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COMPARITIVE STUDY TO ASSESS THE EFFECT OF INTRAVENOUS DEXMEDETOMIDINE ON 0.5%HYPERBARIC BUPIVACAINE SPINAL ANAESTHESIA IN LOWER LIMB SURGERY.

Anaesthesiology

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ABSTRACT

Dexmedetomidine is alpha-2 agonist that was approved by FDA in 1999 for use in human as a short term medication for sedation/analgesia in the ICU. It produces sedation and anxiolysis and also prolongs the duration of spinal anaesthesia. The study was conducted in the Department of Anaesthesiology at DR. S.N.M.C, JODHPUR (RAJASTHAN) on 72 patients with 36 in each group. Hyperbaric 0.5% bupiva*caine 12.5mg(2.5ml)was injected intrathecally in all patients.Patients of group D received loading dose of 1mcg/kg/hr dexmedetomidine over 10minutes and maintainance dose of 0.2mcg/kg/hr through intravenous infusion pump till the end of surgery while group C received the same calculated volume of normal saline. Time for the onset of sensory and motor blockade, duration of analgesia, sedation scores and hemodynamic parameters were assessed. Administration of IV dexmedetomidine during SAB hastens the onset of sensory block and prolongs the duration of sensory and motor block. It provides excellent sedation during surgery .

KEYWORDS

Intravenous dexmedetomidine, Spinal anaesthesia, Bupivacaine

INTRODUCTION

Among all the regional techniques, subarachnoid block is still the first choice especially for lower limb procedures. Spinal anaesthesia using only local anaesthetics is associated with relatively short duration of action and thus early analgesic intervention is needed in post-operative period.Merging of local anaesthetics with adjuvants such as opioids[1,2] or other components,e.g.clonidine[3],allows the reduction of the amount of local anaesthetic and thus the incidence of side effects.[4,5]

Dexmedetomidine is alpha-2 agonist that was approved by FDA in 1999 for use in humans as a short term medication for sedation/analgesia in the intensive care unit.Kanazi et al.[6] found that small doses of dexmedetomidine (3 mcg) used in combination with bupivacaine in humans in spinal anaesthesia prolong the duration of motor and sensory block with preserved hemodynamic stability.

Clonidine and dexmedetomidine produce sedation and anxiolysis by binding to presynaptic alpha2 receptors in locus ceruleus and also prolong the duration of the spinal anaesthesia.[7,8] Dexmedetomdine is approximately eight-times more selective towards the α2 adrenergic receptor than clonidine.Jorm and Stanford[9] found that dexmedetomidine has an inhibitory effect on locus ceruleus(A 6 group) located at the brainstem.

Therefore, the present randomised double blind study has been planned to assess the effect of intravenous dexemedetomidine on characteristics of motor and sensory blockade as well as hemodynamic changes,level of sedation and side effects in patients undergoing lower limb surgeries under bupivacaine spinal anaesthesia.

METHOD

This study was conducted in the department of Anaesthesiology at DR. SAMPURNANAND MEDICAL COLLEGE, JODHPUR (RAJASTHAN) after institutional ethical committee approval.The sample size was calculated as 36 study of subject in each group at alpha error of 0.05 with power of study being 80%.So,the present study was conducted on 72 patients with 36 in each group of ASA physical status I-II,posted for elective lower limb surgery under subarachnoid block,age between 20-60 years,weight 40 to 80 kg and height>140 cm.Informed consent was taken from each patient before the procedure.

Before the commencement of anaesthesia,patients were explained about the methods of sensory and motor assessments.All patients received alprazolam 0.5mg as oral premedication a night before surgery. Tablet metoclopramide 10 mg and tablet pantoprazole 40mg was given a night before and in the morning of the day of surgery. Standard monitoring of heart rate, noninvasive blood pressure, electrocardiography and pulse oximetry was done.

After intravenous insertion of a 18 G catheter,all patients were prehydrated with 8ml/kg of ringer lactate solution.With the patient in sitting position under aseptic preparation, lumbar puncture at the level of L3-L4 through a midline approach using 25 G quincke spinal needle was performed.Hyperbaric 0.5% bupivacaine 12.5mg (2.5ml) was injected in all patients. Fifty cc syringe was filled with either normal saline or dexmedetomidine diluted with normal saline in a concentration of 4mcg/ml.Immediately after intrathecal injection, patient was placed supine and oxygen 5L/min was given by ventimask. Patients allocated group D received loading dose of 1mcg/kg/hr dexmedetomidine over 10minutes and then a maintainance dose of 0.2mcg/kg/hr through intravenous infusion pump till the end of surgery.Patients in group C received the same calculated volume of normal saline as loading dose in 10 minutes and thereafter maintainance dose as in group D. All recordings were performed by an anaesthesiologist blinded to group allocation. NIBP was monitored every 3 minutes for first 15 minutes thereafter, every 5min till the completion of surgery. Hypotension (decrease in systolic B.P.of 20% of baseline or less than 100mm Hg) was treated by administration of additional lactate ringer solution (8ml/kg over 10 min period) or with I.V.bolus of 6-9mg mephentermine or bradycardia (heart rate <60beats/min) was treated with I.V.bolus of 0.3-0.6mg of atropine..

