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Original Research Paper

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A COMPARATIVE STUDY OF INTRATHECAL HYPERBARIC BUPIVACAINE ALONE AND WITH DEXMEDETOMIDINE AS ANADJUVANT FOR INFRA-UMBILICAL PROCEDURES.

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ABSTRACT

Aims & Objectives: Various adjuncts have been used with local anesthetics in spinal anesthesia to provide good quality for intra-operative and better post-operative analgesia. Dexmedetomidine is a new α-2 adrenergic agonist, now being used as a neuraxial adjuvant. The aim of our study was to evaluate the effect of intrathecal administration of dexmedetomidine 10 μg, as an adjuvant to bupivacaine 0.5%, on the onset and duration of sensory and motor block, the hemodynamic effects, and the duration of analgesia and the occurrence of side effects.

Methodology: This prospective randomized double blind study included 90 patients. Patients were randomly allocated into two groups of 45 patients each. Group B received 15 mg of 0.5% hyperbaric bupivacaine with normal saline and group BD received 15 mg of hyperbaric bupivacaine with 10 μg [mcq] of dexmedetomidine with normal saline to a total volume of 3.5 ml. The onset and duration of sensory and motor block, the hemodynamic effects, the duration of analgesia and the occurrence of side effects were noted.

Results: The mean time taken for the sensory block to reach T10 dermatome and motor block to reach Bromage 3 grade was significantly rapid in group BD as compared to group B. The time taken for regression of sensory block to S1 dermatome and Bromage 0 motor block and the time to first rescue analgesic were significantly increased by addition of dexmedetomidine.

Conclusion: Dexmedetomidine added to hyperbaric bupivacaine intrathecally has a dose dependent favorable effect on the onset and regression of sensory and motor block.

KEYWORDS : Dexmedetomidine; Bupivacaine; Spinal

INTRODUCTION

Spinal anesthesia is the most popular regional anesthesia technique. However, the local anesthetic drugs used for spinal anesthesia don't have the advantage of prolonged postoperative analgesia. Pain is inherent to all surgeries causing significant morbidity. It is a continuous challenge for the anesthesiologists as perioperative pain management with least side effects. Many drugs have been used intrathecally as an adjuvant to local anesthetic to prolong postoperative pain relief with variable effects. Regional anesthesia and analgesia has the potential to provide excellent operating conditions and prolonged post-operative pain relief.[1] It is also known to reduce postoperative morbidity and mortality leading to its widespread use.[2] Among all the regional techniques, subarachnoid block is still the first choice especially for below umbilical procedures because of its simplicity, rapid onset of action, less failure rate, cost-effectiveness, and superior level of blockade. However, post-operative pain control is a major problem because spinal anesthesia using only local anesthetics is associated with relatively short duration of action and thus early analgesic intervention is needed in post-operative period.[3]

Various adjuncts such as benzodiazepines, opioids, ketamine, neostigmine and many other drugs have been used with local anesthetics to provide better post-operative analgesia, thereby facilitating rehabilitation and accelerating functional recovery.[4] But these adjuvants (especially opioids) are associated with side effects like pruritus, respiratory depression, urinary retention, post-operative nausea and vomiting which limit their use. Hence, intrathecal α-$_2$ agonists like clonidine are used as adjuvants to local anesthetics to potentiate the effects of local anesthetics and allow a decrease in required doses without causing respiratory depression.[5] Intrathecal α-$_2$ adrenergic agonists have anti-nociceptive action for both somatic and visceral pain.[6] Dexmedetomidine is new alpha-$_2$ agonist used as a short term medication for sedation and analgesia in the intensive care unit. It is highly selective α-$_2$ adrenergic agonist possessing hypnotic, sedative, anxiolytic, sympatholytic, opioid-sparing and analgesic properties without producing significant respiratory depression.[7] It acts by inhibiting the release of nor-epinephrine at locus coeruleus. The enhanced antinociceptive effect is said to be related to its lipophilicity.[8] Study is conducted to evaluate the effect of intrathecal administration of dexmedetomidine on the duration of sensory and motor block, as well as the hemodynamic changes and the level of sedation.

