International Journal of Medical Anesthesiology 2020; 3(2): 111-114

E-ISSN: 2664-3774
P-ISSN: 2664-3766
www.anesthesiologypaper.com
IJMA 2020; 3(2): 111-114
Received: 21-01-2020
Accepted: 23-02-2020

Dr. Girish Verma
Associate Professor, Department of Anaesthesiology, Index Medical College and Research Center, Indore, Madhya Pradesh, India

Dr. Aseem Sharma
Assistant Professor, Department of Anaesthesiology, Mahatma Gandhi Memorial medical College, Indore, Madhya Pradesh, India

Corresponding Author:
Dr. Aseem Sharma
Assistant Professor, Department of Anaesthesiology, Mahatma Gandhi Memorial medical College, Indore, Madhya Pradesh, India

Comparative study of dexmedetomidine and fentanyl as an adjuvant to bupivacaine for epidural Anaesthesia in lower limb Orthopedic surgeries

Girish Verma and Aseem Sharma

DOI: https://doi.org/10.33545/26643766.2020.v3.i2b.132

Abstract
Background: The addition of adjuvants to local anaesthetics causes an improvement in the quality and duration of analgesia which is a pivotal component for both intra operative and post-operative haemodynamic stability. Our study aims to compare the effect of Dexmedetomidine and fentanyl as an adjuvant to epidural bupivacaine in lower limb orthopedic surgeries.
Methods: 60 patients of ASA grade l and ll were randomized into two groups: Gr BD: received 15 ml of 0.75% bupivacaine with 1µg/kg dexmedetomidine and Gr BF: received 15 ml of 0.75% bupivacaine with 1µg/kg fentanyl. Onset of sensory analgesia using cold swab or pinprick, onset of motor blockade using Bromage scale, intra operative hemodynamic variations and complications, time of first demand for analgesia, sedation using Ramsay sedation scale were studied.
Results: The onset (BD-8.75 ± 2.0, BF-10.85 ± 1.8) and duration of sensory blockade (BD-335 ± 31.5, BF-268 ± 36) was found to be better in BD group, incidences of sedation and hypotention were found to be more in the dexmedetomidine group.
Conclusion: Dexmedetomidine as an adjuvant in a dose of 1 µg/kg is an effective adjuvant to bupivacaine for epidural anesthesia, as compared to fentanyl.

Keywords: Dexmedetomidine, epidural, fentanyl, bupivacaine

Introduction
Epidural anaesthesia is a very commonly used technique for inducing surgical anaesthesia and postoperative analgesia in lower limb surgeries [1]. It contributes to intra operative hemodynamic stability and has shown to reduce perioperative stress response thereby causing a decrease in complications and improving patient outcome. It helps in early mobilization by relieving postoperative pain, which decreases the incidence of thromboembolic events [2, 6].
Bupivacaine is lipophilic compound, with stereoslective properties, having a significantly high propensity for cardiotoxicity and CNS toxicity than lignocaine in animals and healthy volunteers [7, 9].
However, bupivacaine has been increasingly used in comparison to lignocaine. A slightly larger dose of bupivacaine may be required at times, but the addition of an adjuvant helps in the reduction of total required dose of local anesthetic and enhances the efficacy thereby providing increased duration and intensity of blockade [10, 12].
Addition of opioids to local anesthetics has several benefits such as improved dynamic pain relief, limited regression of sensory blockade, and decreased dose of local anesthetic [13]. Use of lipophilic opioid (fentanyl) is preferred to hydrophilic as it provides rapid onset of action, rapid clearance, and prevents delayed respiratory depression [14].
Dexmedetomidine is a potent and selective α-2 adrenoceptor agonist. It has relatively high ratio of α-2/α-1 activity (1620:1). The improved specificity of dexmedetomidine for α-2 receptor causes it to be with much more effective sedative, anxiolytic, analgesic and sympatholytic properties with less cardiovascular side effect.
The aim of the present study was to compare the effect of dexmedetomidine and fentanyl as an adjuvant to epidural bupivacaine in lower limb orthopedic surgeries.

