ASSESSING THE BENEFITS OF ADDING DEXMEDETOMIDINE TO INTRATEHICAL HYPERBARIC BUPIVACAINE FOR CAESAREAN SECTION

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ABSTRACT

BACKGROUND
Spinal anaesthesia is the most common and safe anaesthetic procedure performed in parturients for caesarean section. Hyperbaric bupivacaine alone has been used for the last decade for caesarean section. It has rapid onset of action and gives good muscle relaxation & has no adverse effects on foetal APGAR scores. Its limited effects on postoperative analgesia is a matter of concern now a days. Many of the drugs like Tramadol, Butorphanol, Morphine, Fentanyl, Clonidine etc. have been used as an adjuvant to Hyperbaric Bupivacaine in the past; all having their side effects & limitations. Dexmedetomidine is an α-2 adrenergic receptor agonist, benefits of which, when used intrathecally or epidurally as adjuvant, have been proved in many studies. With this background we added 5µg of Dexmedetomidine to Hyperbaric Bupivacaine in caesarean section to observe the characteristic of block, post-operative analgesia, sedation and favourable neonatal outcome.

METHODS
Sixty parturients of ASA physical status I & II undergoing caesarean section were assigned to 2 groups (n=30) to receive either 0.5% hyperbaric Bupivacaine 9 mg (1.8 ml) with Dexmedetomidine 5 µ (Group D) or 0.5% hyperbaric Bupivacaine 9 mg (1.8 ml) with saline (Group C). Block characteristics, haemodynamic parameters, sedation scores and neonatal APGAR score were recorded. Data obtained were compiled and analysed with appropriate tests, p-value of ≤ 0.05 was considered significant.

RESULTS
Onset of sensory and motor block were significantly faster in Group D as compared to Group C. Duration of post-operative analgesia was significantly prolonged in Group D. There was no significant difference in haemodynamic parameters, sedation and neonatal APGAR scores between the groups.

CONCLUSIONS
The use of intrathecal 5 µgm Dexmedetomidine as an adjuvant to Bupivacaine for caesarean section produces rapid and prolonged sensory & motor block & allocates better perioperative analgesia without significant maternal and neonatal adverse effects.

KEYWORDS
Caesarean Section, Dexmedetomidine, Hyperbaric Bupivacaine, Spinal Anaesthesia.

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BACKGROUND
Spinal anaesthesia is the preferred anaesthesia technique for lower segment caesarean section.1-2 It is simple to perform, economical and produces rapid onset of anaesthesia and relaxation. It bears high efficacy, involves less drug doses, minimal neonatal depression, patient awareness with lesser incidence of aspiration pneumonitis. In comparison to general anaesthesia it avoids problems of difficult airway, usage of multiple drugs required in general anaesthesia and allows parturient to be awake and witness and enjoy the birth experience. 0.5% Hyperbaric bupivacaine is the most commonly recognized drug in spinal anaesthesia for caesarean section. However, its fixed duration of anaesthesia, and limited post-operative analgesia, entails the need of higher doses of NSAIDS and opioids in postoperative period, exposing patients to their side effects. Intrathecal α-2 agonists, Clonidine and Dexmedetomidine are used as adjuvant drug to local anaesthetics. They potentiate the effect of local anaesthetics and allows a decrease in the required dose.3-4 Both of these drugs are well studied as intrathecal adjuvants in orthopaedic and general surgeries.5 Dexmedetomidine, is 8 times more selective α 2 adrenergic receptor agonist as compared to Clonidine, thus it can be safely used as intrathecal adjuvant in caesarean surgeries due to its limited effects on respiratory system and level of patient’s
consciousness during surgery. But, its use with intrathecal local anaesthetic agents for caesarean section has not been extensively studied. Hence, we conducted the present study to judge the efficacy of adding Dexmedetomidine to intrathecal hyperbaric Bupivacaine for caesarean section. In this study we added 5μgm of Dexmedetomidine to Hyperbaric Bupivacaine in caesarean section to observe the characteristic of block, post-operative analgesia, sedation and neonatal outcome.

