Original Research Article

Dexmedetomidine infusion on subarachnoid block with bupivacaine in inguinal herniorrhaphies - A prospective study

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Abstract

Background: Dexmedetomidine (D) is alpha-2 agonist that acts as an anaesthetic and analgesic substitute. The goal of this study was to see how intravenous (I.V.) dexmedetomidine affected the length of sensory and motor block, postoperative analgesia, sedation degree, and side effects**. Aims**: To assess the effect of Dexmedetomidine infusion on the duration of analgesia with spinal Bupivacaine for adult patients undergoing herniorrhaphy and to assess side effects. **Materials and methods**: Prospective study was done under the for a period of 11 months. In 80 adults aged 20 to 60 years scheduled for herniorrhaphies were allocated into two study groups, named B and BD using computer generated randomization. The enrolled patients were divided into 2 groups each 40 patients to receive either 0.5 µg/kg dexmedetomidine intravenous bolus over 10 min (Group BD) or saline infusion (Group B) prior to subarachnoid block with 0.5% hyperbaric bupivacaine 12.5 mg **Results**: Numerical pain rating scale scores were significantly lower in group BD. Total analgesic requirement was significantly less in group BD. Time to request for first analgesic dose was longer in group BD as compared to group B. The duration of analgesia was longest in patients received intravenous dexmedetomidine along with spinal bupivacaine. Hemodynamic parameters and incidence of side effects were similar in both the groups. **Conclusion**: Premedication with single dose of intravenous dexmedetomidine 0.5 µg/kg prior to subarachnoid blockade with 0.5% hyperbaric bupivacaine hastens the onset and increases duration of sensory and motor block, with maintenance of stable hemodynamics and arousable sedation in Inguinal Herniorrhaphies.

Keywords: Intravenous; Dexmedetomidine; Bupivacaine; Spinal anesthesia.

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INTRODUCTION

Spinal anesthesia (SA) is a commonly used regional anesthesia technique in lower abdominal surgeries as it is economical and easy to perform. The intrathecal local anesthetic 0.5% hyperbaric bupivacaine with dextrose is appropriate for surgeries lasting for 2 to 2.5 hours.[1] Intrathecal hyperbaric bupivacaine alone is not sufficient to produce postoperative analgesia and hence some adjuvant may have to be added along with local anesthetic. Newer alpha-2 agonist dexmedetomidine has emerged as a wonderful drug in anesthesia practice since last one and a half decade.[2,3] Very few studies have been done with dexmedetomidine as a sedative agent to supplement subarachnoid block. As such there is a paucity of literature on the effect of dexmedetomidine on overall block characteristics of regional anesthesia. Subarachnoid block with local anaesthetics are popular techniques of anaesthesia which have been extensively used for lower abdominal surgery. Subarachnoid block is a simple technique which requires a small dose of local anaesthetic to provide rapid and reliable surgical anaesthesia and minimal risk of drug toxicity. Bupivacaine has been used

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from long back and is now the most widely used local anaesthetic.[4,5] Hyperbaric 0.5% Bupivacaine is a popularly used local anaesthetic drug for subarachnoid block. It is more potent and has a longer duration of action than lignocaine. Duration of spinal anaesthesia and analgesia may be prolonged by addition of opioids, clonidine, neostigmine, or vasoconstrictor agents to the local anesthetic drug for better postop pain relief. Intrathecal and epidural opioids provide selective analgesia without motor or sensory blockade. Intrathecal addition of a low dose of α 2-agonist like clonidine or dexmedetomidine results in significant prolongation of the duration of the sensory and motor blockade induced by hyperbaric bupivacaine

MATERIALS AND METHODS

A double blind prospective randomized control study done under the department of Anesthesiology, from October 2018 to september 2019

Inclusion Criteria: Age group 20- 60 yrs Patients of ASA grade I and II undergoing herniorrhaphies, Weight between 65-75 kg and Height >155cm.

