ANALYSIS OF OUTCOME OF GENERAL VERSUS SPINAL ANAESTHESIA FOR CAESAREAN DELIVERY IN SEVERE PRE-ECLAMPSIA WITH FOETAL COMPROMISE

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The aim of this study was to evaluate and compare the outcome of general versus spinal anaesthesia for caesarean delivery in mothers with pre eclampsia and foetal compromise. Retrospective comparative analysis of peri-operative morbidity and mortality in severe pre eclampsia, conducted at Pakistan Naval Hospital Shifa Karachi, Pakistan, from Jan 2002 to Dec 2003. Sixty patients who had diastolic blood pressure >110mmHg and proteinuria >3+, were selected for study. Thirty patients were given general anaesthesia (GA group) and 30 were delivered under spinal anaesthesia (SA group). Incidence of morbidity, mortality and admission in intensive care unit, were noticed. Statistically, incidence of hypotension and bradycardia was significantly (p<0.05) high in SA group but hypertension and tachycardia were more (P<0.05) in GA group. Clinically haemodynamic changes in both the groups, were in acceptable and manageable limits during the procedure. One-minute Apgar scores were lower in GA group (6 vs. 8) but there was no difference in 5 min scores. Postoperative complications were significantly (p<0.05) more common in GA group (66.7% vs. 16.6%) as compared to SA group. Admission ratio in ICU and total hospital stay, GA vs. SA group was 4:1 and 2:1 respectively. Mortality was more in GA group (6.6% vs. 0%) as compared to SA group. As a conclusion, we advocate that spinal anaesthesia should be used as first choice for severe pre eclamptic patients, which is safer than general anaesthesia, with less postoperative morbidity and mortality.

Key words: *Severe Pre-eclampsia, Foetal Compromise, General Anaesthesia, Spinal Anaesthesia, Morbidity and Mortality.*

INTRODUCTION

Pre-eclamptic toxaemia (PET) is a multi-system disorder that is characterized by endothelial cell dysfunction as a consequence of abnormal genetic and immunological mechanisms. Despite active research for years, the exact aetiology of this potentially fatal disorder remains unknown. Although understanding of the pathophysiology of pre-eclampsia has improved, management has not changed significantly over the years[1]. Anaesthetic management of these patients remains a challenge. Although general anaesthesia can be used safely in pre-eclamptic women, it is fraught with greater maternal morbidity and mortality. Currently, the safety of regional anaesthesia techniques is well established and they can provide better obstetrical outcome when chosen properly. Thus, regional anaesthesia is extensively used for the obstetric management in women with pre-eclampsia[1].

For the past 50 years PET has been one of the two commonest direct causes of pregnancy-related death, being second only to pulmonary embolism in recent UK maternal mortality data, with similar facts in the USA and Australia. For many years most PET deaths were from cerebral haemorrhage, however, since the mid-1980s pulmonary oedema (iatrogenic fluid overload and Adult Respiratory Distress Syndrome) has become the main cause of death[2].

Where Caesarean section is required the relative risks of general and regional anaesthesia must be assessed. Regional anaesthesia is usually considered safer, although cases must be assessed on an individual basis. The added risks associated with general anaesthesia include airway difficulties due to oedema (often aggravated by tracheal intubation), and the presser response to laryngoscopy and intubation[1]. The benefits of epidural analgesia in pre-eclampsia are well recognized and an early epidural is recommended in labor. If a working epidural is already present this should be extended for surgery. But in emergency situation epidural has its own limitations. Epidural anaesthesia was the regional anaesthesia of choice until pencil-point spinal needles were introduced[3]. The disadvantages of epidural anaesthesia are that onset of

block is longer than that of spinal anaesthesia and that the spread of the block is patchy, often giving poor anaesthesia for caesarean delivery. There is documented evidence of conversion of epidural to GA due to patchy anaesthesia or complete failure and there is increasing evidence to show that spinal anaesthesia or combined spinal epidural may be the anaesthesia of choice for pre-eclamptic patients. Especially spinal anaesthesia, which is quick to perform, takes less time to be effective and failure rate is less than epidural[3].

