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ORIGINAL ARTICLE

Effect of Intrathecal Dexmedetomedine as Adjuvant to Bupivacaine in Caesarian Section: A Double Blind Study

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ABSTRACT

Aim: To explore the impact of dexmedetomedine as adjuvant to hyperbaric bupivacaine 0.5% in spinal anaesthesia in caesarian section.
Methods: This study was conducted in Services Hospital, Lahore from 23-2-21 to 31-05-21. Two groups of 30 each were made by dividing patients randomly. Group B was given hyperbaric bupivacaine 0.5% (10mg) diluted in normal saline and in Group BD dexmedetomedine 5µg (0.5 ml) was added to 10mg hyperbaric bupivacaine (0.5%). Spinal Anaesthesia was administered with 25G spinal needle. Haemodynamic changes, onset and duration of sensory and motor block were documented. Inadequate perioperative analgesia was relieved with ketamine. Comparison of hemodynamics was done by independent sample t-test. Characteristics of motor and sensory block, analgesic time period were all presented as median (IQR) and compared by Mann Whitney U test. Comparison of categorical variables was done by Chi square. $p< 0.05$ was considered significant.
Results: The median time for sensory block onset was 2.0(2.0 - 3.0) in Group B vs 2.0(2.0 - 3.0) BD. The median time to reach maximum sensory block was not significantly different. (p-0.151). The two segment sensory regression time was significantly longer in group BD with median time 2.2(2.0 – 3.0) vs 1.5(1.3 – 2.0) hours in group B. Significant increase in analgesic duration was seen in group BD ($p<0.001$). Onset of motor block was higher in group BD significantly (p-0.04). Significant increase in motor block duration was seen ($p<0.05$) in BD vs B group with respective median times 6.0(5.5 – 7.0) and 3.5(3.0 – 4.0).
Conclusion: Intrathecal Dexmedetomidine 5 µg with hyperbaric bupivacaine significantly prolongs both sensory and motor block and prolongs the duration of analgesia in lower segment caesarian section.
Keywords: Dexmedetomedine, Spinal Anaesthesia, Sensory block, Motor block.

INTRODUCTION

Caesarian Section (LSCS) is usually performed under Spinal Anaesthesia. The main advantage of administration of regional anaesthesia is fast onset, high level of block, lower failure rate, few side effects on mother and fetus and cost-effectiveness. T4 level of sensory block is required for an effective anaesthesia for caesarian section. The high level of anaesthesia achieved by local anaesthetic is associated with hemodynamic changes that can lead to reduced uteroplacental perfusion. Reduction in dose of local anaesthetic can decrease the incidence of hemodynamic instability[1,2,3,4,5,6].

Local anesthetics are given intrathecally in combination with other drugs for reduction in dose, better pain relief, prolonged duration of anesthesia and least possible maternal and neonatal side effects[7,8,9]. Various adjuvants used with bupivacaine are opioids, clonidine, magnesium sulphate, ketamine, midazolam and dexmedetomedine to improve the quality of spinal anaesthesia and analgesia[6,10,11,12].

Dexmedetomidine, a selective alpha 2-adrenergic receptor agonist in combination with bupivacaine maintains hemodynamic stability, provides good perioperative analgesia and anaesthesia with least possible side effects in patients undergoing cesarean section[6,11,13,14,15,16,17,18]. It is safe use in cesarean section relies on maternal/fetal index ie 0.77[4]. Bi YH et al demonstrated that in cesarean surgery dexmedetomidine when combined with bupivacaine provided high quality characteristics of sensory block and postoperative analgesia[18]. Meitei et al also showed similar results of adequate anaesthesia and postoperative analgesia with addition of dexmedetomedine to bupivacaine in spinal anaesthesia[15]. The purpose of this study is to evaluate the effects of intrathecal hyperbaric bupivacaine (0.5%) in combination with dexmedetomidine in elective Caesarian Section.

