

Spinal and Epidural anaesthesia for Caesarean section in severe preeclampsia – a comparative prospective randomized study

Bindu Meleveetil¹, Ushakumary Raghunathan^{2,*}, Radha Korumbil Raghavan³

¹Associate Professor, ^{2,3}Additional Professor, Dept. of Anaesthesiology, Govt. Medical College, Kozhikode, Kerala

***Corresponding Author:**

Email: surgeonuk@gmail.com

Received: 7th December, 2016

Accepted: 6th March, 2017

Introduction

Preeclampsia is a multisystem disorder of pregnancy associated with significant maternal, foetal and neonatal morbidity and mortality.⁽¹⁻³⁾ Regional anaesthesia is preferred in these patients because it avoids maternal complications and improves utero-placental blood flow and neonatal outcome.⁽⁴⁾

Epidural anaesthesia has been accepted as the technique of choice for caesarean section in severely preeclamptic patients. Many retrospective studies have assessed the haemodynamic effects of spinal anaesthesia in severe preeclampsia and showed no significant haemodynamic instability.

The aim of this prospective study was to assess the haemodynamic effects and neonatal outcome of spinal anaesthesia compared to that of epidural anaesthesia.

Materials and Method

After Institutional Ethics Committee approval and written informed consent, a prospective randomized study was carried out on 60 severely pre-eclamptic patients in the age group of 18-35 years scheduled for elective caesarean section, over a period of 12 months. Preeclampsia was regarded as severe if the systolic blood pressure was 160mmHg or more and/ or diastolic blood pressure 110mmHg or more on two separate occasions at least 6hours apart and proteinuria on urine dipstick was 3+ or more. All patients were receiving antihypertensive therapy with oral nifedipine 20mg twice daily and if not controlled labetalol 100mg was added once or twice a day. Patients with signs and symptoms of impending eclampsia such as headache, visual disturbances, epigastric pain and convulsions were excluded from this study. Patients with coagulation disorders, history of allergy to local anaesthetics, placental abruption, placenta praevia, HELLP syndrome, renal diseases, cardiac diseases, multiple pregnancies and local infection were also excluded.

The patients were randomly allocated using a computer generated random number list to two groups of 30 each, the spinal group (Group S) and epidural group (Group E). All patients were premedicated with oral Ranitidine 150mg and oral metoclopramide 10mg, two hours prior to surgery. Antihypertensive

medications were continued. Group S received 1.5mL of 0.5% hyperbaric bupivacaine and 25µg fentanyl. Group E received 5mL of 2% lignocaine with adrenaline 1/400000 and 50µg fentanyl and then 3mL increments of 2% lignocaine with adrenaline 1/400000 every 5min till sensory block level upto T4 was attained. On arrival to operating room, patient's baseline heart rate (HR) and non-invasive blood pressure (NIBP) were recorded before any invasive procedure. Patient was in the supine position with a left lateral tilt using a wedge of 10cm under the right buttock. NIBP, ECG and pulse oximeter were attached. NIBP cuff used was of appropriate size such that inflatable bladder covers 75-100% of the circumference of the upper arm. Intravenous line was established using an 18G cannula and an infusion was started with normal saline (NS). Oxygen was given via face mask at the rate of 5L/minute. In group S, spinal anaesthesia was performed using a 25G Quincke spinal needle (Spinocan, B. Braun Melsungen AG, Germany), and was placed at L3-L4 or L2-L3 interspace with the patient in the lateral decubitus position. After observing the free flow of CSF 1.5mL of 0.5% hyperbaric bupivacaine with 25µg fentanyl was injected into the subarachnoid space. The patient was then turned supine with left uterine displacement using the wedge. HR and mean arterial pressure (MAP) were measured every minute for the first 20 minutes and then every 5 minutes till the end of surgery. Whenever hypotension (fall in systolic BP >30% from baseline or a value of <100mmHg) occurred it was treated with intravenous ephedrine 6mg and 100ml NS. Total number of such interventions was documented.

