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A prospective double blinded study on effect of intrathecal dexmedetomidine as adjuvant to hyperbaric bupivacaine on onset and duration of subarachnoid blockade

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Abstract

Objective: To study the effect of low dose intrathecal dexmedetomidine as adjuvant to hyperbaric Bupivacaine in relation to onset & duration of sensory & motor block

Material and Methods: In the present double blinded prospective, randomized controlled trial study, we have aimed to compare the two groups of ASA –grade I patients divided in two groups i.e., group B - Bupivacaine 2.5ml (12.5 mg) alone (control group) and group BD - Bupivacaine 2.5 ml (12.5 mg) combined with Dexmedetomidine 5 µg undergoing lower abdominal and lower limb surgeries to evaluate whether there is any clinching evidence of augmentation of motor and sensory block by addition of low dose dexmedetomidine (5µg).

Results: Among both the groups, mean time to achieve onset of sensory & motor blockade was found to be not statistically significant (P>0.05). The duration of sensory block observed in group BD was 143.6±12.74 in contrast to group B 107±9.74. The difference in mean duration of analgesia between group B vs. BD, is statistically significant (P<0.001).The duration of motor blockade in group B found was 174.2±11.26 in relation of group BD 276.4±13.96which is statistically significant (P<0.001).

Conclusions: It was concluded from the present study that addition of low dose dexmedetomidineto hyperbaric bupivacaine for subarachnoid block definitely prolongs the duration of sensory and motor blockade.

Keywords: Dexmedetomidine, Hyperbaric Bupivacaine, Sub arachnoid block.

Introduction

Sub Arachnoid blockade is the most commonly used anaesthetic technique widely used for lower abdominal and lower limb surgeries. Bupivacaine heavy is the commonest drug used for spinal anaesthesia. Various agents like Magnesium sulphate, fentanyl and clonidinehave been tried as adjuvant for prolongation of sensory and motor blockade with varying degree of success. Clonidine, an α 2 agonist has been widely used intrathecally and through intravenous route to prolong bupivacaine induced spinal blockade. Dexmedetomidine shows more specificity towards α_2 receptor (α_2 /α_1 1600:1) compared with clonidine (α_2 /α_1 200:1). The mechanism of the analgesic action of dexmedetomidine have not been fully elucidated. A number of sites, both supraspinal and spinal, modulate the transmission of nociceptive signals in the CNS. Even peripheral α2 adrenoceptors may mediate ant nociception. It has been widely used as an adjuvant to general as well as spinal anaesthesia. It has been found to produce earlier onset of motor blockade and prolongation of duration of both motor and sensory blockade with preserved hemodynamic stability and arousable sedation when given intrathecally. On this background we proposed to conduct a prospective randomized double blind study to see whether intrathecal dexmedetomidine as adjuvant to Bupivacine (Heavy) given for spinal blockade can affect the onset and duration of sensory and motor blockage.

Materials and Methods

After obtaining institutional ethical and scientific committee approval, and written informed consent from all patients, a randomized, prospective, double blinded, analytical study was started. The study was conducted in the department of Anesthesiology of Durgapur Steel Plant Main Hospital, Durgapur. Sample size was calculated using power analysis and considering the effect size of 35 patients has been calculated in each group considering α error at 5% and power at 90%. To be on safer side and to round off the figure we propose to take 50 patients in each group, using computer generated randomization.

In the present study, 100 patients of either sex of age group between 18 to 60 years belonging to American society of Anesthesiology (ASA) physical status Grade I and II scheduled for elective lower abdomen, lower limb and perineal surgeries under sub arachnoid block at Durgapur Steel Plant Hospital, were enrolled in this study.

Exclusion Criteria of the study were:

1. Patients receiving any drugs that could influence hemodynamic and autonomic function.
2. Patients with the history of allergy to local aesthetics or any contraindication to spinal anesthesia.
3. Patients on oral Alpha blockers and Calcium channel blockers.
4. Chronic Alcoholics and malnourished.
5. Hypovolemia.
6. ECG Abnormalities including A-V block,

incomplete or partial heart block.
7. Coronary artery, Respiratory, Renal, Cerebral diseases.
8. Pregnancy.
9. Age < 17 years and > 60 years.
10. ASA grade III and above.
11. Patient who refuse to give consent.
12. History of Spine surgery, increased intracranial tension and coagulopathy.