Assessment of motor block was done according to the modified bromage scale. (0-patient able to move hip, knee, ankle, 1-unable to move hip, able to move knee and ankle, 2-unable to move hip and knee, able to move ankle, 3-unable to move hip, knee and ankle). Onset of block was assessed by noting time to reach T10 dermatome sensory block and bromage 3 motor block.Sensory and motor block level was recorded every 2 minutes for 20 minutes. Surgery was allowed to start when peak sensory level reaches T10 and Bromage score of 3. If above criteria was not achieved in 20 minutes it was defined as "Total failure" and general anesthesia with intubation was accomplished for surgery.After 60 minutes, sensory block was assessed every 5 minute to know the time to two dermatomal regression. Regression of motor blockade to Modified Bromage Scale 1 was noted. The sedation level was evaluated using Ramsay Level of Sedation Scale: 1.Patient anxious, agitated, or restless; 2. Patient cooperative, oriented, and tranquil alert; 3. Patient responds to commands; 4. Asleep, with brisk response to light glabellar tap or loud auditory stimulus; 5. Asleep, with sluggish response to light glabellar tap or loud auditory stimulus. 6. Asleep, no response. The sedation level was evaluated every 15 minutes using Ramsay level of Sedation Scale till the patient is discharged from PACU. Excessive sedation was defined as score greater than 4/6 .

Intraoperative nausea, vomiting, bradycardia, hypotension, shivering, other side effects, requirement of additional analgesics was recorded.

Time to first rescue analgesic was noted.Tota analgesic requirement during first 24 hr was also noted in terms of number of doses and dose in mg.Statistical analyses were done using computer software (SPSS version 24 and primer).The difference in proportion was analysed by using chi square test and the difference in means were analyzed by using student's t-test.

Table-1: Patients demographics and duration of surgery

Variable	Group D Mean±SD	Group C Mean±SD	p value
Age (in years)	41.66±12.25	44.27±10.91	0.343
Sex (M/F)	23/13	25/11	0.802
ASA (I/II) number of patients	26/10	24/12	0.802
Height (in cm)	161.05±6.91	161.36±8.01	0.862
Weight (in kg)	60.44±9.42	61.2±8.61	0.784
Duration of surgery (in minutes)	81.25±15.49	82.05±15.17	0.875

Table-2: Characteristics of spinal block

Variable	Group D	Group C	p value
Time to reach T10 sensory level(min)	5.44±2.60	9.83±3.71	<0.0001
(min)	17.00±2.31	17.38±2.33	0.480
Time to two dermatomalsensory regression (min)	98.88±9.86	91.38±9.07	0.001
Time to reach Bromage 3 (min)	12.77±3.18	14.00±2.34	0.067
Duration of analgesia (time of first rescue analgesic)(min)	374.86±69.05	189.44±72.85	<0.001

Table 3. Sedation Score in both groups

Ramsay Sedation Score	Group D	Group C	P value
At 30 mins	2.94±0.23	2.08±0.28	<0.0001
At 60 mins	3.94±0.23	2.19±0.40	<0.0001
At 90 mins	3.75±0.43	2.22±0.42	<0.0001

DISCUSSION

Demographic data like age, gender, weight and height were comparable in both groups.(p>0.05,NS).

A) Sensory block characteristics

1) Onset of sensory block

In our study onset of sensory block(time to reach sensory block of T10 level was significantly faster in Group D(5.44±2.60 min)compared to Group C (9.83±3.71min)with P<0.0001. Mean time to reach maximum height of sensory level were comparable in two groups(17.38±2.33 min in Group C and (17.00±2.31 min in Group D,P=0.480)(Table 2).

Harsoor et al.[10] and Contractor et al.[11] also observed similar results.

2) Maximum height of sensory block

The mean of maximum height of sensory blockade in dexmedetomidine group was (T4-T6)compared to (T6-T8) level in control group.Fourteen patients in group D reached T6 while fifteen patients in group C reached T8 level of sensory block. Madhavi et al.[12] also observed the same results.