In group E, an 18G Tuohy epidural needle (Perifix 401, B. Braun Melsungen AG, Germany) was inserted at L3-L4 or L2-L3 interspace with the patient in the lateral decubitus position. Epidural catheter was introduced 4-5cm into the epidural space and 3mL of 2% lignocaine with adrenaline 1/200000 was given as a test dose. The patient was then placed supine with left uterine displacement. 5mL of 2% lignocaine with adrenaline 1/400000 with 50µg Fentanyl was given through the epidural catheter followed by 3mL increments of lignocaine with adrenaline 1/400000 until the loss of

pinprick sensation to T4 sensory level was attained. Since in preeclampsia there is an increased sensitivity to vasoconstrictors, we reduced the dose of adrenaline in the local anaesthetic solution to 2.5µg/mL(1/400000) instead of 5µg/mL (1 in 200000) for epidural. Measurements of HR and MAP were done in the same way as the spinal group.

All patients had their bladder catheterized during surgery and for 12 hours postoperatively. Maintenance fluid was given at a rate of 100mL/h. After delivering the baby 10 units Oxytocin in 100mL NS was given over 30min. The patients were followed up for 24 h

with routine postoperative monitoring and care in the postsurgical ward.

The newborn babies were assessed by Paediatricians who were unaware of the anaesthetic technique used. Apgar scores at 1min and 5min were recorded.

Statistical analysis: Data was analyzed using SPSS v18 software, Pearson Chi square test was used for comparison of demographic data and independent-t test was used to compare quantitative variables between the two Groups.

Results

Both groups were comparable in their age, height, weight and duration of surgery (Table 1).

Table 1: Maternal demographics

Demographic parameters	Group S (n=30)	Group E (n=30)	P value
Mean age (years)	24.53± 4.7	23.63± 3.5	0.402
Mean height (cm)	157.33± 2.5	156.53±2.5	0.226
Mean weight (kg)	58.73 ± 9.09	62.8 ± 11.8	0.192
Duration of surgery (min)	38.5	36.17	0.169

The mean time to attain T4 sensory block in the spinal group was 1.733 ± 0.064 minutes and in the epidural group, it was 16.8 ± 2.85 minutes.

There was no significant difference in mean MAP and HR between the two groups (P>0.05) (Table 2, Fig. 1 and Fig. 2). Lowest MAP and maximum fall in MAP from baseline value, showed no statistically significant difference in spinal and epidural group.

**Table 2: Comparison of Mean Arterial Pressures and Heart Rates
Spinal anaesthesia (n=30) vs. Epidural anaesthesia (n=30)**

Time (min)	Mean MAP		P value	Mean HR		P value
	Group S	Group E		Group S	Group E	
0	111.16 ± 5.9	110.27 ± 7.3	0.611	88.50 ± 5.2	88.25 ± 5.8	0.326
1-10	90.00 ± 7.423	88.93 ± 6.633	0.560	84.53± 8.601	87.40 ± 12.007	0.292
11-20	95.43 ± 6.725	92.30 ± 8.949	0.131	85.38 ± 6.494	89.69± 9.404	0.058
21-30	97.17 ± 9.090	93.67 ± 12.189	0.212	86.13± 7.016	87.37± 7.327	0.508
31-40	99.00 ± 6.928	98.30 ± 8.457	0.727	84.30± 6.939	86.00± 6.988	0.348
41-50	101.97 ± 5.635	102.00 ± 7.206	0.984	82.30± 10.574	86.20±6.541	0.091
51-60	104.90 ± 5.880	103.43 ± 5.544	0.324	83.87± 6.912	86.57± 7.030	0.139