Exclusion criteria: History of drug allergy, Patients with coagulation disorders, liver disease, kidney disease, neurologic disorders, cardio vascular disease, Infection at the site of injection, Pregnancy and Mentally challenged patients.

Sampling was purposive sampling, done using the formula S=z pq/d where z is constant, p is prevalence, q is (1-p) and d is significance level. In this study considering hospital prevalence of 5% and confidence interval of 95% z was 1.96 and d was 0.05 and applying this formula S= sample size was 80 patients.

Using computer-generated randomization, 80 participants were randomly assigned to two study groups, A and B.

Group B: Received Spinal Bupivacaine 0.5% (Heavy) and normal saline Infusion.

Group BD: received Spinal Bupivacaine 0.5% (Heavy) and intravenous Dexmedetomidine 1µg/kg bolus infusion in 20 mL (syringe) over a period of 10 minutes followed by 0.5µg/kg over a period of one hour in 50 mL (syringe).

Groups B and B**D** received the same volume of intravenous bolus dosage (20 mL). Dexmedetomidine 1g/kg was used for the loading dosage in group BD, which was dilute to 20 ml with distilled water, while normal saline was used in group B. Group B and BD received the same volume of intravenous maintenance dosage (50 mL).

An informed, valid, and written consent was obtained in order for the study to be carried out. Starting at midnight the night before surgery, all patients were given nil by mouth, and a tablet of alprazolam (0.01 mg/kg) was given at bedtime the day before surgery. Intravenous access was obtained using an 18-gauge cannula, and 20 minutes before surgery, preloading with 20 ml/kg lactated Ringer's solution was performed. Each patient was given a pulse oximeter, noninvasive blood pressure (BP), and an electrocardiogram monitor when they arrived in the operating room, and baseline values were taken. All of the patients were sorted into two groups of 40 each. The treatment group was unknown to both the patient and the anesthesiologist, and all recordings were made by an anesthesiologist who was also uninformed of the randomization sequence. An anesthesiologist who was not informed of the study medication documented all of the measures.

The same anesthesiologist, who was also an observer, performed all spinal blockades. As a result, both the patient and the observer were unaware of the study. Patients were placed in a flexed lateral position with the operating side down ten minutes after the study medication infusion ended. The surgical table was kept flat, and 12.5 mg of hyperbaric Bupivacaine was injected into the L3–L4 subarachnoid area via the midline method. The patients were immediately changed to a supine position and given supplemental oxygen.

Quality of motor block was assessed by modified Bromage scale (0 = no paralysis; 1 = unable to raise extended leg; 2 = unable to flex knee; 3 = unable to flex ankle).

Level of sedation was noted using Ramsay Sedation Score (1 – Anxious or agitated; 2 – Cooperative and tranquil; 3 - drowsy but responsive to command; 4 –Asleep but responsive to glabellar tap; 5 – Asleep but sluggish response to tactile stimulation; 6 – Asleep and no response). The score was re-assessed every 10 mins after drug administration for up to 180 min and every 15 min thereafter till the patient was awake Excessive sedation was defined as score > 4 out of 6. Before surgery, baseline measurements for heart rate, mean arterial pressure (MAP), and oxygen saturation (SpO2) were taken. HR, MAP, and Spo2 were measured intraoperatively at 5, 20, 40, and 60 minute intervals. HR and MAP were measured at 1, 2, 6, 12, and 24 hours after surgery. Intraoperative hypotension requiring fluid boluses or vasopressors was noted, as well as bradycardia requiring atropine. The time from the end of operation to opening the eyes on being called by name was also recorded. Patient were evaluated for NPRS score at 1, 2, 4, 8, 12, 24 and 48 hours postoperatively. Time to request for first analgesic (Diclofenac 75mg) dose, total analgesic consumption, occurrence of side effects like shivering, nausea and vomiting were recorded along with haemodynamic monitoring. During the postoperative phase, patients were monitored for analgesia and side effects such as shivering sedation, postoperative nausea, and vomiting, and were treated accordingly.