The study was done to study the onset and duration of 5 mcg of Inj.Dexmeditomidine as adjuvant to Hyperbaric Bupivacaine intrathecally in lower abdomen and lower limb surgeries. Patients satisfying the inclusion criteria were placed in two groups of 50each as follows: **Group BD** - 50 Patients receiving Inj Dexmedetomidine 5mcg as adjuvant to intrathecal hyperbaric bupivacaine 12.5 mg. **Group B** - 50 Patients receiving intrathecal hyperbaric bupivacaine 12.5 mg alone. In Pre-operative PAC, adetailed history, systemic examination and laboratory tests were taken, following patient admission. An informed written consent was taken from each patient who satisfies the inclusion criteria. Anthropometric measures - age, height, weight and BMI of all patients were recorded.

All patients were given premedication with tab Alprazolam 0.5mg and Tablet Omeprazole 20mg at bed time previous night. Tab Omeprazole 20mg at 2 hours before surgery in the morning. In the operation theatre, essential monitors like electrocardiogram, pulse oximetry and non-invasive blood pressure were attached to patient. All patients were co-loaded with IV fluids through 18 G IV cannula was administered. Basal parameters like heart rate, NIBP, and SpO_2 was recorded.

Under full aseptic precautions, spinal anaesthesia was performed in sitting position at L3-L4 level through midline approach using 25G Quincke spinal needle (B Braun Medical) with the hole pointing upwards with bupivacaine heavy 2.5ml (12.5 mg) and 5 mcg of Dexmedetomidine in Group BD and bupivacaine heavy 2.5 ml (12.5 mg) alone in group B. Drug given in spinal anaesthesia was loaded and appropriate mixture prepared by third party (another colleague) and a coding done by same third party (another colleague), so that investigator and patient were blinded. 0.9% normal saline used as diluent for dexmedetomidine as per computer generated randomization. Drug was administered slowly over a period of 10 seconds. After successful lumbar puncture, vital parameters as well as sensory and motor blockade level were recorded at 2, 4, 6, 8, 10, 15, 20 minutes since spinal blockade and then again at 120, 130, 140, 150, 160, 170, 180 minutes till three hours. Patients were given 2-3 lit/min of oxygen via simple face mask. Hypotension, defined as SBP <90 mm Hg or >30% fall from the baseline value were treated by injection mephentermine 3 mg intravenous (i.v) and i.v crystalloids. Bradycardia is defined as HR <60 beats/min or >30% decrease from the baseline value and was be treated with i.v atropine 0.3 mg increments. All Patients received as maintenance fluid with isotonic fluids. Sensory blockade was assessed by using pin prick method.

Motor blockade was assessed by Bromage Scale as discussed below:

Table 1: Description of the Bromage score

Grade	Criteria	Degree of block
I	Free movement of legs and feet	Nil (0%)
II	Just able to flex knees with free movement of feet	Partial (33%)
III	Unable to flex knees, but with free movement of feet	Almostcomplete (66%)
IV	Unable to move legs or feet	Complete (100%)

Observations

Table 2: Demographic Data of Studied patients

	Group –B	Group-BD	P-Value	Significance
Age (In Years)	39.22±9.79	39.64±9.14	0.825	Not Significant
Sex				
Male	58.00	62.00	p> 0.05	Not Significant
Female	42.00	38.00	p> 0.05	Not Significant
Weight (In Kgs)	55.26±7.73	55.32±7.38	0.968	Not Significant

Table 3: Onset of Sensory Effect Distribution

	Group		p Value	Significance
	Group B	Group BD		
	Mean±Std. Deviation	Mean±Std. Deviation		
Onset of Sensory Block	7.82±0.92	7.72±0.97	0.598	Not Significant