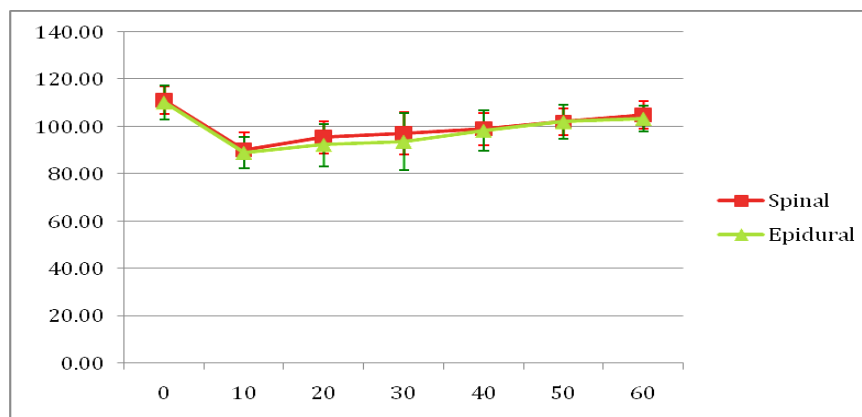


Fig. 1: Comparison of MAP in Spinal and Epidural groups

Baseline 1-10 11-20 21-30 31-40 41-50 51-60 min
 Group S 111.16 90.0 95.43 97.1 99.00 101.97 104.90 mm of Hg
 $\pm 5.9 \pm 7.42 \pm 6.725 \pm 9.09 \pm 6.928 \pm 5.635 \pm 5.88$
 Group E 110.27 88.93 92.30 93.67 98.30 102.0 103.43 mm of Hg
 $\pm 7.3 \pm 6.633 \pm 8.949 \pm 12.189 \pm 8.457 \pm 7.206 \pm 5.544$

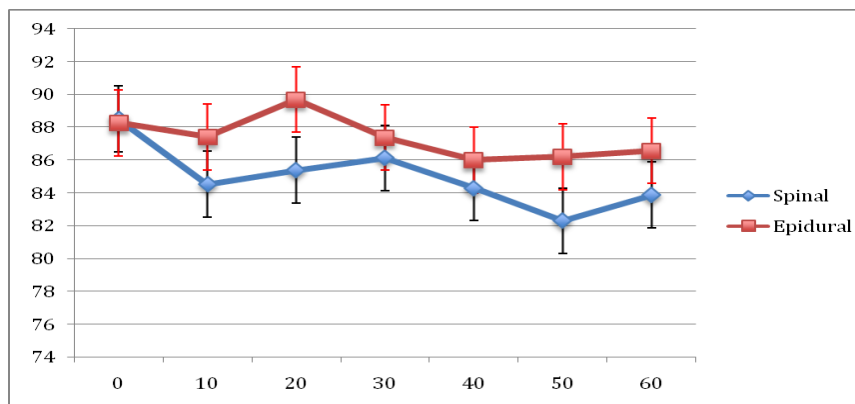


Fig.2: Comparison of Heart rates in Spinal and Epidural groups

Baseline 1-10 11-20 21-30 31-40 41-50 51-60 min
 Group S 88.50 84.53 85.38 86.13 84.30 82.30 83.87 per min
 $\pm 5.2 \pm 8.601 \pm 6.494 \pm 7.016 \pm 6.939 \pm 10.574 \pm 6.912$
 Group E 88.25 87.40 89.69 87.37 86.00 86.20 86.57 per min
 $\pm 5.8 \pm 12.00 \pm 9.404 \pm 7.327 \pm 6.988 \pm 6.541 \pm 7.030$

The lowest MAP was 88.59 ± 7.1 mmHg in group S and 88.18 ± 7.3 mmHg in group E. The maximum fall in MAP from baseline value in group S was 22.58 mmHg and in group E it was 22.09 mmHg.

Hypotension was present in both spinal and epidural groups and was treated with 6mg Ephedrine + 100ml NS. 13 out of 30 patients in group S (43.3%) and 16 out of 30 patients in group E (53.3%) required interventions. The mean number of interventions in group S was 0.5 ± 0.63 and group E was 0.56 ± 0.57 ($P = 0.374$).

The newborn was assessed using Apgar score at 1min and 5 min. All babies except one, in the epidural group, had an Apgar score of more than 7. One baby in the Group E was premature. There was no episode of respiratory depression in any babies.

Discussion

General anaesthesia is riskier in preeclampsia because of accentuated airway edema and narrowing of glottis causing difficult intubation, hypertensive response to laryngoscopy and intubation, decreased intervillous blood supply, increased risk of aspiration and prolongation of neuromuscular blockade in those who received magnesium sulphate.⁽⁵⁾ Regional anaesthesia is preferred to general anaesthesia for caesarean section considering the risks and benefits to the mother and foetus. Compared to epidural anaesthesia, spinal anaesthesia is more reliable, has early onset of blockade, provides better quality

anaesthesia and has less risk of local anaesthetic toxicity.⁽⁶⁾ Spinal anaesthesia may theoretically cause a higher incidence of hypotension than epidural anaesthesia, because of sudden sympathetic blockade causing significant reduction in venous return due to veno-dilatation in the lower part of the body. This is further worsened in pregnancy by aorto-caval compression. The normal physiologic compensation of this reduction in systemic vascular resistance by an increased cardiac output may not set in as, a high level of spinal block inhibits the cardio-accelerator fibres leading to a fall in heart rate. This combined effect of decreased vascular resistance and reduced cardiac output result in high incidence of hypotension after spinal anaesthesia.⁽⁷⁾ However this hypotension following spinal anaesthesia can be easily treated and is short lived and has not been linked to clinically significant differences in outcomes.⁽⁸⁾