Statistical analysis: Then, for each Group, we determined the Mean, Standard Deviation, and SE standard error of the

mean. For all of the variables, an independent sample 't' test was used to find the difference between groups. All mean values of the respective variables in both groups were graphed. For each category, a frequency table is also created. The data obtained was statistically analyzed using Student's t test and chi square test using SPSS version 22.

RESULTS

Table-1: Demographic details in study

Variables	Group-B	Group-BD	P-Value
Age in years	41.5+6.43	42.7+6.21	>0.05
Gender (male/female)	19/21	18/22	>0.05
Weight in kgs	68.2+5.5	69.1+5.8	>0.05
Height in cms	160+49	161+51	>0.05
ASA(I/II)	27/13	28/12	>0.05
Duration of surgery	77.1+6.5	75.4+6.4	>0.05

All the variable in study are comparable in groups.

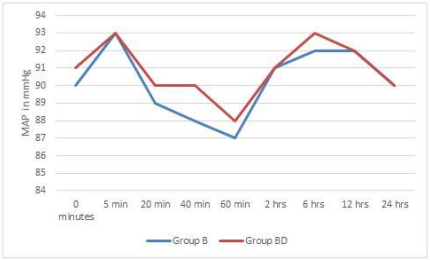

Figure 1: Mean arterial pressure between 2 groups

Mean arterial pressure is insignificant in between 2 groups.

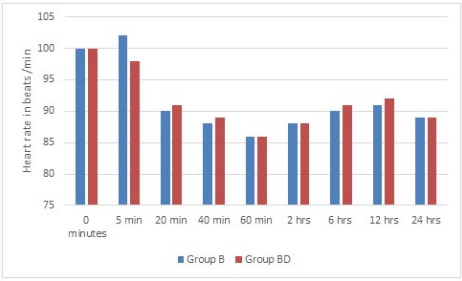

Figure 2: Heart rate in both groups

Heart rate is insignificant in between 2 groups. Patients in both the groups were haemodynamically stable.

Table 2: Comparision of variables in both groups

Variables	Group-B	Group-BD	P-Value
Number of patients given rescue analgesia(%)	24(60%)	8(20%)	<0.001
Mean time for the first dose (min)	181.4+26.3	409+35.5	<0.001
Duration of analgesia	344.8+26.1	488+32.9	<0.001
Total amount of diclofenac given in 24 hrs(mgs)	192.4+36.4	127+32.2	<0.001

The amount of time required for the first analgesic dose to be requested was recorded and compared to total analgesic use. In comparison to Group B, patients in Group BD had a longer pain-free interval. The number of injections of diclofenac was also much lower in Group BD patients.

Table 3: NRS score noted in both groups in study

NRS(Post -operatively	Group-B	Group-BD	P-Value
1	0	0	
2	0	0	
4	4.3+0.9	1.1+0.3	<0.001
8	5.2+0.7	2.4_0.4	<0.001
12	4.5+0.6	3.1+0.4	<0.001
24	2.6+0.5	2.3+0.3	0.11
48	2.1+0.5	1.7+0.4	0.14

Patients were asked to rate their pain on 11-point scale (NRS) ranging from No pain to worst possible pain in post-anaesthesia care unit. It was found that NRS scores were significantly lower in patients who are given with dexmedetomidine i. e. Group BD as compared to Group B.

Table 4: Side effects in present study

Side effects	Group-B	Group-BD
Nausea and vomiting	5(12.5%)	2(5%)
Shivering	8(20%)	1(2.5%)
Bradycardia	4(10%)	2(5%)
Hypotension	2(5%)	3(7.5%)
Drowsiness.	2(5%)	3(7.5%)

Both groups experienced similar side effects such as nausea, vomiting, shivering, bradycardia, hypotension, and drowsiness.