Table 4: Onset of Motor Block Distribution

	Group		p Value	Significance
	Group B	Group BD		
	Mean±Std. Deviation	Mean±Std. Deviation		
Onset of Motor Block	9.2±0.93	9.48±0.99	0.148	Not Significant

Table 5: Duration of Sensory Block Distribution

	Group		p Value	Significance
	Group B	Group BD		
	Mean±Std. Deviation	Mean±Std. Deviation		
Duration of Sensory Block	107±9.74	143.6±12.74	<0.001	Significant

Table 6: Duration of Motor Blockade Distribution

	Group		p Value	Significance
	Group B	Group BD		
	Mean±Std. Deviation	Mean±Std. Deviation		
Duration of Motor Block	174.2±11.26	276.4±13.96	<0.001	Significant

Results

All selected patients under study were clinically hemodynamic stable and devoid of any side effects. None required use of vasopressors for hypotension or Inj.Atropine for bradycardia. None of patient required conversion to general anesthesia due to insufficient block.

In our study we compared the mean time taken to achieve sensory block. In group B it was 7.82 min, which was 1.29% greater than group BD. In group BD the mean time taken to achieve sensory block was 7.72 min, which was 1.28% lesser than group B. It appears that dexmedetomidine causes faster onset of sensory block but the difference between group B and BD were statistically not significant (P>0.05). So it implies that addition of low dose dexmedetomidine with bupivacaine in spinal anesthesia did not affect the onset of sensory block.

On comparison of motor block onset the mean time to achieve motor block to achieve modified bromage scale level among the groups B & BD were 9.2 and 9.48 minutes respectively. In Group B, the mean time taken to achieve motor block was 9.2±0.93 min, which was 2.95% lesser than group BD. Whereas in group BD the mean time taken to achieve motor block was 9.48±0.99 min, which was 3.03% greater than group B. The difference in mean time for motor block onset between group B and BD is statistically not significant (P>0.05), means addition of low dose dexmedetomidine with bupivacaine in spinal anaesthesia did not affect the onset of motor block.

In our study, the mean duration of sensory block among the group B and BD was 107±9.74 and 143.6±12.74 minutes respectively. In group B the mean duration of sensory block was 107±9.74 minutes, that was 33.64% lesser than group BD. Contrary to the group B, in the group BD, the mean duration of sensory block was 143.6±12.74 minutes, which was 25.17% greater than Group B. The difference in mean duration of analgesia between group B vs. BD, is statistically significant (P<0.001). Thus the present study suggests that, addition of dexmedetomidine to bupivacaine in spinal anaesthesia significantly increases the mean duration of sensory block in comparison to bupivacaine alone (control group).

It was found that, the mean time to achieve motor block from Bromage scale level three to Bromage scale level zero among the group B and BD was 174.2±11.26 and 276.4±13.96 minutes respectively. Among group B the mean time to achieve motor block from Bromage scale level three to Bromage scale level zero was 181.03±20.83 min that was 56.35% lesser that group BD. In group BD members, the mean time to achieve motor block from Bromage scale level three to Bromage scale level zero was 353.37 min, which was 36.95% greater than group B. The difference in motor block duration between group B vs. BD, is statistically significant (P<0.001). Hence, it was observed that addition of dexmedetomidine to bupivacaine in spinal anesthesia significantly increases the mean duration of motor blockade in comparison to bupivacaine alone (control group).

Conclusions

The results of the present study suggest that addition of dexmedetomidine in doses given, to bupivacaine for subarachnoid block prolonged sensory and motor blockade in clinically beneficial manner. However, adverse effects that could be encountered by using dexmedetomidine are shivering, bradycardia, hypotension, insufficient block, sedation, nausea and vomiting were not found in our study. It appears that augmentation of sensory and motor blockade by dexmedetomidine may be due to synergism between these drugs although they have got different mechanism of action. The combination of dexmedtomidine and bupivacaine for neuraxial block, herefore appears to be quite attractive for wider clinical practice.

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