METHODOLOGY

After approval from Institutional Ethical Committee, this prospective randomized double blind study was conducted at our institution and informed consent, 90 adult patients, age group 18-60 year, ASA I and II physical status scheduled to undergo various urological, gynecological or orthopedic procedures under spinal anesthesia were enrolled. Routine monitors like NIBP, pulse oximetry, ECG were connected. Baseline blood pressure, heart rate and respiratory rate were noted. Peripheral I.V. line was secured with 18 G cannula. Following infusion of 15 ml/kg of ringer lactate solution and under aseptic preparation, lumbar puncture was performed at L3-L4 position inpatient in sitting or lateral position by midline approach after the local infiltration with 2% lignocaine using a 25G Quincke spinal needle. Patients were randomized into two groups B and BD of 45 patients each using sealed envelope technique. The dose of 0.5% hyperbaric bupivacaine 15 mg (3 ml) was identical in all study groups. Group B received 3 ml of 15 mg of heavy bupivacaine + 0.5 ml of 0.9% normal saline to a total volume of 3.5 ml. Group BD received 3 ml of 15 mg of 0.5% heavy bupivacaine + 0.5 ml of 10 μg of dexmedetomidine with 0.9% saline to a total volume of 3.5 ml. For the purpose of the study, hypotension was defined as a fall of SBP >20% from the baseline or <90 mmHg and was treated with inj. ephedrine 5 mg or mephentermine 6 mg. Bradycardia was defined as HR <50 beats/min and was treated with inj. atropine 0.3-0.5 mg. Respiratory depression (rate <10 bpm) was noted and if occurred was treated with oxygen supplementation and respiratory support if needed. The sensory dermatome level was assessed by pinprick sensation using 23G hypodermic needle along the

midclavicular line bilaterally. The motor dermatome level was assessed according to modified bromage scale. Time taken for sensory block to reach T10 dermatome and motor block to Bromage 3 grade before surgery were noted. The time for sensory block regression to S1, motor block regression to Bromage grade 0 noted. Sedation was assessed at 60 min intra-operatively using Ramsay sedation score. Pain was assessed and noted by visual analogue scale [VAS] score at 1st, 2nd, 4th and 6th hours post-operatively. Duration of analgesia measured from the time of intrathecal injection to the first request of analgesia [VAS > 4] was monitored and VAS 4 or >4 will be given diclofenac 75 mg intramuscularly as rescue analgesia. . Incidence of side effects like nausea, vomiting, hypotension, bradycardia and shivering were noted. The statistical analysis of data was done by using statistical package for social science (SPSS) evaluation version 20. Data were expressed as either mean and standard deviation or numbers and percentages. Demographic data (age, duration of surgery, height, weight, gender, ASA class) was analyses using unpaired Student's t-test (for comparison of parameters among groups). Comparison was carried out using Chi-square ($\chi 2$) test with a P value reported at 95% confidence level. For the time to reach T10 dermatome, Bromage 3 scale and regression of block to S1 dermatome and Bromage 0, time taken to rescue analgesia ANOVA test followed by Tukey's multiple post-hoc tests was used. The level of significance used was $p < 0.05$.

RESULTS

There was no significant difference in the demographic data of the patients in between the 2 groups ($p > 0.05$) (Table 1).

Table 1: Demographic Data (Mean ± S.D)

Parameter	Group B	Group BD	P value
Age(years)	34.37 ± 9.01	35.16 ± 11.55	>0.05
Male	26	30	
Female	19	15	
ASA 1	42	43	
ASA 2	3	2	
Weight (kg)	58.93 ± 8.22	58.56 ± 8.7	
Height (cm)	165.30 ± 3.41	164.1 ± 4.38	

Time taken to reach T10 dermatome is shown in Figure 1. The mean time for sensory block to reach T10 was 5.24±1.49 min, 3.57 ± 0.18 min in groups B, and BD respectively. Tukey's multiple posthoc procedure showed that Group B was higher than Group BD ($p < 0.01$).

Time for motor block to reach Bromage 3 is shown in Figure 2. The time observed was 5.87 ± 0.3 min in Group B and 4.25 ± 0.47 min in group BD. Group BD was lower than Group B($p < 0.01$) by Tukey's posthoc test procedure.

Time taken for sensory regression to S1 was prolonged in time Group BD [355.45 ± 0.47] than Group B [180.99 ± 6.67], was highly significant statistically by Tukey's test ($p < 0.01$).

Motor block regression to Bromage 0 is shown in Group BD [322.97± 4.95] had a significantly prolonged motor block than group B [151.6± 9.81] ($p < 0.05$).

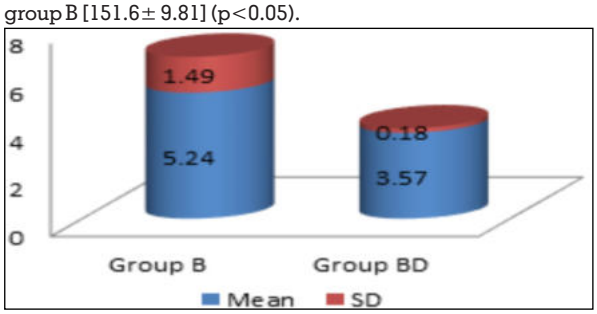

Figure 1: Time to Sensory block to reach T10 level

Statistical analysis by ANOVA test and Tukey's test showed that the time to first analgesic rescue was significantly prolonged in Group BD [362.2±33.24 mins] as compared to Group B[203.77±19.04 mins].

