Research Article

# Comparative study of onset and total time required for sensory and motor blockade of epidural ropivacaine with clonidine and dexmedetomidine for lower limb surgeries

Shrirang N Bamne[1], Shrikrishna N Bamne[2], Shrikant N Bamne[3]

[1]Department of Critical Care Medicine, Manipal Hospital, Bangalore, Karnataka, India.
[2]Department of Physiology, Index Medical College Hospital & Research Centre, Indore, Madhya Pradesh, India.
[3]Department of Neurosurgery, Seva Superspeciality Hospital and Critical Care Centre, Dhule, Maharashtra, India.
Correspondence to: Shrikrishna Nagorao Bamne, E-mail: shrikrishna_bamne@rediffmail.com

Received October 5, 2015. Accepted October 16, 2015

## Abstract

**Background:** Use of ropivacaine in epidural anesthesia has increased in recent past. The high dose needed for satisfactory anesthesia in lower limb surgery can be associated with the adverse events. Dexmedetomidine and clonidine are used as adjuvants with ropivacaine, so that the dose of ropivacaine can be decreased and adverse events can be avoided.

**Objective:** To compare efficacy and safety of clonidine and dexmedetomidine as an adjuvant to ropivacaine for epidural anesthesia in lower limb surgery.

**Materials and Methods:** Subjects were divided randomly into two groups: Group RC, patient received ropivacaine 0.75% 20 mL with clonidine 2μg/kg ($n$ = 30), and Group RD, patient received ropivacaine 0.75% 20 mL with dexmedetomidine 1.5 μg/kg ($n$ = 30). Sensory analgesia using pin prick method, Bromage scale for motor blockade, time to two dermatome regression of sensory level, visual analogue scale for analgesia, Ramsay sedation scale for sedation, and intraoperative hemodynamic parameters were evaluated.

**Result:** It was observed that onset of sensory blockade at T12 level was faster in group RD (6.00 ± 2.03 min) as compared to group RC (7.33 ± 2.54 min). Mean time duration of onset of motor blockade was shorter in group RD (7.17 ± 2.52 min) as compared to group RC (12.67 ± 2.86 min) and time to achieve highest sensory dermatome blockade was shorter in group RD (21.00 ± 2.75 min) as compared to group RC (28.50 ± 2.33 min). Also mean time duration for complete motor blockade was shorter in group RD (20.17 ± 3.40 min) as compared to group RC (27.33 ± 3.14 min).

**Conclusion:** Dexmedetomidine is better as an adjuvant as compared to clonidine.

**KEY WORDS:** Epidural block, ropivacaine, clonidine, dexmedetomidine, lower limb surgeries

## Introduction

One of the very important anesthetic techniques for anesthesia and postoperative analgesia is epidural anesthesia.[1] Epidural anesthesia not only helpful in postoperative early mobilization but also helpful in intraoperative hemodynamic stability as well as perioperative stress response hence prevents surgical complications.[2]

Ropivacaine is used more frequently as compared to the bupivacaine because of certain advantage over later (less motor blockade, less cardiac toxicity).[3] The dose of ropivacaine is more as compared to bupivacaine but it can be decreased by using some adjuvants with the added advantage of increase in total anesthetic effect.[4] Alpha-2 agonists can be a good adjuvant for combination with ropivacaine for decrease in the dose and increase in the anesthetic efficacy. Alpha-2 agonists such as clonidine and dexmedetomidine found to be very useful as adjuvants to ropivacaine.[5,6] Dexmedetomidine has higher selectivity for alpha-2 receptors, hence can be used in

| Access this article online | |
|---|---|
| Website: http://www.ijmsph.com | Quick Response Code: |
| DOI: 10.5455/ijmsph.2016.05102015204 | |

higher concentration as compared to clonidine without much effect on alpha-1 receptors.[7]

Till now, few studies have published regarding the comparison of efficacy of these two adjuvants but more studies need to be carried out looking at small sample size of previous studies and diverse nature of surgeries. Hence, this study was designed with the overall aim of comparison of clonidine versus dexmedetomide as adjuvant to ropivacaine for lower limb surgeries. The primary objective of this study was to compare clonidine and dexmedetomidine as adjuvant to ropivacaine for onset and duration of sensory and motor blockade as epidural anesthesia for lower limb surgery.

## Materials and Methods

This randomized study was conducted in a tertiary care center after obtaining permission from Institutional Ethics Committee. A total of 60 patients of both sexes, American Society of Anesthesiologists Grade I and II, age between 20 and 60 years were included in the study and randomly divided in two groups.