METHODS
After approval of institutional ethics committee, this perspective study was carried out in 60 parturients between 18 to 40 years with ASA physical status I & II undergoing caesarean section under spinal anaesthesia in Chhattisgarh Institute of Medical Sciences, Bilaspur (C.G).

Parturients with pre-existing medical & obstetric co-morbidities, bleeding diatheses, local infection at injection site, raised intracranial pressure, pre-eclampsia and eclampsia, known hypersensitivity to local anaesthetics, emergency cases and patients refusing spinal anaesthesia were excluded from the study. In the present study, 60 subjects were taken and divided into two groups with n=30 in each by alternately allocating patients to receive either 0.5% hyperbaric Bupivacaine 9 mg(1.8 ml) with dexmedetomidine 5 μ (0.2 ml). Group D or 0.5% hyperbaric Bupivacaine 9 mg (1.8 ml) with 0.9% saline solution (0.2 ml) Group C. All data was collected in a proforma specially designed for the study. Preoperative assessment was done for each patient and written informed consent was taken. All patients were transported to operation theatre in left lateral position after thorough preanaesthetic check-up & written informed consent. Patients were preloaded with 500 ml Ringer’s lactate solution half an hour before induction of anaesthesia. All patients received Inj. Ranitidine 50 mg IV and Inj. Metoclopromide 10 mg IV for aspiration prophylaxis. Routine ASA monitoring including heart rate, NIBP, SpO2 was established. Lumbar puncture was performed in lateral position, under aseptic precautions in L3-L4 space using 25G Quincke spinal needle and drug was injected slowly after establishing clear and free flow of cerebrospinal fluid.

Sensory blockade was tested with pin prick method using blunt 24G hypodermic needle every 15 seconds till the onset of sensory blockade and thereafter every 2 min till the maximum level of blockade i.e. T6 is achieved, subsequently sensory blockade was tested at 5, 10, 20, 30, 40, 50 & 60 minutes during first 60 minutes then every hour till 4 hours and 2 hourly up to 24 hours. Post-Operative pain was assessed by Visual analogue scale at same time intervals after completion of surgery. Loss of pin prick sensation at T10 level was defined as the onset of sensory blockade. Time taken to achieve maximum sensory blockade was defined as the time from the completion of the injection of the drug to the maximum sensory blockade level achieved. Duration of sensory blockade was the time taken from the time of injection till the patient felt sensation at S1. Duration of pain relief was defined as the time from spinal injection to the first request for analgesics (VAS >5). Inj. Diclofenac 75 mg IM was used as rescue analgesic with a maximum dose of 150 mg in 24 hours. Degree of motor blockade was assessed by modified Bromage scale. Total duration of sensory and motor blockade and total duration of analgesia were noted. haemodynamic parameters like heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial blood pressure (MAP), respiratory parameters like respiratory rate (RR) and SpO2, sedation score using Ramsay sedation score (RSS) were recorded every 10 min till the end of surgery. Any reduction of SBP more than 20% below baseline or fall in SBP less than 90 mmHg was considered as hypotension. 3 mg IV increments of Inj. Mephentermine or 0.3 mg Atropine were given if necessary. Neonatal APGAR scores were assessed by paediatrician at 1st and 5th minute. haemodynamic monitoring was continued in postoperative period along with VAS score and time to first request for rescue analgesic was recorded. Patients were also monitored for any adverse events after spinal anaesthesia like nausea, vomiting, shivering, hypotension, Bradycardia, respiratory depression and others, if any.

Statistical Analysis
Analysis was done in Microsoft Excel, using Statistical Package for Social Science (SPSS) version 22.0. For continuous and categorical variables, Student’s t-test and Chi square test were used respectively. p<0.05 was considered significant.