3) Time to two Dermatomal Regression

In our study, time to two dermatomal regression was significantly prolonged in Group D (98.88±9.86 min) than in Group C (91.38±9.07 min) p <0.0001, (Table 2). Our study was in accordance with results observed by Harsoor et al.[10], Madhavi et al.[12],Tekin et al[13].,Kaya et al[14],. ,Hong et al.[15],Gupta et al.[16]

B) Motor Block Characteristics

In our study there was no significant difference in time taken for motor blockade to reach modified Bromage Scale 3 in both the groups [12.77±3.11 min in dexmedetomidine group compared to 14±2.38 min in control group P value 0.08 NS] (Table 2).However, the regression time to reach the modified Bromage Scale 1 was significantly prolonged in dexmedetomidine group [144.43+17.85 mins] as compared to control group [123.43+15.71 mins] (P value < 0.001 HS). (Table 2).Similar results were observed by Harsoor et al.[10] and Contractor et al.[11]

C)Hemodynamic Changes

Baseline hemodynamic parameters (HR, SBP, DBP, MBP) were comparable between the group.In our study the mean values of the heart rate were significantly decreased starting at 30 min until 65 min in group D in comparison with group C (P <0.05).Lowest intraoperative heart rate (mean) was significantly lower in dexmedetomidine group [60.63 ± 6.58] as compared to control group [67.36± 6.74) (P value - <0.001) .

Like our study the mean heart rate was significantly lower in dexmedetomidine group [70.4] as compared to control group [77.63] at 20 minutes (P value- 0.02) in the study done by Tekin et al.[13]Higher but statistically not significant incidence of bradycardia in dexmedetomidine group [16.66%] compared to control group [8.3%] (P value 0.46) was reported by Al Mustafa et al.[17]

Mean values of mean arterial BP were significantly lower in dexmedetomedine group at 12, 60, 65, 70 mins after spinal block compared to control group(P values<0.05). Harsoor et al.[10] observed MAP significantly low (P<0.05) from 60th min until the end of surgery.

D) Ramsay sedation scores

In our study mean values of Ramsay sedation scores were significantly higher in dexmedetomidine group between 15 to 105 min as compared to control group (P value <0.001).Sedation scores in dexmedetomidine group ranged from 2-4. Sedation scores in control group ranged from 1-3.

Ramsay sedation score was 2 in all patients in control group and ranged from 2-5 in dexmedetomidine group in the study done by Hong et al.[15] Al Mustafa et al.[17]noted that the median sedation scores during surgery were 4 in the dexmedetomidine group and 2 in the control group (P value <0.001).

E) Postoperative analgesia

Dexmedetomidine inhibits the release of substance P from the dorsal horn of the spinal cord, leading to primary analgesic effects.[18]

The time to first request for postoperative analgesic was significantly prolonged in dexmedetomidine group [374.86±69.05 min] as compared to control group [189.44±72.85 min] (P value <0.001). The 24 hours mean requirement of diclofenac was significantly less in dexmedetomidine group (mean no. of doses 1.69±0.46 and total dose 118.75±37.50 mg) as compared to control group(mean no. of doses 2.66±0.47 and total dose 200.0±35.85 mg) (P value of < 0.001). The 24 hr mean requirement of tramadol was significantly less in dexmedetomidine group (mean no. of doses 1.00±0.00 and total dose 50±0.0 mg) as compared to control group (no. of doses 1.54±0.67 and 79.54±33.30 mg) .Similarly,studies of Kaya et al.[14] Hong et al.[15] Whizar-Lugo et al.[18] were in accordnce with our study.

F) Postoperative nausea and vomiting

None of patients in both groups has episode of vomiting. Similar results were reported in previous studies.[19,20]

CONCLUSION

Low dose intravenous dexmedetomidine significantly decrease the time of onset of sensory block and prolongs the duration of sensory and motor block of bupivacaine spinal anaesthesia. Dexmedetomidine causes significant decrease in heart rate, mean arterial blood pressures. No significant decrease in systolic and diastolic blood pressures.The incidence of bradycardia and requirement of atropine is statistically not significant.

Dexmedetomidine induced bradycardia is transient and responds to atropine.The changes in blood pressure are without significant clinical impact and hypotension can be easily managed with bolus of IV fluids and mephentermine. Dexmedetomidine provides excellent sedation during surgery and sedation scores reach normal after stopping the drug.Dexmedetomidine significantly decreases postoperative analgesic requirement in first 24 hours.

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