Patients with the history of diabetes, hypertension, coagulation disorders, on anticoagulant therapy, kidney disease, psychiatric disorder, allergy to local anesthetics, and history of drug interaction of ropivacaine with clonidine or dexmedetomidine were not considered suitable for the study and excluded during recruitment.

All the patients underwent thorough preanesthesia checkup that included detailed history, general and systemic physical examination, and investigations as per the pro forma and were randomly allocated to one of the following two groups.

1. Group RC: Patient received ropivacaine 0.75% 20 mL with clonidine 2μg/kg ($n$ = 30)
2. Group RD: Patient received ropivacaine 0.75% 20 mL with dexmedetomidine 1.5μg/kg ($n$ = 30)

On arrival in the operation theater, Nil By Mouth (NBM) status and consent was checked and confirmed. Monitoring of heart rate, blood pressure, oxygen saturation, and respiratory rate was initiated. The baseline readings of this parameter were recorded. An intravenous (IV) access was secured with 18G cannula and an infusion of Ringer lactate was started at 8–10 mL/kg. 18G epidural catheter was inserted in L2–3 or L1–2 intervertebral space using Tuohy needle under all aseptic precaution in sitting position. Five centimeter of the catheter length was kept in epidural space and a test dose of 3 mL of 2% lignocaine hydrochloride solution containing adrenaline 1:200,000 was injected. After 3–5 min of administering test dose and confirming its correct placement, patients in group RC were given 20 mL of 0.75% ropivacaine and 2 μg/kg of clonidine in supine position by epidural route. Patients in group RD were given 20 mL solution of 0.75% ropivacaine and 1.5 μg/kg of dexmedetomidine. Heart rates, blood pressure, $SPO_2$ (it is peripheral capillary oxygen saturation, an estimate of amount of oxygen in the blood) and respiratory rate were recorded at every 5 min interval throughout the surgery. The pin prick method was used to evaluate and check sensory level, whereas Bromage scale was used to measure motor blockade effect at 5, 10, 15, 20, 25, and 30 min interval after epidural administration of the drug.

Sensory block by pin prick method was graded as Grade 0, sharp pin felt; Grade 1, analgesia, dull sensation felt; and Grade 2, anesthesia, no sensation felt. Bromage scale for motor blockage was used for motor blockage assessment: 0 = no block, 1 = inability to raise extended leg, 2 = inability to flex knee, and 3 = inability to flex ankle and foot. If there was persistent pain on pin prick method after about 25–30 min of epidural administration of drug, the block was deemed unsuccessful and the patient was excluded from the study. The patient was given surgical position 25–30 min after epidural administration of drugs after confirming complete establishment of sensory and motor blockade. Grading of sedation was evaluated by five-point scale, that is, 1 = alert and wide awake, 2 = arousable to verbal command, 3 = arousable with gentle tactile stimulation, 4 = arousable with vigorous shaking, and 5 = unarousable. Analgesia was evaluated by visual analogue scale ranging from 0 = lack of pain to 10 = worst imaginable pain. Sedation score was recorded just before initiation of surgery and every 5 min thereafter throughout the surgical procedure. Analgesia and sedation were evaluated hourly for initial 6 h, then 6 hourly for next 18 h in postoperative period.

Hypotension was defined as systolic pressure falling more than 20% and was treated first with fluid challenge and then with 3–6 mg Inj. mephentermine IV bolus. Heart rate <50 beats/min was treated with 0.6 mg Inj. atropine IV. IV fluids were given as per body weight and operative loss requirement. During surgical procedure, adverse events such as anxiety, nausea, vomiting, pruritus, and shivering were noted. Nausea and vomiting were treated with Inj. ondansetron 4 mg IV. All the vitals and hemodynamic parameters were recorded in recovery room at 5, 10, 15, 20, 25, and 30 min.

Rescue analgesia was given with a top-up dose of 8 mL of 0.2% ropivacaine in postoperative period if the visual analogue scale score was more than 3. Time for rescue analgesia was noted. After surgery, patients were shifted to postanesthetic care unit where they remained for at least 6 h.

Parameters such as time of onset of sensory blockade, highest dermatomal level of sensory blockade, time of onset of motor blockade, complete establishment of motor blockade, time for two segment regression of sensory blockade, and time of rescue analgesia were measured periodically.

