



**A randomised prospective study to assess the analgesic efficacy of peripheral nerve block using ropivacaine with dexamethasone vs. dexmedetomidine for postoperative analgesia in lower limb surgeries**

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**Abstract**

**Background:** The use of peripheral nerve blocks using local anaesthesia along with adjuvant helps in pain relief for longer duration. It is the key to enhance clinical rehabilitation as an important part of the multimodal analgesia scheme.

**Aim and objective:** The aim was to compare the efficacy of dexmedetomidine and dexamethasone as an adjuvant to ropivacaine for post-operative analgesia with Adductor canal and popliteal sciatic nerve block in lower limb surgeries.

**Material and methods:** This Randomized interventional study was done on 30 patients, with ASA1,2,3, above 18 years age posted for lower limb(knee and below) surgeries. After informed consent, patient was allocated into the two groups through random number.

**Group DX:** 30ml ropivacaine 0.375% + 8 mg dexamethasone.

**Group DM:** 30ml ropivacaine 0.375% + 25 µg dexmedetomidine.

Spinal anaesthesia was performed under complete aseptic conditions using a spinal needle of 26 Gauge where hyperbaric 0.5% bupivacaine 15mg and clonidine 30µg injected. Adductor canal and popliteal sciatic nerve block was given at the end of surgery Visual analogue scale (VAS) was used to evaluate the postoperative pain. Time of the first request for postoperative analgesia and the number of injections were recorded.

**Results:** The VAS score was significantly lower in dexmedetomidine group in the first 48hrs. The mean duration of action of block was significantly longer in the dexmedetomidine group and the requirement of analgesic consumption after giving the peripheral nerve block was noted much earlier in dexamethasone group as compared to dexmedetomidine group.

**Conclusion:** In our study, it was noted that Dexmedetomidine when added to ropivacaine prolongs the duration of analgesia and decreases analgesic consumption compared to dexamethasone with ropivacaine.

**Keywords:** Randomised, peripheral, ropivacaine, dexamethasone vs. dexmedetomidine

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## **Introduction**

Regional anaesthesia provides short-term relief of postoperative pain. The use of peripheral nerve blocks using local anaesthesia along with adjuvant helps in pain relief for longer duration. It is the key to enhance clinical rehabilitation as an important part of the multimodal analgesia scheme.<sup>1</sup> The emergence of ultrasound technology has accelerated peripheral nerve block (PNB) technology development.<sup>2,3</sup> PNB has become the cornerstone of perioperative pain management in modern surgical practice.

Single-injection PNB is an attractive option because it is technically easier and can be performed quickly. The finite duration of single injection techniques is one of the greatest limitations of PNB in acute pain management. Continuous catheter techniques are widely employed to prolong regional analgesia; however, they have several drawbacks, such as the difficulty of catheter removal and the increased risk of infection.<sup>4,5</sup> Therefore, there is a growing demand to identify a reliable solution for prolonging analgesia duration from PNB. Conventional pain treatment (NSAIDs, paracetamol, and opioids) has various side effects.<sup>6</sup> The role of multimodal analgesia for postoperative management is beneficial.

Peripheral nerve blocks provide effective unilateral analgesia and reduce the chances of opioid-related and autonomic side effects, producing less motor blockade, and fewer neurological complications<sup>7</sup>. Different agents have been combined with local anesthetics (LA) over the years to prolong the duration of action, with varying degrees of success. Analgesic adjuvants include opioids, epinephrine, sodium bicarbonate, magnesium sulfate, dexamethasone, ketorolac, ketamine, neostigmine, midazolam, cortisol and  $\alpha$ 2-adrenergic receptor ( $\alpha$ 2-AR) agonists.<sup>8-10</sup> One such agent is dexmedetomidine, it is a potent as well as highly selective alpha-2 adrenergic agonist

having a sedative, sympatholytic, and analgesic effect and has been described as a safe and effective additive in many anesthetic applications and analgesic techniques.<sup>11, 12</sup> Another agent glucocorticoid, dexamethasone, has also been shown to be effective in a number of clinical studies.<sup>11, 12</sup> Steroid produces a degree of vasoconstriction, thereby reducing local anaesthetic absorption. Furthermore, it potentiates the activity of inhibitory potassium channels on nociceptive C fibres (through glucocorticoid receptors), thereby decreasing the activity of nociceptive C fibres.<sup>14</sup>

### **Aim and Objective**

The aim was to compare the efficacy of dexmedetomidine and dexamethasone as an adjuvant to ropivacaine for post-operative analgesia with Adductor canal and popliteal sciatic nerve block in lower limb surgeries.