DISCUSSION

For procedures lasting more than 120 minutes, the medication of choice is intrathecal 0.5 percent hyperbaric bupivacaine. Various medications, such as magnesium sulphate, neostigmine, midazolam, fentanyl, and clonidine, have been used as adjuvants to local anaesthetics through the intrathecal route to extend the duration of spinal anaesthesia. Although opioids have become a common spinal anaesthetic adjuvant, they can cause pruritus and respiratory depression when mixed with a local anaesthetic solution.[6] Dexmedetomidine, which is pharmacologically similar to clonidine, has an 8-fold higher affinity for 2 receptors than clonidine. It causes drowsiness and anxiolysis by binding to 2receptors in the locus ceruleus, which suppresses sympathetic activity and reduces norepinephrine release, lowering heart rate and blood pressure. The patient experiences agony, uncertainty, and discomfort as a result of postoperative pain related to abdominal procedures. Postoperative abdominal pain might cause pulmonary problems such basal pneumonitis and collapse due to insufficient breathing effort. Hypertension and tachycardia caused by stress are also fairly prevalent. There are a variety of systemic analgesics available, but each has its own set of side effects. Pruritis, constipation, nausea, vomiting, and urine retention are all typical adverse effects. Continuous spinal catheters and epidural catheters, for example, are excellent regional analgesic methods. Its high lipophilicity allows for fast

absorption in the cerebrospinal fluid and binding to the spinal cord's alpha 2 receptor. It extends the duration of both sensory and motor blockage generated by local anaesthetics, regardless of administration route. It is widely used in both vitreoretinal surgery and dentistry.[7] The addition of dexmedetomidine to bupivacaine prolongs the duration of peripheral blocks and lowers the need for postoperative analgesics.[8,9] In one investigation, Venn RM *et al.* found that in cardiac patients, postoperative analgesic requirements were lowered by 50% and the need for rescue midazolam sedation was reduced by 80%.[10] In this study mean arterial blood pressure has No statistically and clinically significant with p value > 0.05. In this study mean heart rate in groups is clinically significant in heart rate occurred after infusing dexmedetomidine but It is not statistically and clinically significant with p value > 0.05. Our study is comparable to study done by Royzada B *et al.*, Rakesh kumar *et al.* studies.[12,13] In present study, 40 patients were given subarachnoid block with bupivacaine 0.5% 20 ml (Group B) and 40 patients were given subarachnoid block with bupivacaine 0.5% 20 ml + inj. dexmedetomidine 0.5-1 µgm/Kg (Group BD). Postoperative analgesia was compared by Numeric rating scale for pain. Pain was recorded on 1, 2, 4, 8, 12, 24, 48 hours interval from application of block. NRS scores were less, indicating better postoperative pain relief in group B as compared to group BD. NRS scores at 4, 8, and 12 hours were significantly low in group D. The time between the application of the subarachnoid block and the request for the first analgesic dose, as well as the total duration of analgesia and total analgesic consumption, were compared. Patients in Group D had much longer analgesia and used significantly less Inj. Diclofenac. Similarly, Hong *et al.*[14] and Whizar-Lugo *et al.*[15] found that in the dexmedetomidine group, postoperative pain intensity was lower and the mean time to first request for postoperative analgesia was longer than in the control group (6.6 h vs. 2.1 h). When compared to midazolam and saline, Kaya *et al.*16 found that dexmedetomidine prolonged the duration to the first request for postoperative analgesia (P 0.01) and lowered analgesic requirements (P 0.05). When used in conjunction with general anaesthesia, dexmedetomidine as an adjuvant to local anaesthetics has been proven to reduce intraoperative medication needs, increase oxygenation, and prolong postoperative anaesthesia. Rakesh kumar and Sunitha study mean pain score at 30 mt in group A is 0 and for group B is 0.4. It is not statistically significant. whereas mean pain score at interval is clinically and statistically significant with p value <0.001. Patients in both the groups were haemodynamically stable with minimal side effects.[13]

CONCLUSION

Hemodynamic alterations caused by dexmedetomidine are temporary, although they respond to pharmacological medications and intravenous fluid delivery. Dexmedetomidine is a good sedative for surgery, and sedation levels return to normal within 15 minutes after the drug is stopped. Dexmedetomidine works well for intraoperative sedation, postoperative analgesia, and reducing postoperative shivering.

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