RESULTS
There was no significant difference in demographic data between the two groups. All the patients completed the study.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group D</th>
<th>Group C</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (y)</td>
<td>21.6±2.9</td>
<td>22.3±3.8</td>
<td>0.45</td>
</tr>
<tr>
<td>Mean Weight (kg)</td>
<td>53.7±6.1</td>
<td>54.8±5.6</td>
<td>0.95</td>
</tr>
<tr>
<td>Mean Height (cm)</td>
<td>154.9±4.4</td>
<td>152.3±4.5</td>
<td>0.73</td>
</tr>
<tr>
<td>Mean BMI (kg/m²)</td>
<td>22.6±2</td>
<td>23.7±2.9</td>
<td>0.82</td>
</tr>
<tr>
<td>Duration of surgery</td>
<td>46±8</td>
<td>45±6</td>
<td>0.42</td>
</tr>
</tbody>
</table>

Table 1. Demographic Profiles of the Groups

<table>
<thead>
<tr>
<th>Block Characteristics</th>
<th>Group D</th>
<th>Group C</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time for onset of analgesia (sec)</td>
<td>51±11.6</td>
<td>67±11.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Maximum sensory level</td>
<td>7 6</td>
<td>7 6</td>
<td>1.0</td>
</tr>
<tr>
<td>Time to peak sensory level (min)</td>
<td>3.7±0.1</td>
<td>4.76±1.2</td>
<td>0.023</td>
</tr>
<tr>
<td>Time taken for sensory regression to S1</td>
<td>350±45.2</td>
<td>320±14.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Duration of analgesia (min)</td>
<td>410.3±74.4</td>
<td>64.9±11.4</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Time for onset of motor block (sec)</td>
<td>48.8±13.9</td>
<td>73.5±15.5</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Time for maximum motor block (min)</td>
<td>3.5±0.6</td>
<td>8.4±2.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Duration of motor block (min)</td>
<td>353.4±35.4</td>
<td>110.2±11.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Request for first analgesic dose (min)</td>
<td>360.4±37.5</td>
<td>120±13.7</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

Table 2. Comparison of Block Characteristics in the Two Groups

The mean time of onset of analgesia to T10 level was significantly faster in Group D compared to Group C (p <0.001). The maximum sensory levels obtained in two groups were comparable and sufficient for the surgery (T4-T8). Peak sensory level was achieved earlier in Group D compared to Group C (p = 0.023). The time taken for
sensory regression of the blockade to S1 level was more in Group D compared to Group C (p < 0.001). Duration of analgesia was prolonged in Group D compared to Group C.

24 hours Postoperative VAS Scores were Consistently Low in Group D Compared to Group C (Figure 1). The time of onset of Bromage Grade I and IV motor block was rapid in Group D compared to Group C (p < 0.001). The RSS was almost similar and all parturients had RSS ≤ 2. Neonatal APGAR scores at 1 and 5 min was comparable in Group D and Group C.

Mean intraoperative heart rate was comparable in both the groups (Figure 2).

There was no significant difference in Mean postoperative heart rate in both the groups. (Figure 3) haemodynamic parameters like heart rate, mean blood pressure, SpO2 and respiratory rate were comparable.

Mean arterial pressure was comparable in group C and group D in intraoperative as well as postoperative period.

There is not much difference in incidence of hypotension and bradycardia in both the groups. Adverse effects observed in this study were almost similar in both the groups. (Table 3)