### Statistical Analysis

A descriptive statistics was reported in the form of frequency, mean, and SD. Unpaired $t$-test was used to compare baseline factors between two groups. As data were not following normal distribution hence nonparametric Mann–Whitney test was used to compare both groups for different parameters. $P < 0.05$ was considered significant. The statistical software SPSS version 17 (SPSS Inc., Chicago, IL).

**Table 1:** Comparison of baseline characteristics between RC and RD groups

| Variables | Group RC (*n* = 30) | Group RD (*n* = 30) | *P* |
|---|---|---|---|
| Age (years) | 38.17 (11.86) | 38.10 (12.44) | 0.965 |
| Weight (kg) | 58.07 (5.29) | 55.80 (10.38) | 0.443 |
| Duration of surgery (min) | 103.50 (30.60) | 102.50 (25.92) | 0.892 |

Values are reported as mean (SD).
$p < 0.05$: significant.

**Table 2:** Grades of sensory blockade at T12 level with respect to time in RC and RD groups

| Time (min) | Group RC | Group RD | *P* |
|---|---|---|---|
| 5 | 0.53 (0.51) | 0.80 (0.41) | <0.05 |
| 10 | 1.13 (0.35) | 1.63 (0.49) | <0.05 |
| 15 | 1.47 (0.51) | 2.00 (0.00) | <0.05 |
| 20 | 2.00 (0.00) | 2.00 (0.00) | >0.05 |
| 25 | 2.00 (0.00) | 2.00 (0.00) | >0.05 |
| 30 | 2.00 (0.00) | 2.00 (0.00) | 1.000 |

Values are reported as mean (SD).
$p < 0.05$: significant.

**Table 3:** Grades of sensory blockade at T10 level with respect to time in RC and RD groups

| Time (min) | Group RC (*n* = 30) | Group RD (*n* = 30) | *P* |
|---|---|---|---|
| 5 | 0.00 (0.00) | 0.00 (0.00) | >0.05 |
| 10 | 0.13 (0.35) | 0.77 (0.43) | <0.05 |
| 15 | 0.83 (0.38) | 1.70 (0.47) | <0.05 |
| 20 | 1.10 (0.31) | 1.97 (0.18) | <0.05 |
| 25 | 1.77 (0.43) | 2.00 (0.00) | <0.05 |
| 30 | 2.00 (0.00) | 2.00 (0.00) | >0.05 |

Values are reported as mean (SD).
$p < 0.05$: significant.

**Table 4:** Grades of sensory blockade at T8 level with respect to time in RC and RD groups

| Time (min) | Group RC (*n* = 30) | Group RD (*n* = 30) | *P* |
|---|---|---|---|
| 5 | 0.00 (0.00) | 0.00 (0.00) | >0.05 |
| 10 | 0.00 (0.00) | 0.00 (0.00) | >0.05 |
| 15 | 0.03 (0.18) | 0.77 (0.43) | <0.05 |
| 20 | 0.50 (0.51) | 1.70 (0.47) | <0.05 |
| 25 | 1.03 (0.56) | 1.97 (0.18) | <0.05 |
| 30 | 1.73 (0.45) | 2.00 (0.00) | <0.05 |

Values are reported as mean (SD).
$p < 0.05$: significant.

**Table 5:** Highest dermatomal level of sensory blockade in RC and RD groups

| Highest dermatomal level of sensory blockade | Frequency in group | |
|---|---|---|
| | RC | RD |
| T4 | 3 (10) | 2 (6.7) |
| T6 | 23 (76.7) | 26 (86.7) |
| T8 | 4 (13.3) | 2 (6.7) |

**Table 6:** Grades of motor blockade with respect to time in RC and RD groups

| Time (min) | Group RC ($n$ = 30) | Group RD ($n$ = 30) | $P$ |
|---|---|---|---|
| 5 | 0.00 (0.00) | 0.57 (0.50) | <0.05 |
| 10 | 0.50 (0.51) | 1.13 (0.35) | <0.05 |
| 15 | 1.13 (0.43) | 1.97 (0.49) | <0.05 |
| 20 | 1.90 (0.48) | 2.70 (0.47) | <0.05 |
| 25 | 2.47 (0.51) | 2.97 (0.18) | <0.05 |
| 30 | 3.00 (0.00) | 3.00 (0.00) | >0.05 |

Values are reported as mean (SD) of score of Bromage scale.
$p < 0.05$: significant.

## Results

There was no significant difference in baseline characteristics such as age and weight between two groups. There was statistically significant difference for duration of surgery between both groups [Table 1].

