INTRODUCTION

Hypertensive disorder of gestation, complicating 5% to 7% of all pregnancies, can precipitate maternal cardiovascular response that may lead to maternal and fetal hypotension. Pregnancy-induced hypertension (PIH) and preeclampsia, depicted as a pregnancy-specific hypertension, can cause cardiac output to decrease and result in maternal hypotension [1]. The administration of non-steroidal anti-inflammatory drugs (NSAIDs) is increasingly used for the treatment of PIH [2]. However, these drugs can lead to hypotension [3]. Therefore, the management of PIH includes the use of analgesic agents to prevent hypotension [4].

We conducted a study to compare the effect of fractionated versus bolus dose of bupivacaine in spinal anaesthesia for patients with PIH undergoing elective caesarean section. The study was conducted in the Department of Anaesthesiology of a tertiary care centre from January 2017 to June 2017.

MATERIALS AND METHODS

Sixty patients were divided into two groups (30 in each). Group B patients received bolus dose of local anaesthetics, while group F patients received fractionated dose of local anaesthetics. Characteristic of sensory and motor block, duration of analgesia and hemodynamic stability were compared.

The study was conducted in the Department of Anaesthesiology of a tertiary care centre from January 2017 to June 2017. Sixty patients were divided into two groups (30 in each). Group B patients received bolus dose of local anaesthetics, while group F patients received fractionated dose of local anaesthetics. Characteristic of sensory and motor block, duration of analgesia and hemodynamic stability were compared.

Spinal anaesthesia is the preferred technique for elective and emergency caesarean section. Spinal anaesthesia provides dense block, greater hemodynamic stability, and longer duration of analgesia compared to local anaesthesia [5]. The administration of regional anaesthesia (RA) not only avoids the maternal complications with GA like difficult intubation, vasopressor response to intubation, but also maintains uteroplacental blood flow if hypotensive episodes are prevented and improve neonatal outcome [6,7].

Spinal anaesthesia in patients with PIH is more prone to severe maternal hypotension and haemodynamic instability. In this study, we compared the effects of fractionated versus bolus dose of local anaesthetics in spinal anaesthesia for hemodynamic stability, characteristic of sensory and motor block and duration of analgesia in patients with history of mild to moderate PIH.

KEYWORDS:

- spinal anaesthesia
- preeclampsia
- caesarean section
- fractionated dose
- Bupivacaine


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In this study we compared the effects of fractionated versus bolus dose of local anaesthetics in spinal anaesthesia for hemodynamic stability, characteristic of sensory and motor block, and duration of analgesia.

Methods:

Sixty patients were divided into two groups (30 in each). Group B patients received bolus dose of local anaesthetics, while group F patients received fractionated dose of local anaesthetics. Characteristic of sensory and motor block, duration of analgesia and hemodynamic stability were compared.

Result:

All the patients were haemodynamically stable in Group F as compared to Group B. Duration of sensory and motor block and duration of analgesia were longer in Group F as compared to Group B.

Conclusion:

Fractionated dose of spinal anaesthesia provides dense block, greater hemodynamic stability, and longer duration of analgesia as compared to bolus dose.

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ABSTRACT

INTRODUCTION

Hypertensive disorder of gestation, complicating 5% to 7% of all pregnancies, can precipitate maternal cardiovascular response that may lead to maternal and fetal hypotension. Pregnancy-induced hypertension (PIH) and preeclampsia, depicted as a pregnancy-specific hypertension, can cause cardiac output to decrease and result in maternal hypotension [1]. The administration of non-steroidal anti-inflammatory drugs (NSAIDs) is increasingly used for the treatment of PIH [2]. However, these drugs can lead to hypotension [3]. Therefore, the management of PIH includes the use of analgesic agents to prevent hypotension [4].

Study done by Badheka [2] et al showed that there are higher chances of hypotension with bolus dose of LA as compared to fractionated dose of LA. They observed that fractionated dose of the local anesthetic agent, in which two-third of the total calculated dose is given initially followed by one-third dose after a time gap of 90 s, achieves adequate SA and provides a dense block with better haemodynamic stability [5].

In this study we compared the effect of fractionated versus bolus dose of LA in spinal anaesthesia for hemodynamic stability, characteristic of sensory and motor block, and duration of analgesia in patients with history of mild to moderate PIH.
Intraoperatively HR, NIBP, Spo2 were continuously monitored.

Hypotension was treated with inj Ephedrine 5mg iv when mean arterial pressure decreased ≥ 30% of baseline and repeated as required. Bradycardia, HR < 60/min was treated with inj Atropine 0.6mg iv. Total number of hypotensive episodes were recorded. After delivery, we administered inj Carprofen 200ug IM and inj Oxytocine 20IU diluted in 500ml R/L slowly. Attending paediatrician assessed APGAR at 1 and 5 min. Incidence of nausea, vomiting, pruritus, urinary retention were noted.