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METHODOLOGY

After approval from institutional review board, this double blind randomized control trial was carried out in Services Hospital, Lahore from 23-2-21 to 31-05-21. Sixty parturients at term of ASA grade I and II, scheduled for elective lower segment caesarean section under subarachnoid block were included in the study. Exclusion criteria was patient's refusal, history of chronic drug abuse, bleeding disorders, local infection and allergy to study drugs. After explaining the protocol of the study, written informed consent was taken from all the patients. Patients were allocated randomly into two groups of 30 each by lottery method. B group was given bupivacaine hyperbaric (0.5%) in dose of 10mg with normal saline (0.5 ml) and in Group BD dexmedetomedine 5µg (0.5 ml) was added to 10mg hyperbaric bupivacaine (0.5%). Drugs were prepared by a person who did not perform the block and blinding was ensured by using similar syringes.

In the operation theatre, baseline values of blood pressure, heart rate and oxygen saturation were recorded. 12-15ml/kg of Ringer's Lactate Solution was administered via 20G branula as preloading agent before spinal block.

Under aseptic measures, with parturients in in sitting position, SA was administered in the intervertebral space at the level of L3–4. After introduction of 25 G pencil point needle, the study drug was given after confirmation of free flow of cerebrospinal fluid. Patient was placed in the supine position immediately with a tilt towards the left for uterine displacement. The time at which the study drug was given completely was noted as time zero. A record of haemodynamic changes was taken at an interval of 2-min for 30 minutes. Hypotension (decrease in systolic blood pressure greater than 20% from baseline value or less than 90 mmHg) was treated with norepinephrine. When heart rate was less than 50 beats per minute, 0.3–0.5 mg atropine was given.

Pinprick method (loss of pinprick sensation to a 23 G needle) was used to determine the onset of sensory block at the highest level. It was assessed from the administration of the drug every 2 min for first 15 min and then every 30 minutes for 2 hours. Sensory block duration was noted from time zero to the time subject started

feeling sensation at S1. Time to two segment sensory regression was recorded.

Motor block was assessed by Modified Bromage Scale. (0-Able to move hip, knee and ankle, 1-Unable to move hip, but able to move knee and ankle, 2-Unable to move hip and knee, but able to move ankle, 3-Unable to move hip, knee and ankle) Duration of motor block was noted. Injection ketamine (1 mg/kg) intravenously was used as rescue analgesia intraoperatively. Patients in which the spinal anaesthesia failed were excluded from study.

Statistical analysis: Sample size was calculated taking mean onset of sensory block in Group B (7.43±2.23 min) and Group BD (6.46±1.35 min) keeping 80% power of study and alpha error 0.05[7]. The collected data was entered in SPSS version 24.0. Quantitative variables were represented as mean±Sd and qualitative variables as frequency and percentages. Independent sample t-test was used to compare hemodynamics between groups. The data for measurements of time of onset of sensory block, time to reach maximum height, two segment sensory regression time, duration of analgesia, time of onset of motor block, time to reach maximum motor block and duration of motor block, being skewed, were all presented by median(IQR). Statistical analysis among the groups was done by Mann Whitney U test. Categorical variables were analysed by Chi square test. $p < 0.05$ was considered significant.

RESULTS

The average age in Group B was 27.3±4.7 and Group BD was 26.3±4.8 years and difference was insignificant among the groups. The median time for onset of sensory block was 2.0(2.0-3.0) in Group B vs 2.0(2.0-3.0) in Group BD. The median time to reach maximum sensory block was not significantly different with p-value 0.151. In group BD, two segment sensory regression time was significantly longer with median time 2.2(2.0–3.0) hours while for the group B it was 1.5(1.3–2.0) hours. In BD group, there was a significant increase in analgesic period with a median time difference of 4.5 hours. Significant greater motor block onset time was seen in BD in comparison to B group. The total duration of motor block for group BD was significantly prolonged than group B with respective median times in two groups as 6.0(5.5–7.0) and 3.5(3.0 – 4.0) (Table 1).

Baseline measurements were not same so the difference of minimum level achieved during caesarean from baseline was measured (**difference=baseline–minimum level during surgery**) and compared between two groups. It was noted that the minimum level of difference was not significant among the two groups for any of the measures (Table 2).

Finally the incidence of hypotension was measured by using MAP <60mmHg as threshold level for two groups. It was observed that there were 4(13.3%) cases in group BD, for whom the MAP went below threshold level and 11(36.7%) for group B (significantly different) (p=0.037) (Table 3).