Previous data showed that spinal anaesthesia was controversial in PET[4] - the anticipated potential risks of pulmonary oedema, profound cardiovascular instability, possibly from a fall in cardiac output[5], and the consequent recourse to iv fluids and vasoconstrictors, suggested that it was not a technique to be recommended in PET. However during the last decade, after the advent of pencil point spinal needles and newer local anaesthetic agents, it has been tried with favorable results. In most of the obstetrical centers it is now being used as anaesthesia of first choice for pre-eclamptic patients[6-9].

The data from previous studies demonstrates that pre-eclampsia / eclampsia - related complications and haemorrhage are the leading causes for admission of obstetric patients to the ICU[10,11]. Both are associated with increased risk of maternal morbidity and mortality[12], which is more prevalent perioperatively in patients given general anaesthesia as compared to regional anaesthesia[1].

Most of these studies recommend further clinical trial to choose the best technique[6-9]. In our center we have been using both the techniques of anaesthesia, general as well as spinal for many years and recently we have adopted the later technique in 98% such patients.

STUDY DESIGN
Retrospective comparative analysis of perioperative morbidity and mortality in severe pre eclampsia, was conducted after approval of Hospital Research Council, at Pakistan Naval Hospital Shifa Karachi Pakistan, from Jan 2002 to Dec 2003.

PATIENTS AND METHODS
During the past two years, in a total of 8271 deliveries, 1950 caesarean deliveries were performed at our center. The incidence of pre-eclampsia was 12%. Diastolic blood pressure in 60 patients was >110 mmHg and proteinuria>3+, they were labeled as severe pre-eclamptics with foetal compromise and operated as emergency cases. Foetal compromise criteria (table 1) was loss of short-term variability (STV), heart rate (HR) <60 or >150 and early or late deceleration. Patients with deranged coagulation profile, antipartum haemorrhage, intrauterine death or impending eclampsia, were excluded from study.