Duration of sensory block was defined as interval between intrathecal administration of LA to S2 segment regression. Duration of motor blockade was defined as intrathecal administration of LA to achievement of modified Bromage scale 0. We assessed post-operative pain by Visual analogue scale every 30 min for 2 hour and every hourly for 6 hrs. Patients were given inj Diclofenac sodium 75mg IM whenVAS ≥ 4. Duration of analgesia was defined as time from intrathecal injection to first requirement of rescue analgesia.

All observation were recorded and results were analysed using Open Epi software. Quantitative data were presented as mean ± sd and analysed using unpaired t test while Qualitative data were assessed using Chi square test. P<0.05 was considered statistically significant.

RESULTS

Demographic profile was comparable in both the groups (table 1)

Onset of sensory and motor blockade was statistically significant among two groups - 1.44 ± 0.12 (group B) and 1.27 ± 0.19 (group F) and 5.36 ± 0.79 (group B) and 4.55 ± 0.52 (group F), respectively. Duration of sensory and motor regression was statistically significant among two groups- 176 ± 14 (group B) and 216 ± 18 (group F) and 130 ± 11 (group B) and 155 ± 15 (group F), respectively. (table 2)

Patients were haemodynamically more stable in Group F as compared to Group B [Figure 1]. Four patients (13.33%) in Group F and 11 patients were haemodynamically more stable in Group B [Figure 1]. Four patients (13.33%) in Group F and 11 patients (36.66%) in Group B required vasoressor [P = 0.03]. Duration of analgesia was longer in Group F (200 ±20) as compared to Group B (160 ± 27) [P< 0.00].

Four patients in Group B and two patients in Group F developed nausea and vomiting. One patient in each of the Group developed shivering. None of the patients developed dryness of mouth, pruritus, sedation, respiratory depression, bradycardia and headache in both the groups.

Table 1(demographic profile)

<table>
<thead>
<tr>
<th>DEMOGRAPHIC PROFILE</th>
<th>MEAN ± SD</th>
<th>P value</th>
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</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>Group B</td>
<td>24.63 ± 3.65</td>
</tr>
<tr>
<td></td>
<td>Group F</td>
<td>24.63 ± 3.65</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>Group B</td>
<td>154 ± 3.81</td>
</tr>
<tr>
<td></td>
<td>Group F</td>
<td>154.63 ± 3.42</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>Group B</td>
<td>58.5 ± 7.89</td>
</tr>
<tr>
<td></td>
<td>Group F</td>
<td>56.93 ± 6.19</td>
</tr>
<tr>
<td>Duration of surgery (min)</td>
<td>Group B</td>
<td>55.16 ± 3.35</td>
</tr>
<tr>
<td></td>
<td>Group F</td>
<td>54.9 ± 4.24</td>
</tr>
<tr>
<td>Gestational age (weeks)</td>
<td>Group B</td>
<td>36.4 ± 1.06</td>
</tr>
<tr>
<td></td>
<td>Group F</td>
<td>36.6 ± 1.4</td>
</tr>
<tr>
<td>Dose (ml)</td>
<td>Group B</td>
<td>2.15 ± 0.05</td>
</tr>
<tr>
<td></td>
<td>Group F</td>
<td>2.16 ± 0.04</td>
</tr>
<tr>
<td>APGAR score</td>
<td>Group B</td>
<td>8.1 ± 0.09</td>
</tr>
<tr>
<td></td>
<td>Group F</td>
<td>8.3 ± 0.3</td>
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</table>

Table 2 (characteristics of sensory and motor block)

<table>
<thead>
<tr>
<th>SENSORY BLOCK</th>
<th>MEAN ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group B</td>
<td>Group F</td>
</tr>
<tr>
<td>Onset in minutes</td>
<td>1.44 ± 0.12</td>
<td>1.27 ± 0.19</td>
</tr>
<tr>
<td>Peak level of block in minutes</td>
<td>5.33 ± 0.71</td>
<td>4.63 ± 0.72</td>
</tr>
<tr>
<td>Regression in minutes</td>
<td>1.76 ± 0.14</td>
<td>2.16 ± 0.18</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>MOTOR BLOCK</th>
<th>MEAN ± SD</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group B</td>
<td>Group F</td>
</tr>
<tr>
<td>Onset in minutes</td>
<td>3.56 ± 0.79</td>
<td>4.55 ± 0.52</td>
</tr>
<tr>
<td>Regression in minutes</td>
<td>130 ± 11</td>
<td>155 ±15</td>
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</table>

DISCUSSION

In pregnancy induced hypertension, there is an abnormal trophoblastic invasion of the maternal spiral arteries, leads to impaired uteroplacental perfusion. Vasocostruction and maternal hypertension occur due to release of vasoactive factors into the maternal circulation and endothelial dysfunction.[16,20] The sympathetic blockade that result from neuraxial anesthetic technique for LSCS, reduces serum catecholamine levels, decreases uteroplacental resistance and improves intervillous flow in pre-eclamptic parturients. These physiological effects of neuraxial blockade are potentially beneficial in hypertensive parturients. Spinal anesthesia has no effect on APGAR score and umbilical artery pH in pre-eclampsia as long as the systolic blood pressure is maintained around 80% from baseline.

