth weight may be because the mothers had more severe diseases.

In our study, Apgar score at 1 minute (7.29±1.56 versus 6.41±1.64; $p<0.003$) and 5 minutes (8.26±1.67 versus 7.64±1.71; $p<0.002$) was significantly lower in group G patients. The result of our study is in concordance with the study done by **Tarek Mohamed Ramadan et al.[17] ;** the APGAR score at 1 and 5 min was significantly higher in group S than in group G ($p <0.05$). The results of a study by Martin TC et al. 65 are similar to ours.

In our study, overall, 24.1% of neonates required NICU admissions after birth, 19.4% in group S and 35.7% in group G ($p<0.038$) (Table 12). The results of **Hall DR et al. [24]**and **Martin TCet al.[23]**are in concordance with our study. In contrast, **VitusOkwuchukwu Obi1 et al. [25] observed** no significant difference in the number of neonates admitted into the Intensive Care Units.
Our study's overall neonatal mortality was 15.2%, with 9.7% in group S and 28.6% in group G ($p< 0.001$). (Table 13) The greater severity of pre-eclampsia, foetal distress, lower gestational age and lower birth weight may have contributed to the higher mortality rate in group G.

We also observed causes of neonatal mortality; in order of frequency, causes of mortality in group S were HIE-3 (50%), sepsis (40%) and VAP (10%).In group G, the causes of mortality were sepsis (60%),HIE-3 (33%), and MAS (17%). There was no significant difference. Similar results are observed in the studies conducted by **Keerath K et al. [20]** and **Ajuzieogu OV et al.[26]**

CONCLUSION:

To conclude, in this study,

- Significantly higher intra-operative blood pressure was observed among GA group than SA group.
- Severe pre-eclamptic mothers receiving general anaesthesia required more critical care support.
- Maternal morbidity and mortality was significantly higher with general anaesthesia.
- Neonatal outcome were poorer in the GA group, with lower apgar scores and a significantly higher morbidity and mortality.
- Although we found no statistically significant difference in the hospital stays of patients in surviving GA and SA group patients, Spinal anaesthesia remains a reasonable anaesthetic option in severe preeclampsia patients for caesarean delivery if there is no contraindication to spinal anaesthesia. However the adequacy of safety of spinal anaesthesia as an alternative to general anaesthesia in severe preeclampsia, remains to be elucidated in further larger randomised trials.

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