Patients were divided in two groups, GA (general anaesthesia n: 30) and SA (spinal anaesthesia n : 30). Mean age of GA group versus SA group, was 26±5 and27±5 years, weight 67±4 and 68±4 kg and height 160±3 and 161±4cms, respectively (table 2). All the patients were given 700 ml of IV
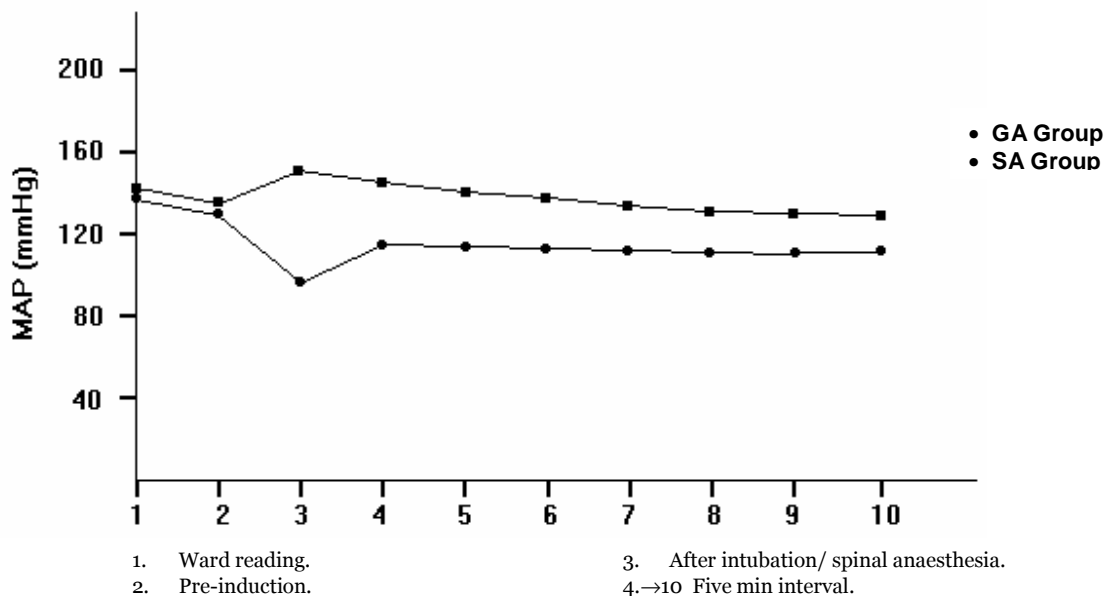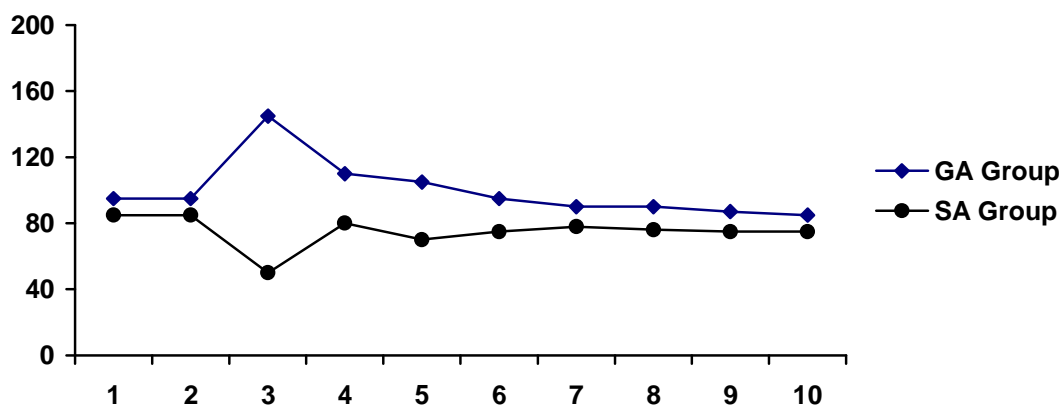

1. Ward reading.
2. Pre-induction.
3. After intubation/ spinal anaesthesia.
4.→10 Five min interval.

Fig. 1: Mean blood pressure changes in both groups.

1. Ward reading.
2. Pre-induction.

3. After intubation / spinal anaesthesia.
4.→10 Five min interval.

Fig. 2: Heart rate changes in both the groups.

Table 1: *Foetal heart rate abnormalities indicating caesarean delivery.*

S No.	Foetal Heart Rate Abnormalities	GA group	SA group
1.	Loss of STV	5	4
2.	Loss of STV and bradycardia	6	5
3.	Loss of STV and early decelerations	7	8
4.	Tachycardia	6	6
5.	Late decelerations	6	7
	Total	30	30

STV- Short-term variability   GA-general anaesthesia   SA-spinal anaesthesia

Table 2: *Demographic data.*

S No.	Demographic Data	GA group	SA group
1.	Age, yr (mean ± SD)	26 ± 5	27 ± 5
2.	Weight, Kg (mean ± SD)	67 ± 4	68 ± 4
3.	Height. Cm (mean ± SD)	160 ± 3	161 ± 4
4.	Systolic BP, mmHg (mean ± SD)	182 ± 15	180 ± 15
5.	Systolic BP, mmHg (mean ± SD)	119 ± 7	118 ± 8
6.	MAP, mmHg (mean ± SD)	140 ± 11	139 ± 11
7.	Heart Rate, per min (mean ± SD)	97 ± 5	96 ± 5
8.	Proteinuria 3+, No.	13	16
9.	Proteinuria 4+, No.	17	14
10.	Gravity, median (range)	15 (1-4)	1 (1-6)
11.	Parity, median (range)	0.5 (0-3)	0.5 (0-3)
12.	Active labor, No.	11	4
13.	Not induced, no labor, No.	8	16
14.	Induced, no labor, No.	11	10
15.	Gestational age, weeks	35.1 (3.2)	34.9 (2.6)