The average MAP for group B remained below from group BD through 2-16 minutes of surgery duration, while the heart rate started high for group B initially raised a bit at 4 min and then declined. In group BD the HR declined smoothly whereas between 12 to 16 minutes time both had similar heart rate.

Table 1: Comparison of age and various times between two groups

Parameter	Group B Mean ±SD Median (Q1-Q3)	Group BD Mean ±SD Median (Q -Q3)	P-value
Age	27.3 ± 4.7	26.3 ± 4.8	0.418
Onset time of Sensory Block (min.)	2.0(2.0 - 3.0)	2.0(2.0 - 3.0)	0.663
Time to reach Max. Block height (min.)	6.0(4.0 - 10.0)	8.0(6.0 - 10.0)	0.151
Two segment sensory regression time (hr.)	1.5(1.3 - 2.0)	2.2(2.0 - 3.0)	<0.001
Duration of Analgesia (hr.)	3.0(2.5 - 4.0)	7.5(6.5 - 8.3)	<0.001
Time of Onset of Motor Block (min.)	2.0(2.0 - 2.0)	2.0(2.0 - 2.0)	0.040
Time to reach Maximum Motor Block (min.)	5.0(2.0 - 8.0)	6.0(4.0 - 10.0)	0.231
Duration of Motor Block (hr.)	3.5(3.0 - 4.0)	6.0(5.5 - 7.0)	<0.001

Table 2: Comparison for the difference of minimum level achieved during surgery from base line for two groups

Measure	Group				P-value
	Group B		Group BD		
	Mean	SD	Mean	SD	
Systolic BP	22.27	9.65	19.41	9.44	0.252
Diastolic BP	30.61	14.03	27.90	9.98	0.392
Mean arterial pressure	28.04	11.78	23.17	11.33	0.108
Heart rate	15.18	15.33	14.76	15.27	0.915

Table 3: Incidence of Hypotension with mean arterial pressure < 60 mmHg for two groups

Minimum MAP (mmHg)	Group B	Group BD	Total
<60.0	11(36.7%)	4(13.3%)	15(25%)
≥60.0	19(63.3%)	26(86.7%)	45(75%)
	30(100%)	30(100%)	60(100%)

Chi Sq 4.36, P value 0.037

DISCUSSION

Pain relief in the postoperative period is an essential component for females undergoing caesarian section. This initiates quick recovery and early breast feeding with good care of newborn. Also, endocrine changes and stress response because of pain may interfere with lactation. Mostly opioids are used as spinal adjuvants in caesarean cases but it has adverse effects like emesis, pruritus and the possibility of respiratory depression secondary to rostral spread[10]. α2 adrenoreceptor agonist act by combining with C-fibers and dorsal horn neurons (postsynaptic) when given intrathecal. The decrease in release of transmitters of C fibre and dorsal horn neurons hyperpolarization lead to pain relief[10]. Intrathecal α2 receptors have antinociceptive impact on both visceral and somatic pain[4,16,19]. The activation of α2 –agonist receptors in spinal cord by dexmedetomedine inhibits the release of the nociceptive neurotransmitter substance P[4,10]. Its analgesic effects are due to block of intracellular movement of potassium[4]. Dexmedetomedine has been used as an additive to local anaesthetics in regional anaesthesia to prolong their action and improve the depth of anaesthesia thus relieving pain for increased time period[18]. Liu S et al has reported increased duration of sensory block by 134.42 min and that of motor block by 114.27 min with DEX. The duration of pain relief increased by an estimate of 216.90 min. Varying doses of dexmedetomidine (3,5,0 and 15µg) has been added to bupivacaine in lower limb surgeries, caesarian section and transurethral prostatectomy[16].

The current study evaluated the impact of dexmedetomidine (5 µg) as additive in spinal anaesthesia. The median time to reach maximum height and sensory block onset in the two groups was not different significantly in the results of our study. In BD group analgesic period was significantly longer than control. In group BD, motor block onset and duration was also higher significantly. Previous studies have shown comparable results with dexmedetomedine.

