Research Article

Comparison of the effects of intrathecal dexmedetomidine, intrathecal clonidine as spinal adjuvants for lower limb and lower abdominal surgeries

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Abstract

Context: Lower limb and lower abdominal surgeries are usually performed under spinal anesthesia. α_2 agonists, like clonidine and dexmedetomidine are said to prolong the action of local anesthetics when administered intrathecally. **Aims:** To investigate the effect of intrathecal administration of dexmedetomidine or clonidine on sensory, motor block and hemodynamic parameters. **Settings and Design:** Prospective Randomised Controlled Double Blind study. **Methods and Material:** 150 patients were randomly allocated into three groups. Patients in Group A received 2ml of hyperbaric bupivacaine + 5 µg dexmedetomidine in 1 ml normal saline, Group B received 2 ml of hyperbaric bupivacaine + 50 µg of clonidine in 1 ml normal saline and Group C received 2 ml of hyperbaric bupivacaine + 1 ml normal saline **Results:** Duration of sensory blockade was significantly prolonged in Group A (317.2± 90.27 minutes) and Group B (291.9± 82.63 minutes) when compared to Group C (204.26± 84.77 minutes). The median cephalad spread of the drug was T8 in Group A (Range T 4-T10), T6 in Group B (Range T2-T10) and T10 in Group C (Range T6-T12). The regression of motor blockade to Bromage score 0 was comparable between Group A and B but was significantly prolonged in comparison to Group C (Group A-323.14±93.43, Group B-296.31± 94.67 and Group C-206.98± 88.00). **Conclusions:** Intrathecaldexmedetomidine is comparable to intrathecal clonidine and prolongs the duration of motor and sensory blockade with minimal side effects.

Keywords: Spinal Anesthesia, Dexmedetomidine, Clonidine, Adjuvant, Intrathecal.

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Received Date: 13/07/2014 Accepted Date: 26/07/2014

Access this article online

Quick Response Code:

Website: www.statperson.com

DOI: 27 July 2014

INTRODUCTION

Local anesthetics used for spinal anesthesia alone are associated with a relatively short duration of action and donot cover the postoperative analgesic needs.[1] Opioids are common adjuvants but postoperative nausea and vomiting, pruritis and respiratory depression still remain a concern.[2] α_2 agonists such as clonidine have been investigated extensively for their role in prolonging spinal anesthesia. Clonidine has been used in the intravenous form, intrathecal, epidural and oral routes in order to prolong the action of local anesthetics.[3,4,5,6.] Dexmedetomidine is a new highly selective α_2 agonists which is 10 times more potent than clonidine.[7,8.] It is known to produce good quality of analgesia, with good hemodynamic stability. However, studies which have evaluated the effects of dexmedetomidine when administered intrathecally in comparison to clonidine are sparse. So we decided to compare the effects of adding dexmedetomidine and clonidine as spinal adjuvants on sensory and motor blockade.

How to site this article: Pradeep A Dongare, S. S. Nethra, K. Sudheesh, P. Prabha, Devika Rani D., M. Sathesha. Comparison of the effects of intrathecal dexmedetomidine, intrathecal clonidine as spinal adjuvants for lower limb and lower abdominal surgeries. *International Journal of Recent Trends in Science and Technology* July 2014; 11(3): 418-421 http://www.statperson.com (accessed 27 July 2014)

SUBJECTS AND METHODS

After obtaining approval of the institutional review board and ethical committee, 150 patients coming for lower abdominal and lower limb surgeries of ASA physical status I and II, aged 18-60 yrs, were included in this prospective randomized double blinded study. Those patients with history of allergy to the drug, heart block, dysrhythmias, uncontrolled Hypertension, beta blocker, calcium channel blocker, ACE inhibitor therapy, patient refusal for regional procedure, bleeding diathesis, patients weighing less than 50 kg and more than 80 kg and patients taller than 170 cm and shorter than 150 cm were excluded from the study. Patients were given Tab Alprazolam 0.5 mg and Tab Ranitidine 50 mg as a premedication at the night before surgery. On arrival pulse oximetry, non-invasive blood pressure, electrocardiographies were monitored. Following administration of 500 ml of Ringer's lactate solution, the patients were administered sub arachnoid block in the sitting position with a 25G Quincke's spinal needle in the L3-L4 space using a midline approach. Using computer generated random numbers patients were allocated into 3 groups.

- Group A patients were administered 2ml of 0.5% hyperbaric Bupivacaine and 5 µg of Dexmedetomidine diluted in 1 ml of normal saline.
- Group B patients were administered 2 ml of 0.5% hyperbaric Bupivacaine and 50 µg of clonidinediluted in 1 ml of normal saline.
- Group C patients were administered 2 ml of 0.5% hyperbaric Bupivacaine and 1 ml of normal saline as control.
- After intrathecal injection patients were positioned in the supine position and were administered oxygen at 5L/min using a simple facemask. The anesthesiologist performing the block was blinded to the drug administered.