crystalloid fluid preoperatively and their blood pressure was controlled with hydrazaline, nefedipine or nitroglycerine infusion. Magnesium sulfate loading dose of 4G in 100 ml saline, was given over 30 min, followed by maintenance dose of 1-2g/hr. Patients were shifted to operation theater when their blood pressure was under control i.e. systolic <160mmHg and diastolic <110 mmHg.

In GA group patients were induced with thiopentone 5mg/kg and succinylcholine 1mg/kg. Lignocaine 1.5 mg/kg was given to reduce the intubation response. Rapid sequence induction was done and anaesthesia was maintained with 50% nitrous oxide in oxygen and 0.5-1% isoflurane. Nalbuphine 0.20 mg/kg was given after delivery. Blood pressure (figure 1) and heart rate (figure 2) were monitored in the ward[1], before induction[2], after intubation[3] and at 5 min interval[4-10] till completion of the operation. In SA group 0.75 % heavy bupivacaine 1.5 ml was administered at L3-4 or L4-5 and level of anaesthesia was achieved upto T4-6. Patient was given 2-4 L/min of oxygen. Blood pressure was monitored just after spinal anaesthesia and at 5 min interval. If required the patient was sedated with midazolam (2-4mg).

The parameters noted (table 3) were incidence of morbidity and mortality and admission in intensive care unit. Morbidity parameters observed were incidence of perioperative hypotesion and hypertension, changes in heart rate during anaesthesia, postoperative complications (table 4) like fits, pulmonary oedema, acute renal failure, aspiration pneumonitis and delayed recovery from anaesthesia. Apgar scores after 1 and 5 min in neonates and admission ratio of mothers, in ICU and total hospital stay were also noted.

Twenty five percent fall or rise in blood pressure (BP) from the baseline, was considered as hypotension or hypertension respectively. Similarly 25% rise or fall in heart rate (HR) from the base line, was considered as tachycardia or bradycardia respectively.

Data was analyzed by using SPSS version 10. Students' t-test was used for mean comparison of significant factors and Varance test (ANOVA) for inter and intra group analysis of the parameters.

RESULTS

As shown in table 3 incidence of intra-operative and postoperative hypotension was 16.6% and 6.6% respectively, in GA group as compared to 33.3% and 13.3% in SA group. Difference in two groups was significant (p<0.05). In contrast intraoperative and postoperative hypertension was 73.3% and 16.6% respectively, in GA group as compared to 16.6% and in SA group (p<0.05). Incidence of tachycardia was more (73.3%) in GA group as compared to SA group (33.3%) but bradycardia was more (33.3%) in SA group as compared to GA group (16.6%). There was significant difference (P<0.05) in HR in both the groups. Most of the patients in SA group developed bradycardia followed by hypotension, which responded to atropine 1mg IV and rapid crystalloid infusion. Where as most of the GA group patients showed hypertensive response and tachycardia after endotracheal intubation, which settled down with in 10 minutes.

Table 3: *Incidence of morbidity & mortality in GA and SP groups.*

S No.	Parameter	GA group (n 30)	SA group (n 30)
1.	Intraoperative Hypotension	5 (16.6%)	10 (33.3%)
2.	Postoperative Hypotension	2 (6.6%)	4 (13.3%)
3.	Intraoperative Hypertension	22 (73.3%)	2 (6.6%)
4.	Postoperative Hypertension	5 (16.6%)	nil
5.	Tachycardia	22 (73.3%)	10 (33.3%)
6.	Bradycardia	5 (16.6%)	10 (33.3%)
7.	Apgar scores (1 min)	6 (4-8)	8 (6-10)
8.	Apgar scores (5 min)	9	9
9.	Postoperative complications	20 (66.7%)	5 (16.6%)
10.	Admission in ICU	20 (66.7%)	5 (16.6%)
11.	**Days in hospital**	**12 (7-15)**	**6 (4-10)**
12.	Mortality (mother)	2 (6.6%)	Nil