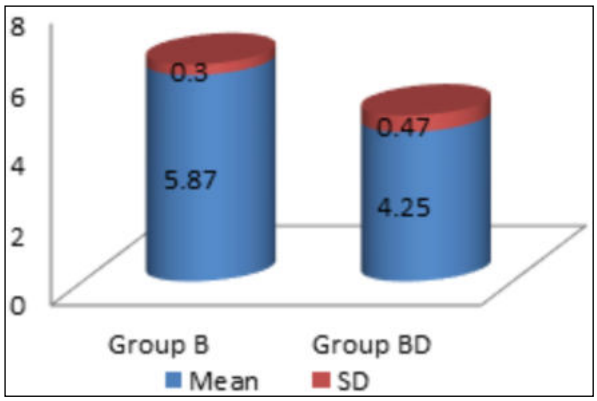

Figure 2: Time To Reach Motor Block Bromage Grade 3

Regarding VAS score at 4th and 6th post-operative hours Group BD had lower pain scores as compared to B. (Figure 3).

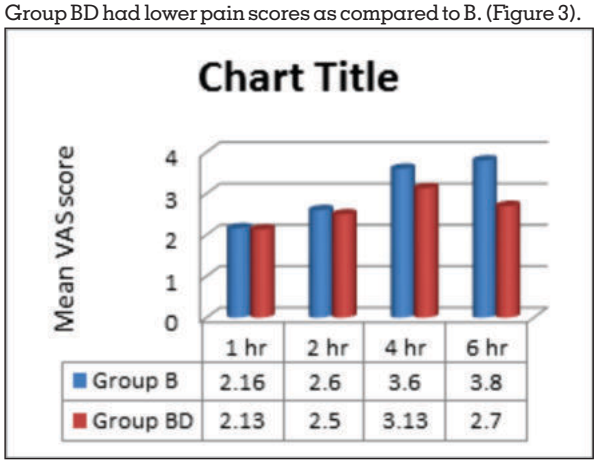

Figure 3: Mean VAS Scores In Two Groups

Sedation was assessed by Ramsay sedation score 2 patients (4.44%) in group BD, 1 patient (2.22%) in Group B had a sedation score of 1.28 patients (93.3%) in group B, 29 patients (96.6%) in Groups BD had a sedation score of 2. Statistical analysis showed that there was no significant difference in the sedation scores achieved between the 2 groups ($p = 0.77$).

Regarding the incidence of side effects, two patients in group B, one patient in Group BD had PONV. One patient in Group B had shivering. One patient in group B and group BD each had bradycardia requiring atropine. Two patients in group B and one in groups BD had hypotension. No incidences of respiratory depression were noted. There were no statistically significant differences observed in the two groups.

DISCUSSION

Intrathecal α-$_2$ agonists like clonidine are used as adjuvants to local anesthetics to potentiate the effects of local anesthetics and allow a decrease in required dose without causing respiratory depression.[5] Intrathecal α-$_2$ adrenergic agonists have antinociceptive action for both somatic and visceral pain.[6] Dexmedetomidine is an alpha-$_2$ agonist and it was approved by FDA in 1999 for use in humans as a short term medication for sedation/analgesia in the intensive care unit. The mechanism by which intrathecal α-adrenoceptor agonists prolong the motor and sensory block of local anesthetics is not well known.[9] It may be an additive or synergistic effect secondary to the different mechanism of action of the local anesthetic. The local anesthetic acts by blocking sodium

channels whereas α-adrenergic agonists are said to act by binding to pre-synaptic C-fibres and postsynaptic dorsal horn neurons. Their analgesic action is a result of depression of the release of C-fiber transmitters and hyperpolarisation of post-synaptic dorsal horn neurons and prolonged motor block might be caused by direct impairment of excitatory amino acids release from spinal interneurons.[10]

In this study, addition of dexmedetomidine (10 μg) to hyperbaric bupivacaine intrathecally produced a rapid onset of sensory and motor block, prolonged the sensory and motor block and the time to first analgesic requirement significantly decreased. It also maintained stable hemodynamics with minimal side effects. Results of the current study concur with the results obtained by Al-Mustafa MM et al, [11] Tarbeeh et al, [11] and Jamliya RH et al,[12] who found that dexmedetomidine has a dose-dependent effect on the onset and regression of sensory and motor block and the time to rescue analgesia with lower VAS scores and minimal side effects when used as an adjuvant to spinal bupivacaine.

CONCLUSION

On the basis of our study we conclude that addition of dexmedetomidine to hyperbaric bupivacaine intrathecally produces a rapid onset of sensory and motor block, prolongs the sensory and motor block and the time to first analgesic requirement significantly with stable hemodynamic parameters, and minimal side effects.

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