Sensory parameters like time to reach dermatomal level of T10, maximum height of the block attained, time taken for regression to S1 dermatomal level were noted using a cold swab in the midclavicular line. Motor parameters were recorded using the modified Bromage scale[1] (Bromage 0, the patient able to move hip, knee and ankle. Bromage 1, the patient is unable to move the hip but can move the knee and ankle. Bromage 2, the patient is unable to move the hip and knee but can move the ankle. Bromage 3, the patient is unable to move the hip knee or ankle.). Time to reach the bromage 3 and time of motor blockade to regress to bromage score 0 were recorded. Pulse oximetry, non invasive blood pressure, electrocardiogram were measured every 5 minutes intraoperatively and every 15 minutes postoperatively for one hour. Sedation was graded as per the Ramsey sedation scale[9] (1-Awake and anxious, agitated, or restless, 2-Awake, cooperative, accepting ventilation, oriented, tranquil, 3-Awake; responds only to commands, 4-Asleep; brisk response to light glabellar tap or loud noise, 5-Asleep; sluggish response to light glabellar tap or loud noise stimulus but does not respond to painful stimulus, 6- Asleep; no response to light glabellar tap or loud noise). Hypotension was defined as systolic blood pressure less than 90 mmHg and bradycardia was defined as heart rate of less than 50 bpm. InjMephentermine 6 mg iv was used to treat hypotension and Inj Atropine 0.6 mg iv for bradycardia.

Statistical Data Analysis

Sample size was calculated keeping the power at 80% and confidence intervals at 95%, to detect a difference of at least 20% in the mean sensory regression time for sensory blockade. The minimum sample size required was 31 in each group. We included 50 patients in each group to allow for possible dropouts and better validation of results. All the parametric data are presented as mean ± standard deviation and analysed using Statistical Package for Social Sciences (SPSS) version 15.0. Independent t test and Oneway ANOVA tests were used to compare the parametric data between the groups and paired t test used for intra group comparison. Chi square test and Fisher exact test were applied for nominal data as required. Post hoc analysis and Bonferoni correction was applied as necessary. P-value of less than 0.05 was considered as statistically significant.

RESULTS

The demographic data (Table 1) like age sex height and weight were comparable between the three groups. The statistical analysis was done using SPSS 17.0. Using this software we compared the three groups. The time to reach sensory level of T10 was 4.82±3.31 minutes in Group A, 4.44±2.65 minutes in Group B and 5.30±3.38 minutes in Group C. Time of regression of sensory blockade to S 1 was comparable between Groups A and B but were significantly prolonged in comparison to Group C (Group A 317.2± 90.27 minutes, Group B -291.9± 82.63 minutes and 204.26± 84.77 minutes). The median cephalad spread of the drug was T8 in Group A (Range T 4-T10), T6 in Group B (Range T2-T10) and T10 in Group C (Range T6-T12). (Table 2) All patients achieved motor blockade of bromage score 3. The onset of motor blockade measured by time to attain bromage score 3 were 6.57±3.71 minutes in Group A, 5.95±4.31 minutes in Group B and 7.48± 4.25 in Group C. The regression of motor blockade to Bromage score 0 was comparable between Group A and B but was significantly prolonged in comparison to Group C (Group A-323.14±93.43,Group B-296.31± 94.67 and Group C-206.98± 88.00) with p

values of 0.000. (Table 2) 13 patients in Group B, 11 in Group A and only 2 in Group C had hypotension (p-0.003). Postoperatively the Blood pressure in Group B was significantly lower statistically but clinically there was no hypotension. (Table 3) 3 patients in Group A, 2 patients in Group B and 1 patient in Group C had bradycardia (p-0.594). Postoperatively the heart rate was comparable between the three groups. (Table 3) The mean sedation scores intraoperatively were 2.16± 0.77 in Group A, 2.10±0.51 in Group B and 1.34± 0.80 in Group C. The post operative sedation scores were 2.04±0.70 in Group A, 2.06± 0.47 in Group B and 1.32± 0.79 in Group C. There was no significant fall in the oxygen saturation in all the three groups both intraoperatively and postoperatively. (Table 3)