Table 4: *Indications for admission in ICU.*

S No.	Indications	GA group	SA group
1.	Post operative hypertension	5 (16.6%)	Nil
2.	Post operative hypotension	2 (6.6%)	3 (10%)
3.	Fits	2 (6.6%)	1 (3.3%)
4.	Pulmonary oedema	5 (16.6%)	Nil
5.	Aspiration pneumonitis	1 (3.3%)	<u>Nil</u>
6.	Acute renal failure	2 (6.6%)	1 (3.3%)
7.	Delayed recovery	3 (10%)	Nil
	Total	26 (66.7%)	5 (16.6%)

Apgar score in GA group was 6(4-8) as compared to 8(6-10) in SA group. A total of 66.7% mothers were admitted in ICU in GA group and their total days in the hospital were 12(7-15) as compared to16.6% and 6(4-10) days respectively in SA group.

Indication for admission in ICU in GA versus SA group, were post-operative hypertension (16.6% vs. 0%), post operative hypotension (6.6% vs.10%), fits (6.6% vs. 3.3%), pulmonary oedema (16.6% vs. 0%), aspiration pneumonitis (3.3% vs. 0%), acute renal failure (6.6% vs. 3.3%) and delayed recovery (10% vs. 0%), as shown in table 4. There was significant difference ($p<0.05$) in both the groups. Post operative fits were observed in three patients, 2 in GA group and only one patient form SA group, which were controlled in two patients, with midazolam and magnesium sulfate but one patient from GA group, aspirated and developed pulmonary oedema, requiring ventilatory support. She developed cardiac arrest on third postoperative day, was resuscitated but fits continued, requiring heavy sedation and relaxation. She again developed cardiac arrest on 5th postoperative day and could not be revived. Another lady, who was delivered under GA, developed Adult Respiratory Distress Syndrome (ARDS) postoperatively, requiring ventilatory support. She developed tension pneumothorax followed by cardiac arrest, on 2nd postoperative day. She was resuscitated but could not survive.

DISCUSSION
There are several reasons for preferring spinal anaesthesia to general anaesthesia for caesarean sections. Babies born to mothers having spinal anaesthesia may be more alert and less sedated as they have not received any general anaesthetic agents through the placental circulation. As the mother's airway is not compromised, there is a reduced risk of aspiration of gastric contents causing chemical pneumonitis. Although spinal anaesthesia is not contra-indicated in the presence of mild pre-eclampsia, such patients may have altered clotting function and are relatively hypo-volaemic. There is always a chance that a pre-eclamptic patient may suddenly fit and anticonvulsant drugs (diazepam or thiopentone) must be immediately available. The advantages and disadvantages of spinal versus general anaesthesia will have to be carefully considered for each patient[13]. On the other hand, spinal anaesthesia conveys significant advantages over epidural anaesthesia such as the simplicity of its use and the speed of onset, which allows neuraxial anaesthesia in urgent Caesarean sections and thus reduces the necessity for general anaesthesia. The small doses of local anaesthetics required to perform spinal anaesthesia reduce the risks of systemic toxicity to zero. Spinal anaesthesia is now considered the method of choice for urgent Caesarean section. Preliminary studies indicate that spinal anaesthesia may be safely performed in patients with severe pre-eclampsia, in whom spinal anaesthesia was previously considered controvercial[14].