Risk–benefit profiles of spinal anaesthesia and general anaesthesia for pre-eclampsia strongly favour the use of spinal anaesthesia when feasible. Potential complications of general anaesthesia, such as hypotensive crisis, stroke, and difficult airway management, are leading causes of morbidity and mortality in the pre-eclamptic population. In addition, exaggerated pressure response to laryngoscopy may increase maternal catecholamines and compromise uteroplacental blood flow and increase fetal acid base abnormalities.[11]

In day to day practice, number of LSCS has been rising rapidly. For spinal anaesthesia most commonly inj Bupivacaine heavy (0.5%) is used with dosage between approximately 12 to 15 mg. It has rapid onset of action but maternal hypotension and high spinal blockade are common occurrence after unadjusted dosage of LA.[5,8] Results of various clinical studies confirm that height and weight are important patient factors for deciding final level of block height. [4,14] Harten compared the effect of two dosage regimens, fixed dose versus adjusted dose considering height and weight, and concluded that adjusted dose is associated with lower incidence of hypotension and better fetal outcome.[10]

Schnider[21] et al concluded that onset time for adequate sensory block is proportional to height of patients while inversely proportional to weight. A retrospective study observed a higher percentage of hypotension in pregnant women with obesity class three, which might be due to the greater extension of a higher sympathetic blockade caused by compression of the subarachnoid space by the pregnant abdomen associated with obesity.[18] The need of local anaesthetic in SA is lower in pregnant patients. Mechanisms suggested for this include pregnancy-specific hormonal changes, which affect the action of neurotransmitters in the spinal column, increased permeability of neural membranes and other pharmacokinetic and pharmacodynamic changes.[1,19]

Daneli[4] et al used 0.5% hyperbaric Bupivacaine in a dose of 0.06 mg/cm, which was adequate for providing effective spinal block in 95% of woman undergoing LSCS. Jigisha Badheka[2] used a dose of 0.07mg/cm, 0.5% Bupivacaine in her study to compare the effect of fractionated versus bolus dose of LA in spinal anaesthesia for LSCS. For fractionated dose, they administered initial two third dose then after 90 sec time gap, the remaining one third dose was administered. Similarly, in our study we used the dosage of 0.07 mg/cm of height, considering height is the only parameter. In fractionated group we administered one half of total calculated dose then after 90 sec time gap we administered remaining dose.
In our study, we compared the effect of fractionated versus bolus dose of LA in SA for hemodynamic stability, characteristics of blockade and duration of analgesia in mild to moderate PIH patient undergoing LSCS.

In our study, bolus group received a mean (range) dose of 2.15 (2-2.4) ml whereas fractionated group received a mean (range) dose of 2.16 (2-2.5) ml which were comparable among the two groups. We did not observe any sensory blockade above T4 level in either group as shown in Table 2.

Fahmy and colleagues[6] compared the hemodynamic and anaesthetic effect of same dose of bolus versus fractionated Bupivacaine. He concluded that fractionated dose of Bupivacaine prolonged the duration of sensory and motor blockade with better hemodynamic stability. Favarel et al.[7] studied a randomised trial in 60 patients undergoing hip fracture surgery and concluded that titrated dose of Bupivacaine was safer, more efficient and provide better cardiovascular stability than a single bolus dose. Jigisha et al.[2] concluded that fractionated dose provide better hemodynamic stability, longer duration of analgesia than bolus dose of LA in patients undergoing LSCS. The results of above studies were comparable with ours.

For control of maternal hypotension, we used inj ephedrine. In our study, we found more hypotension with single bolus dose of LA in spinal anaesthesia as compared to fractionated dose. However, Apgar scores were almost similar in both groups in our study.

The limitations of our study were that we had assessed neonatal outcome by Apgar score only and not able to include umbilical cord pH or blood gas values or uteroplacental blood flow. Hence, we were unable to comment further on uteroplacental perfusion.

Further studies and research comparing bolus and fractionated dose in patients undergoing various surgeries and LSCS for severe PIH can be done to evaluate the effectiveness of fractionated dose in maintaining haemodynamic stability.

CONCLUSION

Fractionated dose of SA provides dense block, greater haemodynamic stability and longer duration of analgesia compared to bolus dose in patients undergoing elective caesarean section. To prevent sudden hypotension in PIH patients, fractionated dose of SA can be an acceptable and safe alternative in LSCS.

Conflict of interest - Nil

Financial support - Nil

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