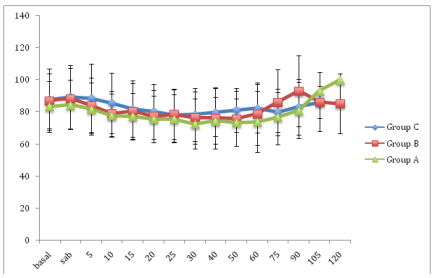

Figure 1: Heart Rate (bpm) Data Presented as Mean±SD

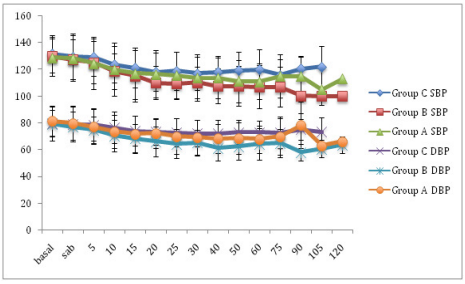

Figure 2: Blood Pressure (mmHg) Data Presented as Mean±SD

Table 1: Patient's Characteristics

Parameter	Group A	Group B	Group C	P value
Age (years)	36.86±12.11	34.18±9.99	36.02±12.75	0.509
Gender	Male- 46	Male-42	Male-42	0.313
	Female-4	**Female-8**	**Female8**	
Duration of Surgery(min)	57.66±22.26	60.26±20.86	62.20±27.74	0.633
Type of Surgery				0.613
Lower Limb	32	28	26	
Lower Abdominal	14	14	18	
Perineal	4	8	6	

Data presented as Mean±SD

Table 2: Sensory and Motor Characteristics

	Group A	Group B	Group C	P value
Onset of sensory block (min)	4.82±3.31	4.44±2.65	5.30±3.38	0.390
Onset of motor blockade (min)	6.57±3.71	5.95±4.31	7.48± 4.25	0.176
Regression of sensory blockade (min)	317.2± 90.27	291.9±82.63	204.26± 84.77	0.000*
Regression of motor blockade (min)	323.14±93.43	296.31±94.67	206.98± 88	0.000*
Median and Range of sensory block (min)	T8(T4-T10)	T6(T2-T10)	T9 (T6-T12)	0.000*

*P value<0.05 = statistically significant difference. Data presented as Mean±SD

Table 3: Side effects

Side Effect	Group A	Group B	Group C	P value
Hypotension	11	13	2	0.003*
Bradycardia	3	2	1	0.594
Nausea	0	0	0	
Vomiting	0	0	0	
Shivering	0	0	0	

Data presented as numbers of patients, *P-value < 0.05 = statistically significant difference

DISCUSSION

The primary aim of our study was to assess the duration of sensory and motor block with addition of 5µg of dexmedetomidine or 50µg of clonidine as spinal adjuvant. The duration of sensory and motor blockade was significantly prolonged in the clonidine and dexmedetomidne groups. Furthermore, the median maximum height of the block was significantly higher in the clonidine group in comparison to the other two groups. However, onset time for both sensory and motor blockade was comparable between the two groups. α_2 receptor agonists have been postulated to prolong the

duration of sensory and motor blockade of spinal anesthesia by acting on the presynaptic C-fibers and post synaptic dorsal horn neurons. Dexmedetomidine is a selective α_2 agonist with a α_2:α_1 binding ratio of 1620:1. In comparison clonidine has a binding ratio of 220:1 and hence, dexmedetomidine is 10 times more potent than clonidine.[8] Various animal studies have used dexmedetomidineintrathecally in doses ranging from 2.5 mcg to 100 mcg. Human studies have used 3-15 mcg of dexmedetomidineintrathecally. We decided to use 5 mcg of dexmedetomidine for the ease of dilution and 50 mcg of clonidine as it is 10 times less potent than dexmedetomidine. Kanazi *et al*. have compared 3µg of dexemedetomidine and 30µg clonidine intrathecally and have found that both reduce the onset times to both motor and sensory block and prolong the regression times of both motor and sensory blocks. Even though we did not find significant difference in the onset of sensory and motor block in our study, the duration of sensory and motor blockblock was significantly prolonged in comparison to the control group and was comparable between groups dexmedetomidine and clonidine.[8] Mahendru *et al* in their study have compared 30 µg clonidine with 5 µg of dexmedetomidine administered intrathecally and have found a prolongation in the sensory and motor blockade with dexmedetomidine. But, in our study we have used equipotent doses of clonidine and dexmedetomidine.[10] The incidence of hypotension varied from 3.3% to 10% in different studies but, there was a higher incidence of hypotension (22% in dexmedetomidine group and 26% in the clonidine group) in the present study in spite of use of lower dose of bupivacaine.[5,8,11.]This is explained by the hypothesis that high dose bupivacaine causes maximal autonomic blockade and hypotension, the addition of α_2 agonist does not make a difference, but when used with low dose bupivacaine the contribution of α_2 agonist to autonomic blockade may be higher, leading to greater incidence of hypotension. In a recent study Kim *et al*. found a lower incidence of hypotension using a lower dose of bupivacaine and a lower dose (3µg) of dexmedetomidine. [12] Kanazi *et al* have found comparable hemodynamics with lower dose of dexmedetomidine and Mahendru *et al* have found comparable hemodynamics with 5 µg of dexmedetmidine and 30 µg of clonidine.[8,10] In our study hypotension was effectively treated with a single dose of mephentermine. All studies have shown lower incidence of nausea and vomiting and higher sedation scores. In our study also we have found the same results. In conclusion, Intrathecaldexmedetomidine is comparable to intrathecal clonidine and prolongs the duration of motor and sensory blockade with minimal side effects.

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Source of Support: None Declared
Conflict of Interest: None Declared