Bi YH et al in accordance with our results concluded that dexmedetomedine 3 µg when added to bupivacaine (10mg) increased the motor block duration (5.82±0.95h vs 3.56±1.02h) (p<0.0001). They did not find significant difference in the median

time to reach maximum sensory height among the groups 15.0(10.0,15.0) vs15.0(12.5,20.5). They also reported stable hemodynamics with dexmedetomedine[16].

Qi X compared intrathecal 5 µg Dexmedetomidine with Morphine as additives in Cesarean Sections. Similar to our study results the sensory regression to S1 segment time was significantly longer in group BD (253.21-42.79 min) vs (188.33-37.62 min) in group B. The period of analgesia was also prolonged in BD group (17.59-6.23h) as compared to control (3.53-1.68 h). Motor block duration was also increased in BD group[7].

Consistent with our study, the findings of research by Liu L et al were not different significantly in onset time of sensory (4.7±1.1 vs 4.5±1.3 min, P>0.05) and motor block (4.1±2.0 vs 4.3±1.9 min, P>0.05) with 5 µg Intrathecal dexmedetomidine with bupivacaine. In D vs C group, variation in sensory block duration was significant (120.5±37.0 vs 70.5±34.5 min, P<0.05). Pain free period was increased in Dexmedetomedine group than Control (230.5±40.5 vs 145.1±28.5 min, P<.001)[11].

Sushruth MR supported the results of our study. They used 9 mg hyperbaric bupivacaine (0.5%) with Dexmedetomidine (5 µg) in caesarian section and found significantly prolonged duration of sensory (364 vs 126 min) and motor block (341 vs 113 min) in D group (p<0.001). The period of analgesia was also significantly longer in Group D (420.3±74.6 vs 68.9±11.1 min), p< 0.001. In D group, first request analgesic time was significantly greater in comparison to C (420 and 69 min). The difference was in faster onset of sensory block (45 sec) and peak sensory level that was achieved earlier in Group D (3.98±1.8 min). This could be due to variation in methodology[1].

In correlation to our study , Meitei et al when evaluated intrathecal bupivacaine alone with dexmedetomidine (2.5µg) for lower segment caesarean section, did not find significant difference in the beginning of sensory block (27.13+13.03 sec vs 34.73+13.95 sec) and in time to reach maximum sensory height (242.80+89.75sec vs 222.67+65.95 sec) among the groups. Time of first rescue analgesic was significantly (P<0.001) prolonged in group BD (221.93±62.61 min) compared to group B (138.43±31.24 min). The motor block onset was significantly higher in BD vs group B (188.67±78.17 sec vs 165.83±75.49 sec) and duration was prolonged with significance (208.33±62.70 sec vs 169.73±56.44 sec) (p<0.0001)[15].

A decrease in hemodynamics have been reported with use of intrathecal dexmedetomedine. The results of our study did not show significant change in the difference of minimum level of heart rate and mean arterial pressure (p>0.05). Significantly less hypotension was observed with 5 µg dexmedetomedine.

Nasr IA et al compared the safety and efficacy of sufentanil (10 µg) and dexmedetomedine (10 µg) with 15 mg 0.5% hyperbaric bupivacaine as intrathecal adjuvants in caesarian section. Contrary to our study results they found significant shorter onset time of sensory block in Group D (7.2 ± 2.7 min) in comparison to Bupivacaine alone (9.1 ± 3.6 min) (p=0.014). In their study hypotension occurred in 17% with bupivacaine vs 7% with Dexmedetomedine. This was also different from our study in which 36% had hypotension in group B vs 13% in group BD[9]. This could be due to difference in the doses used for bupivacaine and dexmedetomedine.

There were some limitations in the current study. Apgar scores were not compared at 1 and 5 minutes among groups for assessment of neonatal outcome. Sedation was also not recorded. Further studies can be done regarding APGAR score and sedation scores with different doses of dexmedetomedine.

CONCLUSION

Intrathecal Dexmedetomidine 5µg when added with hyperbaric bupivacaine (0.5%) prolongs both sensory and motor block significantly and increases the analgesic duration in lower segment caesarian section.

Conflict of interest: None

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