One previous study showed that the incidence of complications following GA (68.8%) were significantly ($P < 0.05$) more than that of SA (47.1%)[16]. Commonest complication following GA was intraoperative hypertension (68.8%), which was slightly more (73.3 %) in our study and patients showed exaggerated response to laryngoscopy, both the blood pressure (BP) (73.3%) as well as heart rate (73.3%) were high after intubation and administration of iv lignocaine did not effectively reduce the response in pre eclamptic mothers. On the other hand intraoperative hypotension following SA was[16] as compared to 33.3% in our study and the difference among GA versus SA groups, in our study, was significant ($p<0.05$). Incidence of bradycardia followed by hypotension, just after SA was 33.3%, which responded to

atropine and iv fluid therapy. As the heart rate increases blood pressure (BP) became to normal in almost all the patients. Development of bradycardia in GA group was relatively less (16.6%) as compared to SA group (33.3%). Another contradictory study showed that the severely preeclamptic patients had a less frequent incidence of clinically significant hypotension during SA (16.6% versus 53.3%; P = 0.006) than that in healthy patients but in this study SA and GA groups were not compared[15].

Hypotension was treated with conventional treatment using ephidrine and IV fluid therapy and hypertension was controlled with nitroglycerine infusion. We observed that although haemodynamic changes during SA and GA, were statistically significant but clinically these were acceptable and manageable and did not have any deleterious effect on the patients of both groups.

Dyer and Farbas in their prospective, randomized trial comparing general with spinal anaesthesia for caesarean delivery in preeclamptic patients with a nonreassuring foetal heart trace, concluded that one-minute Apgar scores were significantly lower (p<0.05) after general anaesthesia than spinal anaesthesia but five minutes scores were almost similar[8]. The haemodynamic changes during anaesthesia did not appear to have any major effect on the clinical condition of the neonate, as assessed by Apgar scores[8,17]. Our findings were the same, one min Apgar scores in GA group were 6 (4-8) as compared to SA group 8 (6-10) but 5 min scores were 9 in both groups.

Since the criteria for major morbidity differ among institutions, the need to transfer to the intensive care unit (ICU) is used as an indicator of illness severity. The data from a previous study conducted at United Arab Emirates University, demonstrates that hypertension-related complications (25%) and haemorrhage (28.5%) are the leading causes for admission of obstetric patients to the ICU[18]. We observed that 66.7% patients from GA group, were admitted in ICU as compared to 16.6% from SA group. Indications for ICU admission were (in order of frequency), postoperative hypertension, pulmonary oedema, delayed recovery, postoperative hypotension, fits, acute renal failure and aspiration pneumonitis. Similarly hospital stay in GA group was more (12 days) as compared to SA group (6 days). Difference in both the parameters between two groups is significant (p<0.05). This admission ratio is certainly more as compared to data shown in ICU from developed countries[20,21]. The relatively high ICU admission rate in our setup, might be due to the lack of a high dependency unit, where patients not suitable for ward observation were transferred to the ICU.

A previous study conducted in India stated that the nature of complications following GA were more serious which may even lead to mortality (4.3%), whereas following SA it was less serious and easily manageable. Hence GA is not as safe as it is thought[16]. We also found that postoperative complications are more serious after GA than SA and mortality in GA group is 6.6% as compared to zero in SA group.

General as well as regional anaesthetic techniques are equally acceptable for caesarean delivery in pregnancies complicated by severe preeclampsia if steps are taken to ensure a careful approach to either method[22]. But postoperative morbidity and mortality is more after general anaesthesia as compared to spinal anaesthesia[16].

In conclusion both the techniques of general as well as spinal anaesthesia, can be used for severe pre eclamptic patients with foetal compromise, coming for emergency caesarean delivery. Haemodynamic changes in both techniques are acceptable and manageable during the operation, but post operative morbidity, requiring admission in ICU and mortality, are more common after general anaesthesia. Stay in the hospital is also prolonged in these patients as compared to patients operated under spinal anaesthesia. It is therefore recommended that spinal anaesthetic technique should be used as first choice for severe pre eclamptic patients, which is as safe as general anaesthesia, with less postoperative morbidity and mortality.

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