**DISCUSSION**

Central neuraxial blockade is conventional method for performing caesarean section for many decades. It is associated with less maternal morbidity, rapid onset of analgesia as well as motor blockade and muscle relaxation. This technique is most favoured due to its ease and reliability and definitive endpoint. Intrathecal Bupivacaine is most commonly used drug and several studies have been conducted to study its block characteristics. Intrathecal dose of Bupivacaine for Caesarean section suggested by many authors is between 10-15 mg for block up to T6 level. Alan Santos et al suggested dose of 7.5-10 mg 0.5% hyperbaric Bupivacaine for caesarean section in a parturient of height 150-170 cm. Demographic profile in our institution is also the same, so we used the dose of 9 mg Bupivacaine in the present study. With recent advances in anaesthesia, anaesthesiologist’s arena has extended to postoperative...
pain relief and comfort of the patient. Nausea, vomiting, shivering, visceral pain and wrenching in immediate postoperative period causes lot of agony to the patient. As the anaesthetic effect of intrathecal Bupivacaine is limited to few hours, need for additives with less side effects and prolonged action aroused. Neostigmine, Butorphanol, Midazolam Morphine, fentanyl, Clonidine and Dexmedetomidine as additive to Bupivacaine for spinal anaesthesia in general surgery has been studied by many clinicians.\textsuperscript{8} These drugs prolongs analgesia, but their use has been limited by their side effects. Neostigmine causes nausea & vomiting, Butorphanol and Midazolam potentiates hypotension, Opioids like Morphine & Fentanyl causes pruritus, retention of urine and constipation, Clonidine is associated with bradycardia and hypotension.\textsuperscript{9} While giving anaesthesia for caesarean section safety of mother as well as fetus is of utmost importance. So safety of additive drug should be well established and clinically proven for intrathecal use. Drug with minimal side effects and high efficacy are chosen. Dexmedetomidine among other additives being used has greater safety profile. It significantly prolongs the duration of anaesthesia as well as analgesia, prevents shivering\textsuperscript{10} with minimal sedation and hypotension and it has no adverse effect on neonatal APGAR score. The mechanism behind such rapid onset is not very clear, it may be due to direct action of \( \alpha-2 \) agonists on \( \alpha \) motor neurons in ventral horn of spinal cord producing anaesthetic effects.\textsuperscript{11-12} There are not many studies on addition of Dexmedetomidine to intrathecal Bupivacaine for caesarean section. So, we conducted this study to highlight the beneficial effects of adding Dexmedetomidine to Bupivacaine in caesarean section surgery. Dose of 2.5 -10 \( \mu \)gm is considered optimal for intrathecal use by many authors.\textsuperscript{3,4} So we took 5\( \mu \)gm Dexmedetomidine as optimum dose for intrathecal addition to Bupivacaine in this study.\textsuperscript{13} In present study Group D received intrathecal hyperbaric Bupivacaine 0.5\% 9 mg (1.8 ml) and Dexmedetomidine 5\( \mu \)gm while Group C received intrathecal hyperbaric Bupivacaine 0.5\% 9 mg (1.8 ml) and 0.9\% saline. Time for onset of analgesia was faster (51±11.6 seconds) in Group D as compared to group C (67±11.5 seconds). Group D patients took less time to achieve maximum sensory level i.e. T6. (p<0.05). Onset of motor blockade and time to maximum motor blockade assessed by Bromage scale was faster in Group D (3.5±0.6 minutes) as compared to Group C (6.4±2.6 minutes). Duration of analgesia and motor block was significantly (p<0.05) prolonged in Group D. There was significant difference in time to request for First analgesic dose. Group D patients requested for first rescue analgesic dose in (360.4±37.5 minutes) whereas Group C patients requested in (120.2±13.7 minutes). Mean VAS score was consistently low in Group D patients, 24 hours postoperatively. In our study we found rapid onset of analgesia along with prolonged sensory and motor blockade with intrathecal addition of Dexmedetomidine to Bupivacaine. Patients were haemodynamically stable in intraoperative and postoperative period.\textsuperscript{14} There were no sedative effects on mother as well as foetus & APGAR which concurs with other studies.\textsuperscript{5,15} haemodynamic stability and Ramsay sedation score was also comparable in both the groups & it correlates with other studies.\textsuperscript{14}

CONCLUSIONS
Addition of Dexmedetomidine to hyperbaric Bupivacaine for spinal anaesthesia in caesarean section results in rapid onset of sensory & motor block with minimal complications. Dexmedetomidine does not affect haemodynamic parameters and APGAR score. Its efficacy and safety are well established in caesarean delivery along with prolonged postoperative analgesia.

REFERENCES