Materials and Methods
This randomized double-blinded study was carried out in 60 patients undergoing lower limb surgeries.

After getting approval from the Hospital ethical Committee, patients aged 18-60 years of both the sex and ASA Grade I or II satisfying inclusion criteria, were recruited. During preanesthetic visit the patients were explained about the study purpose, merits and demerits of the procedure and instructed to ask for analgesia as per need and informed written consent was obtained from the patients. Patients were fasted for 8 h and premedicated with tablet ranitidine 150 mg and tablet alprazolam 0.5 mg in the night, the day before and in the morning of the day of surgery. All patients were preloaded with 10-15 ml/kg of ringer lactate, and baseline reading of all the study parameters were recorded.

Patients were randomized into two groups bupivacaine with fentanyl (BF) and bupivacaine with dexmedetomidine (BD) by computer generated numbers. Group BF received 10 ml of 0.5% bupivacaine with 1 µg/kg fentanyl, and group BD received 10 ml of 0.5% bupivacaine with 1 µg/kg dexmedetomidine epidurally.

In operation theater baseline vital parameters such as noninvasive blood pressure, pulse oximetery and electrocardiograpy were recorded and intravenous line was secured. The epidural space was identified and confirmed using loss of resistance to air. A test dose of 3 ml of 2% lignocaine with 1:200,000 adrenaline was administered following which 16 ml of the study drug was administered epidurally as per randomization.

Onset of sensory block was evaluated by using cold swab and pin prick along the midline at every 2-3 minute, till onset of block at T10. The degree of motor block was assessed using the Bromage motor scale: 0-Free movement of legs and feet, 1-able to flex knee with free movement of feet, 2-unable to flex knees, but movement of feet, 3-unable to move legs or feet. The assessment for motor block was done every 5 min after administration of study drug till a block of Bromage grade 3 motor blockade was achieved. The level of sedation was assessed 10 min after grade 3 motor blockade. Onset of sensory analgesia was defined as the time taken to achieve loss of cold sensation at T10 dermatome level from the end of injection of the study drug. Duration of analgesia was defined as the time taken from the onset of sensory block at T10 to the time of pain sensation at the surgical site with a visual analog scale score of >3. Peak sensory level was defined as the highest dermatome level of sensory blockade achieved after administration of study drug. Time to two dermatome regression was defined as the time interval from the sensory block at the highest dermatome to the regression of sensory blockade by two dermatomes. The sensory level was assessed every 15 min after 2 h of epidural bolus injection till 2 dermatome regression of sensory level was observed.

The time to complete motor blockade was defined as the time interval from the administration of epidural study drug to the attainment of grade 3 motor blockade in the lower limbs. The assessment for motor block was done every 2-3 mins after administration of study drug till a block of Bromage grade 3 motor blockade was attained.

The statistical analysis was done using SPSS version 19.0. The values and results were presented in numbers and Mean ± Standard deviation. The confidence level of the study was 95% and a *p* value of <0.05 indicated statistically significant result.

Results

The study comprised of 60 patients, 30 patients in each group. Both the groups were comparable with respect to age, sex, height and weight characteristics. The type and duration of surgery were also found to be comparable.

The onset of sensory analgesia and time of complete motor blockade was significantly faster in group BD as compared to group BF.

All the patients of gr BD reached modified Bromage grade 3 but only 86% of BF gr reached modified Bromage grade 3. So the degree of motor blockade was significantly greater and denser in group BD.