In our study, the fall in MAP from baseline values showed no significant difference in both spinal and epidural group. Many studies published also show similar results.^(4,9) In a large prospective study, it was found that even though the incidence of hypotension was more in the spinal group, the duration of hypotension was short and easily treatable.⁽¹⁰⁾

The number of patients requiring interventions and mean number of intervention were similar in both groups. This agrees with the other studies where ephedrine requirements were similar in spinal and epidural groups.^(4,11,12) In a study monitoring beat to

beat variation in cardiac output, it was found that patients with severe preeclampsia undergoing caesarean section had clinically insignificant changes in cardiac output during spinal anaesthesia.⁽¹³⁾ Another prospective study comparing haemodynamic effects of spinal anaesthesia for caesarean section in normotensive parturients and in those with severe preeclampsia, the preeclamptics had less hypotension and less vasopressor requirement.⁽¹⁴⁾ Other two prospective studies, comparing the effects of spinal anaesthesia in preeclamptic and healthy parturients, also found similar haemodynamic effects and vasopressor requirements.^(15,16)

In normal pregnancy there is increased synthesis of prostaglandins and nitric oxide which act as vasodilators and there is increased dependence on sympathetic vasoconstriction for vascular tone. Sympathetic blockade after spinal anaesthesia is associated with sudden and excessive hypotension. In preeclampsia vascular endothelial damage occurs, which produces increased amount of endogenous vasopressors like thromboxane and endothelin. So even after spinal anaesthesia, vascular tone is maintained preventing excessive fall in blood pressure. In normal pregnancy there is reduced sensitivity to exogenous vasoconstrictors leading to increased vasopressor requirement to reverse the hypotension. In preeclampsia there is an increased sensitivity to vasoconstrictors and so less vasopressor is required.^(17,18)

Opioids have been used by several workers as an additive to local anaesthetics for regional anaesthesia to reduce the dose of local anaesthetic. Better haemodynamic stability with adequate anaesthesia has been found with the use of low dose hyperbaric bupivacaine and opioid such as fentanyl as compared to conventional doses of hyperbaric bupivacaine.^(19,20) In our study we used 7.5mg bupivacaine and 25µg fentanyl for spinal anaesthesia.

Many studies suggested spinal anaesthesia as a safer alternative to general anaesthesia in patients with severe preeclampsia.^(21,22) They found comparable haemodynamic effects and better neonatal outcome with spinal anaesthesia. The neonatal outcome assessed by Apgar scoring was similar in spinal and epidural group. This may be due to the short duration of hypotension and maintenance of utero-placental blood flow.

From our study we found that spinal anaesthesia was comparable to that of epidural anaesthesia in haemodynamic effects and neonatal outcome which support the use of spinal anaesthesia in severely preeclamptic patients. Also the time to attain adequate sensory level of anaesthesia is much shorter in spinal anaesthesia compared to epidural anaesthesia. So it is suitable for emergency surgeries as well. None of the patients in our series had convulsions during surgery or post-operatively.

The advantage of epidural anaesthesia is that it can be used for effective postoperative analgesia. Shorter duration of postoperative analgesia following spinal anaesthesia may be overcome by the use of adjuvants like opioids to the spinal anaesthetic.

Conclusion

Haemodynamic effects of spinal anaesthesia were comparable to that of epidural anaesthesia in patients with severe preeclampsia. Neonatal outcome was similar in both spinal and epidural anaesthesia. So spinal anaesthesia can be recommended as the preferred anaesthetic technique in patients with severe preeclampsia because it is more cost effective, easy to perform, produce more reliable and rapid anaesthesia and avoids problems associated with epidural and general anaesthesia.

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