e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(3); 380-384

Original Research Article

A Hospital Based Clinical Assessment of the Effect of Dexmedetomidine Infusion on the Duration of Analgesia with Spinal Bupivacaine for Adult Patients Undergoing Herniorrhaphy

Neeraj Kumar[1], P.K.Sinhha[2]

[1]Senior Resident, Department of Anaesthesia, Anugrah Narayan Magadh Medical College Hospital, Gaya, Bihar, India

[2]associate Professor, Department of Anaesthesia, Anugrah Narayan Magadh Medical College Hospital, Gaya, Bihar, India

Received: 16-01-2024 / Revised: 18-02-2024 / Accepted: 20-03-2024
Corresponding Author: Dr. Neeraj kumar
Conflict of interest: Nil

Abstract

Aim: The aim of the present study was 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.

Methods: A double blind prospective randomized control study done in the Department of Anaesthesia, Anugrah Narayan Magadh Medical College and Hospital, Gaya , Bihar, India from July 2019 to June 2020. and 100 patients were included in the study.

Results: All the variables in study are comparable in groups. 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. 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. The groups experienced similar side effects such as nausea, vomiting, shivering, bradycardia, hypotension, and drowsiness.

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.

Keywords: Intravenous; Dexmedetomidine; Bupivacaine; Spinal anesthesia

Introduction

Spinal anesthesia is a unique technique to provide sensory and motor blockade in the large part of the body with a lesser amount of drug, hence very popular for infraumbilical surgeries. Usually, without any additive one can achieve 60–90 min anesthesia with a spinal block. Nowadays, anesthetists are fortunate enough to have agents that can be used either intrathecally or intravenously to enhance the efficacy and duration of the block they are called adjuvants. Some of the drugs that were previously used are epinephrine, magnesium sulphate, fentanyl, midazolam, clonidine [1-4], nowadays dexmedetomidine is trending. Dexmedetomidine was a newer congener of clonidine, a dextro isomer of medetomidine, first introduced for short-term Intensive Care Unit sedation in 1999, is having 8 times more selectivity to α2-adrenergic receptors than clonidine which might permit its application in relatively high doses for sedation and analgesia without any unwanted vascular effects from activation of α1 receptors. Dexmedetomidine is rapidly emerging drug as an adjuvant to general anesthesia, regional anesthesia, spinal anesthesia, during monitored anesthesia care, as premedication and for postoperative sedation and analgesia. [5]

Dexmedetomidine is an excellent drug for sedation in intubated as well as non- intubated patients in critical care and for short procedures. Sleep induced with dexmedetomidine is termed as cooperative sleep, and the drug does not disturb the sleep architecture, as well as, the respiratory drive. Taking the advantage of these properties, we decided to study the effects of dexmedetomidine by administrating it intravenously in association with the subarachnoid block.

Dexmedetomidine is a selective α2 agonist; these receptors are found in many sites throughout the body including central nervous system (CNS), spinal, and peripheral tissues. In CNS, the highest densities of α2 receptors are found in the locus ceruleus, an important modulator of vigilance. Presynaptic activation of the α2A-adrenoceptors in the locus ceruleus inhibits the release of norepinephrine (NE) and results in the sedative and hypnotic effects. Furthermore, the locus ceruleus is the site of origin for the descending medullospinal noradrenergic pathway. Stimulation of the α2-adrenoceptors in this area terminates the propagation of pain signals leading to analgesia. At the spinal cord, stimulation of α2 receptors at the substantia gelatinosa of the dorsal horn leads to inhibition of the firing of nociceptive neurons and inhibition of the release of substance P. Furthermore, the α2-adrenoceptors located at the nerve endings have a possible role in the analgesic mechanisms of α2 agonists by preventing NE release. The spinal mechanism is the principal mechanism for the analgesic action of dexmedetomidine even though there is a clear evidence for both a supraspinal and peripheral sites of action. Newer alpha-2 agonist dexmedetomidine has emerged as a wonderful drug in anesthesia practice since last one and a half decade. [6]

The aim of the present study was 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

A double blind prospective randomized control study done in the Department of Anaesthesia, Anugrah Narayan Magadh Medical College and Hospital, Gaya , Bihar, India from July 2019 to June 2020 and 100 patients were included in the study.

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.

Using computer-generated randomization, 100 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 BD 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. Patients 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

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	42.6+6.44	43.7+6.24	>0.05
Gender (male/female)	23/27	22/28	>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 variables in study are comparable in groups.