The assessment of sensory blockade at T12, T10, and T8 levels was mentioned in Tables 2, 3, and 4, respectively. The highest level of achieved sensory block is given in Table 5 and the evaluation of motor blockade is given in Table 6.

## Discussion

This study was conducted with the aim of comparison of clonidine and dexmedatomidine as adjuvant to ropivacaine for lower limb surgery. It was observed that onset of sensory blockade at T12 level was faster in group RD (6.00 ± 2.03 min) as compared to group RC (7.33 ± 2.54 min). Mean time duration of onset of motor blockade was shorter in group RD (7.17 ± 2.52 min) as compared to group RC (12.67 ± 2.86 min) and time to achieve highest sensory dermatome blockade was shorter in group RD (21.00 ± 2.75 min) as compared to group RC (28.50 ± 2.33 min). Also mean time duration for complete motor blockade was shorter in group RD (20.17 ± 3.40 min) as compared to group RC (27.33 ± 3.14 min).

In this study, it was observed that sensory blockade onset was earlier in dexmedetomidine group as compared to the clonidine group. Similar findings were observed in other studies such as Bajwa et al.[5] and Kaur et al.[8] Dexmedetomidine is more lipid soluble as compared to clonidine hence the penetrability in the brain is higher and that may be the reason for superior action. Dexmedetomidine reaches to cerebrospinal fluid within 5 min and it also has higher selectivity of alpha-2 receptor.[8] Same reasons can be given for the superior motor blockade of dexmedetomidine as compared to clonidine. Clonidine blocks the neural transmission of nociceptive stimuli in C and Aδ fiber by mainly increasing the inhibitory potassium conductance. Indirectly it increases the duration of action of local anesthetics by decreasing the absorption of local anesthetics from the blood vessels. Dexmedetominde acts on spinal and supraspinal sites deals with nociceptive transmission.

The results of this study are very similar to few other studies, which shows that sensory block last longer than motor blockade. This may be because of the large doses of anesthesia needed for large fibers that are responsible for motor activity as compared to small fibers responsible for sensory conduction.[9]

### Limitations

The sample size of the study is less and no formal sample size calculation was carried out. Some nonsignificant differences between parameters may be because of the insufficient power to detect actual difference. There is a need of larger study to explore the effect of dexmedetomine in comparison to clonidine as an adjuvant to ropivacaine in epidural anesthesia.

## Conclusion

Dexmedetomidine is more lipid soluble as compared to clonidine, hence the penetrability in the brain is higher and that may be the reason for its superior action.

## References

1. Moraca RJ, Sheldon DG, Thirlby RC. The role of epidural anesthesia and analgesia in surgical practice. Ann Surg 2003; 238(5):663–73.
2. Rigg JR, Jamrozik K, Myles PS, Silbert BS, Peyton PJ, Parsons RW, et al. Epidural anaesthesia and analgesia and outcome of major surgery: a randomised trial. Lancet 2002; 359(9314):1276–82.
3. Halpern SH, Walsh V. Epidural ropivacaine versus bupivacaine for labor: a meta-analysis. Anesth Analg 2003;96(5):1473–9, table of contents.
4. Chandran S, Hemalatha S, Viswanathan PN. Comparison of 0.75% ropivacaine and 0.5% bupivacaine for epidural anaesthesia in lower extremity orthopaedic surgeries. Indian J Anaesth 2014; 58(3):336–8.
5. 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(2):116–21.
6. Swami SS, Keniya VM, Ladi SD, Rao R. Comparison of dexmedetomidine and clonidine (alpha2 agonist drugs) as an adjuvant to local anaesthesia in supraclavicular brachial plexus block:

a randomised double-blind prospective study. Indian J Anaesth 2012;56(3):243–9.
7. Masuki S, Dinenno FA, Joyner MJ, Eisenach JH. Selective $\alpha$2-adrenergic properties of dexmedetomidine over clonidine in the human forearm. J Appl Physiol 2005;99(2):587–92.
8. 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(4):463–9.
9. Singh S, Aggarwal A. A randomized controlled double-blinded prospective study of the efficacy of clonidine added to bupivacaine as compared with bupivacaine alone used in supraclavicular brachial plexus block for upper limb surgeries. Indian J Anaesth 2010;54(6):552–7.

**How to cite this article:** Bamne SN, Bamne SN, Bamne SN. Comparative study of onset and total time required for sensory and motor blockade of epidural ropivacaine with clonidine and dexmedetomidine for lower limb surgeries. Int J Med Sci Public Health 2016;5:1369-1373

**Source of Support:** Nil, **Conflict of Interest:** None declared.