Table 1: Demographic Data and Mean Duration of Surgery

Parameters	Group BF	Group BD	P value
AGE:(years)	42.6±8.0	47.13±7.6	>0.05
Gender:(M:F)	20.6	16.02	>0.05
Mean duration of surgery: (mins)	90.26±25.62	97.22±25.88	>0.05

Table 2: Onset of sensory block and motor block

	Group BF	Group BD	P value
Onset of sensory block (min)	10.8±1.8	8.75±2.0	<0.05
Time to achieve completemotor block (min)	22.8±3.4	15.0±2.5	<0.05

Table 3: Mean arterial pressure and heart rate

Heart rate	group BF	group BD	p value(BF Vs BD)
Before epidural injection	82.6±8.0	84.6±7.2	>0.05
after 10 min	75.6±7.3	68.6±9.6	<0.05
after 45 min	77.5±7.2	81.2±6.8	>0.05
Mean Arterial Pressure			
Before epidural injection	95.8±3.2	94.7±4.2	>0.05
after 10 min	81.7±2.6	76.7±3.0	<0.05
after 45 min	88.0±3.0	86.2±3.6	>0.05

Mean arterial pressure after 10 mins was significantly lower in BD group as compared to BF Groups. There was no statistically significant difference in MAP at 45 mins in both the groups [Table 3]. Mean heart rate after 10 mins of epidural injection was significantly lower in Group BD as compared to Group BF. Mean heart rate after 45 mins was 77.5 ± 7.2 in Group BF, and 81.2 ± 6.8 in Group BD. Mean heart rate after 45 min was lower in Group BF compared to BD.

Incidences of hypotention and bradycardia was higher in

BD group as compared to BF group. 40-45% of the patients of BD group showed incidences of hypotention and bradycardia which was treated with inj. Mephentermine 6 mg and inj. Atropine 0.4 mg. Sedation was more amongst the patients in BD group as compared to BF group. Two cases of BF group presented with respiratory depression. Though incidences of pruritus was more in BF group there was no statistically significant difference in the incidence of nausea and vomiting, pruritus among these two groups.

Discussion

Epidural anaesthesia is a versatile technique widely used in anaesthetic practice. Its potential to decrease postoperative morbidity and mortility has been demonstrated in many studies. There is evidence that regional anaesthesia, particularly epidural blockade, attenuates or inhibits surgical stress by blocking afferent neural stimuli from reaching the central nervous system, as well as by blocking the efferent activation of sympathetic nervous system [15, 16]. The synergism between epidural local anaesthetics and opioids is well established, but the evidence regarding the combination of LA with dexmedetomidine through epidural route is scarse in literature [17].

Chandran *et al*. [18]. Compared the characteristics of 0.75% ropivacaine and 0.5% bupivacaine and concluded that bupivacaine at these doses produced more effective anesthesia. Hence, we used 0.5% bupivacaine to provide epidural anaesthesia.

Alpha-2 agonist agents when used as an adjuvants have been shown to augment the actions of local anesthetics both in regional blocks and central neuraxial blockade with no adverse neurological effects [19, 20]. Some studies have shown synergism between epidural dexmedetomidine and bupivacaine [21]. Dexmedetomidine has been shown to increase sensory and motor block duration during epidural anesthesia with bupivacaine, prolongs postoperative analgesia, and does not cause significant hemodynamic instability [22]. In this study we have used dexmedetomidine in a dose of 1µg/Kg epidurally as an adjuvant to bupivacaine. Studies of intrathecal dexmedetomidine as an additive to local anesthetics have observed a dose-dependent prolongation of sensory block, increase in motor block duration, along with prolongation of the postoperative analgesia, thus a decrease in the local anesthetic dose in high-risk patients [23].

Fentanyl acts primarily as an agonist at µ-opioid receptors to enhance the analgesic potential. The dorsal roots contain opioid-binding sites and fentanyl either acts directly on the spinal nerve or by penetrating the duramater to act at the spinal roots [24].

In this study, the mean time of onset of sensory block and motor block was shorter in dexmedetomidine group as compared to fentanyl group. Furthermore, onset of both sensory and motor block was faster with addition of dexmedetomidine to bupivacaine compared to addition of fentanyl. These results were similar with the results of Salgado *et al*. [21]. Gill *et al*, [25] also reported the onset time to be shorter in dexmedetomidine group as compared to fentanyl group.