**Objective:** The duration of postoperative analgesia (the time to the first rescue analgesic request) through the assessment of VAS (ranging from 0 to 10, where 0 no pain and 10 maximum pain) every 2 h during the first 6 h and then every 6 h thereafter for 48h postoperatively.

**Study type:** Randomized interventional study.

**Study duration:** 2 months.

**Inclusion criteria:** ASA 1, 2, 3 patients above 18 years age posted for lower limb (knee and below) surgeries.

**Exclusion criteria:** Patient refusal and paediatric population below 18 years age. After informed consent, patient was allocated into the two groups through random number.

**Group DX:** 30ml ropivacaine 0.375% + 8 mg dexamethasone.

**Group DM:** 30ml ropivacaine 0.375% + 25 µg dexmedetomidine.

Patients were clinically evaluated and routine preoperative investigations done including CBC, coagulation profile, liver function tests, kidney function tests, fasting blood sugar. In the operative room ECG, non-invasive blood pressure and pulse oximeter were connected and baseline parameters such as systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MBP), heart rate (HR), and oxygen saturation (SpO<sub>2</sub>) recorded. An intravenous (IV) line was inserted and preloading with Ringer lactate done. Spinal anaesthesia was performed under complete aseptic conditions using a spinal needle of 26 Gauge where hyperbaric 0.5%

bupivacaine 15mg and clonidine 30µg injected. Adductor canal and popliteal sciatic nerve block was given at the end of surgery using a 22 Gauge 100 mm length, short-bevelled regional block needle, skin antiseptic solution, sterile gloves, and an ultrasound machine.

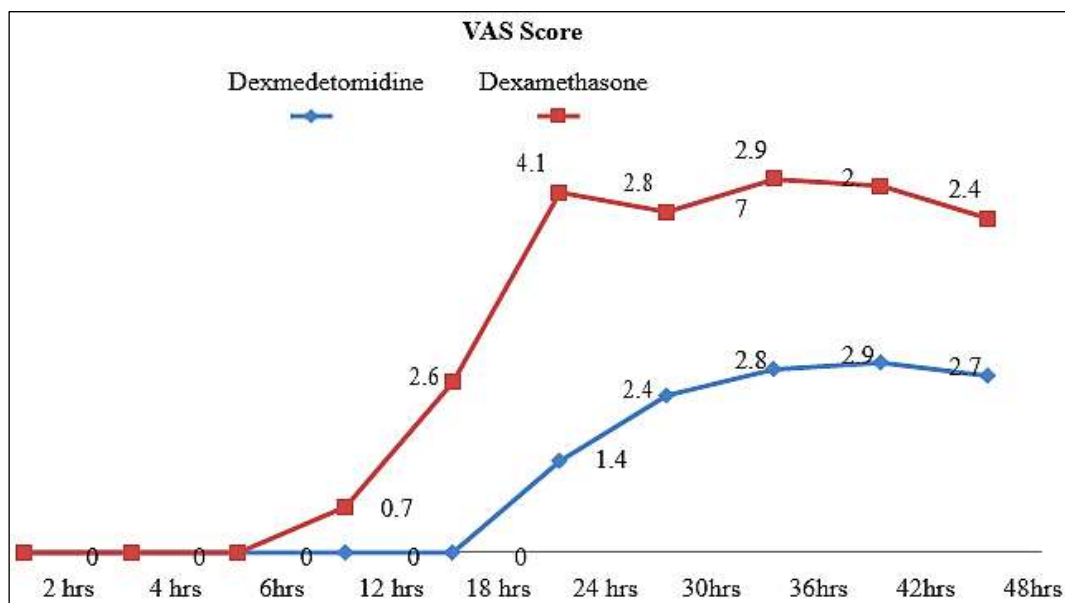
**Postoperative settings:** Visual analogue scale (VAS) was used to evaluate the postoperative pain; the visual analogue scale is a validated, subjective measure for acute and chronic pain, where the patient marks on a 10 cm line that represents a continuum between “no pain” on the left end (0 cm) of the scale and the “worst pain” on the right end of the scale (10 cm). When VAS  $\geq$  3 postoperatively, intravenous tramadol 2mg /kg was given. Time of the first request for postoperative analgesia and the number of injections were recorded. Any side effects had been recorded such as hypotension (systolic arterial pressure < 90 mmHg), arrhythmia, bradycardia (HR < 60 beat/min), nausea and vomiting, or any other complications.