Table 2: Comparison of variables in both groups

Variables	Group-B	Group-BD	P-Value
Number of patients given rescue analgesia (%)	30 (60%)	10 (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	6 (12%)	2 (4%)
Shivering	10 (20%)	1(2%)
Hypotension	2(4%)	3(6%)
Drowsiness.	2(4%)	3(6%)

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

Discussion

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. [7] 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. [8]

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. [9] The addition of dexmedetomidine to bupivacaine prolongs the duration of peripheral blocks and lowers the need for postoperative analgesics. [10,11] In one investigation, Venn RM et al [12] found that in cardiac patients, postoperative analgesic requirements were lowered by 50% and the need for rescue midazolam sedation was reduced by 80%. All the variables in study are comparable in groups. 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.

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. The groups experienced similar side effects such as nausea, vomiting, shivering, bradycardia, hypotension, and drowsiness. Similarly, Hong et al [13] and Whizar-Lugo et al [14] 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 [15] 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.

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.

References

1. Kamibayashi T, Maze M, Weiskopf RB, Weiskopf RB, Todd MM. Clinical uses of α2-adrenergic agonists. The Journal of the American Society of Anesthesiologists. 2000 Nov 1;93(5):1345-9.
2. Saxena H, Singh S, Ghildiyal S. Low dose intrathecal clonidine with bupivacaine improves onset and duration of block with haemodynamic stability. Internet J Anes - thesiol. 2010;23(11):9137.
3. Thakur A, Bhardwaj M, Kaur K, Dureja J, Hooda S, Taxak S. Intrathecal clonidine as an adjuvant to hyperbaric bupivacaine in patients undergoing inguinal herniorrhaphy: A randomized double-blinded study. Journal of Anaesthesiology Clinical Pharmacology. 2013 Jan 1;29(1):66-70.
4. Sethi BS, Samuel M, Sreevastava D. Efficacy of analgesic effects of low dose intrathecal clonidine as adjuvant to bupivacaine. Indian journal of Anaesthesia. 2007 Sep 1;51(5):415-9.
5. Eren G, Cukurova Z, Demir G, Hergunsel O, Kozanhan B, Emir NS. Comparison of

dexmedetomidine and three different doses of midazolam in preoperative sedation. Journal of Anaesthesiology Clinical Pharmacology. 2011 Jul 1;27(3):367-72.
6. Bajwa S, Kulshrestha A. Dexmedetomidine: an adjuvant making large inroads into clinical practice. Ann Med Health Sci Res. 2013 Oct;3 (4):475-83.
7. Kanazi GE, Aouad MT, Jabbour-Khoury SI, Al Jazzar MD, Alameddine MM, Al-Yaman R, Bulbul M, Baraka AS. Effect of low-dose dexmedetomidine or clonidine on the characteristics of bupivacaine spinal block. Acta anaesthesiologica scandinavica. 2006 Feb ;50(2):222-7.
8. Virtanen R, Savola JM, Saano V, Nyman L. Characterization of the selectivity, specificity and potency of medetomidine as an α2-adrenoceptor agonist. European journal of pharmacology. 1988 May 20;150(1-2):9-14.
9. Gujral GS, Agarwal M, Gautam P. Evaluation of the effect and safety of dexmedetomidine as an additive to local anaesthesia in peribulbar block for vitreoretinal surgery. Indian J Ophthalmol 2019;67(5):636-640.
10. Chattopadhyay I, Banerjee SS, Basu S, et al. Effects of intrathecal dexmedetomidine as an additive to low dose bupivacaine in patients undergoing transurethral resection of prostate. Indian J Anaesth 2017;61(12):1002-1008.
11. Sun Q, Liu S, WU H, et al. Dexmedetomidine as an adjuvant to local anaesthetic in transversus abdominis plane block: a systematic review and meta-analysis. Clin J Pain 2019;35(4):375-384.
12. Venn RM,Bradshaw CJ, Spencer R, et al. Preliminary UK experience of dexmedetomidine, a novel agent for postoperative sedation in the intensive care unit. Anaesthesia 1999;54(12):1136-1142.
13. Hong JY, Kim WO, Yoon Y, Choi Y, Kim SH, Kil HK. Effects of intravenous dexmedetomidine on low-dose bupivacaine spinal anaesthesia in elderly patients. Acta anaesthesiologica scandinavica. 2012 Mar;56 (3):382-7.
14. Whizar-Lugo V, Gomez-Ramirez IA, Cisneros-Corral R, Martinez-Gallegos N. Intravenous dexmedetomidine vs. intravenous clonidine to prolong bupivacaine spinal anesthesia. A double blind study. Anestesia en Mexico. 2007;19(3):143-6.
15. Kaya FN, Yavascaoglu B, Turker G, Yildirim A, Gurbet A, Mogol EB, Ozcan B. Intravenous dexmedetomidine, but not midazolam, prolongs bupivacaine spinal anesthesia. Canadian Journal of Anesthesia. 2010;57(1): 39.