Bajwa *et al*. studied the addition of fentanyl and dexmeditomidine to bupivacaine in epidural block in patients of lower limb orthopedic surgeries and concluded that the onset of sensory anaesthesia was fast and the mean duration of analgesia was prolonged in group with dexmedetomidine as an adjuvant.

MAP after 10 mins was significantly lower in BD group as compared to BF Groups. There was no statistically significant difference in MAP at 45 mins in both the groups. HR after 10 mins of epidural injection was significantly lower in Group BD as compared to Group BF. In a study by Akin *et al*., [26] mean heart rate, blood pressure, respiratory depression, hypoxia decreased significantly in dexmedetomidine group. The findings in the present study correlated with the findings in literature. Kaur *et al*., found both fentanyl and dexmedetomidine to be comparable when used in combination with 0.5% bupivacaine [22].

Though more number of patients in BD group experienced sedation but no significant difference was observed between the two groups with respect to maximum sedation achieved. In this study the number of times and dose of requirement of rescue analgesia was less in dexmedetomidine group as compared to fentanyl group.

Conclusion

Based on the results in the present study, dexmedetomidine is found to be an effective adjuvant to bupivacaine for epidural anesthesia as compared to fentanyl in doses of 1 µg/kg as it provides faster onset, prolonged duration of analgesia. With more incidences of hypotention, bradycardia and sedation when dexmedetomidine is used as an adjuvant.

Source of Support: Nil
Conflict of Interest: None declared

References

1. Schultz AM, Werba A, Ulbing S, Gollmann G, Lehofer F. Peri operative thoracic epidural analgesia for thoracotomy. Eur J Anaesthesiol. 1997; 14:600-3.
2. Nimmo SM. Benefit and outcome after epidural analgesia. Contin Educ Anaesth Crit Care Pain. 2004; 4:44-7. 2.
3. Park WY, Thompson JS, Lee KK. Effect of epidural anesthesia and analgesia on perioperative outcome: A randomized, controlled Veterans Affairs cooperative study. Ann Surg. 2001; 234:560-9. 3.
4. Holte K, Kehlet H. Epidural anesthesia and analgesia - Effects on surgical stress responses and implications for postoperative nutrition. Clin Nutr. 2002; 21:199-206. 4.
5. Rigg JR, Jamrozik K, Myles PS, Silbert BS, Peyton PJ, Parsons RW *et al*. Epidural anesthesia and analgesia and outcome of major surgery: A randomised trial. Lancet. 2002; 359:1276-82. 5.
6. Moraca RJ, Sheldon DG, Thirlby RC. The role of epidural anesthesia and analgesia in surgical practice. Ann Surg. 2003; 238:663-73.
7. Graf BM, Abraham I, Eberbach N, Kunst G, Stowe DF, Martin E *et al*. Differences in cardiotoxicity of bupivacaine and ropivacaine are the result of physicochemical and stereoselective properties. Anesthesiology. 2002; 96:1427
8. Dony P, Dewinde V, Vanderick B, Cuignet O, Gautier P, Legrand E *et al*. The comparative toxicity of ropivacaine and bupivacaine at equipotent doses in rats. Anesth Analg. 2000; 91:148
9. Knudsen K, Beckman Suurküla M, Blomberg S, Sjövall J, Edvardsson N. Central nervous and cardiovascular effects of i.v infusions of ropivacaine, bupivacaine and

placebo in volunteers. Br J Anaesth. 1997; 78:507-14
10. Chandran S, Hemalatha S, Viswanathan P. Comparison of 0.75% ropivacaine and 0.5% bupivacaine for epidural anesthesia in lower extremity orthopaedic surgeries. Indian J Anaesth. 2014; 58:336-8. 7.
11. Markham A, Faulds D. Bupivacaine. A review of its pharmacology and therapeutic use in regional anesthesia. Drugs. 1996; 52:429-49. 8.
12. Wahedi W, Nolte H, Witte P. Bupivacaine in epidural anesthesia. Dose-response relationship and a comparison with ropivacaine. Reg Anaesth. 1990; 13:57-65. 3.
13. Cooper DW, Turner G. Patient-controlled extradural analgesia to compare bupivacaine, fentanyl and bupivacaine with fentanyl in the treatment of postoperative pain. Br J Anaesth. 1993; 70:503-7.
14. Fischer RL, Lubenow TR, Liceaga A, McCarthy RJ, Ivankovich AD. Comparison of continuous epidural infusion of fentanyl-bupivacaine and morphine-bupivacaine in management of postoperative pain. Anesth Analg. 1988; 67:559-63.
15. SC O'Riain, Buggy DJ, Kerin MJ, Watson RWG, Moriarty DC. Inhibition of the stress response to breast cancer surgery by regional anaesthesia and analgesia does not effect vascular endothelial growth and prostaglandin E2, Anaesthesia and Analgesia. 2005; 100(1):244-249.
16. Kehlet H. Modification of responses to surgery by neural blockade: clinical implication. In Neural Blockade in Clinical Anaesthesia and Management of Pain, M. Cousins and P. Bridenbaugh, Eds, 1998; 129-178, J. B. Lippincott, Philadelphia, Pa, USA,.
17. Soto RG, Fu ES. Acute pain management for patients undergoing thoracotomy. Ann Thorac surg. 2003; 75:1349-57.
18. Chandran S, Hemalatha S, Viswanathan P. Comparison of 0.75% ropivacaine and 0.5% bupivacaine for epidural anesthesia in lower extremity orthopaedic surgeries. Indian J Anaesth. 2014; 58:336-8.
19. Marhofer D, Kettner SC, Marhofer P, Pils S, Weber M, Zeitlinger M *et al*. Dexmedetomidine as an adjuvant to bupivacaine prolongs peripheral nerve block: A volunteer study. Br J Anaesth. 2013; 110:438-42. 5.
20. Bajwa SJ, Bajwa SK, Kaur J, Singh G, Arora V, Gupta S *et al*. Dexmedetomidine and clonidine in epidural anaesthesia: A comparative evaluation. Indian J Anaesth. 2011; 55:116-21. 6.
21. Salgado PF, Sabbag AT, Silva PC, Brienze SL, Dalto HP, Módolo NS *et al*. Synergistic effect between dexmedetomidine and 0.75% ropivacaine in epidural anesthesia. Rev Assoc Med Bras. 2008; 54:110-5. 7.
22. Kaur S, Attri JP, Kaur G, Singh TP. Comparative evaluation of ropivacaine versus dexmedetomidine and ropivacaine in epidural anesthesia in lower limb orthopedic surgeries. Saudi J Anaesth. 2014; 8:463-9.
23. Al-Mustafa MM, Abu-Halaweh SA, Aloweidi AS, Murshidi MM, Ammari BA, Awwad ZM *et al*. Effect of dexmedetomidine added to spinal bupivacaine for urological procedures. Saudi Med J. 2009; 30:365-70.
24. Ozgurel O. Comparison of fentanyl added to ropivacaine or bupivacaine in spinal anaesthesia. Reg Anesth Pain Med. 2003; 28:23.
25. Gill RS, Acharya G, Rana A, Arora KK, kumar D, Sonkaria LK *et al*. Comparative evaluation of addition of fentanyl and dexmedetomidine to ropivacaine for epidural anaesthesia and analgesia in lower abdominal and lower limb orthopedic surgeries. EJPMR 2016; 3:200-5.
26. Akin S, Aribogen A, rsiane G. Dexmedetomidine as an adjuvant to epidural analgesia after abdominal surgery in elderly intensive care patients. A prospective, double - blind, clinical trial. Curr Ther Res Clin Exp. 2008; 69:16-28.