HR and MBP were measured upon arrival to the PACU and after 30 min, then every hour if the patient remained in the PACU. In the surgical ward, vital signs (HR, SBP, MBP, DBP) as well as pain intensity was assessed every 2 h during the first 6 h and then every 6 h thereafter for 48 h postoperatively.

**Table 1:** Patient characteristics

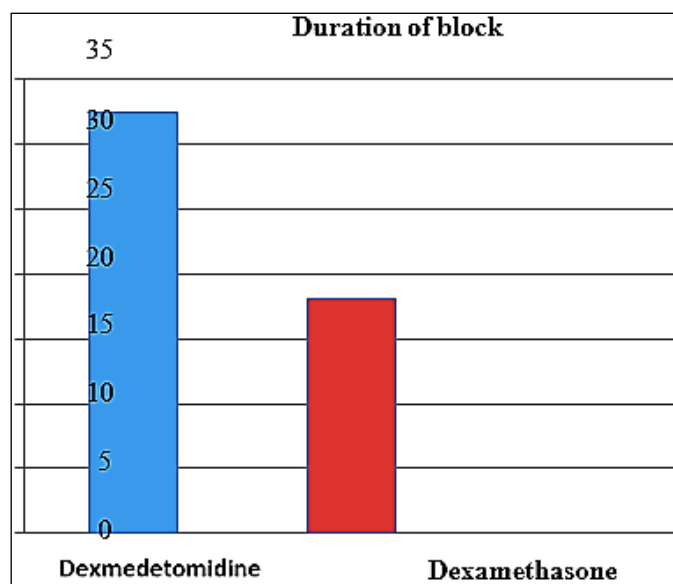
Characteristics	Dexamethasone (n=15)	Dexmedetomidine (n=15)
Mean Age (years)	40.2	42.6
Sex (male/female)	9/6	9/6
Volume of mixture (mL)	30	30
Mean HR (bpm)	77.5	81.4
Mean systolic BP (mmHg)	122.1	124.8
Mean diastolic BP (mmHg)	75.9	74.7
Oxygen saturation (SpO2 in %)	100	100

There were no significant differences between the two groups in their demographic variables and clinical parameters.



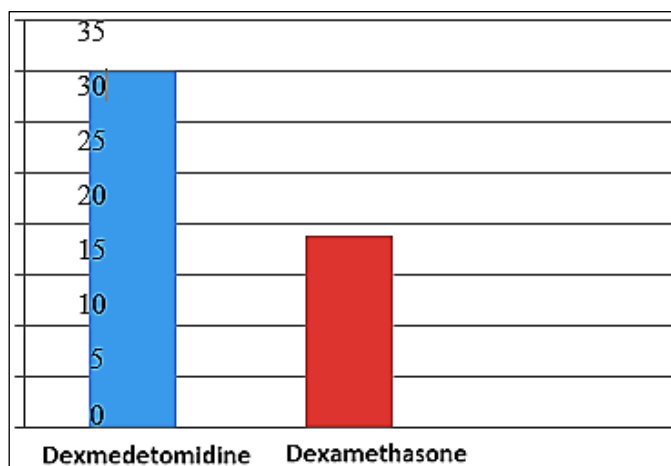
**Figure 1: Mean VAS score (range: 0-10) at 2, 4, 6, 12, 18, 24, 30, 36, 42, 48hrs postoperative**

VAS score was significantly lower in dexmedetomidine group in the first 48hrs.



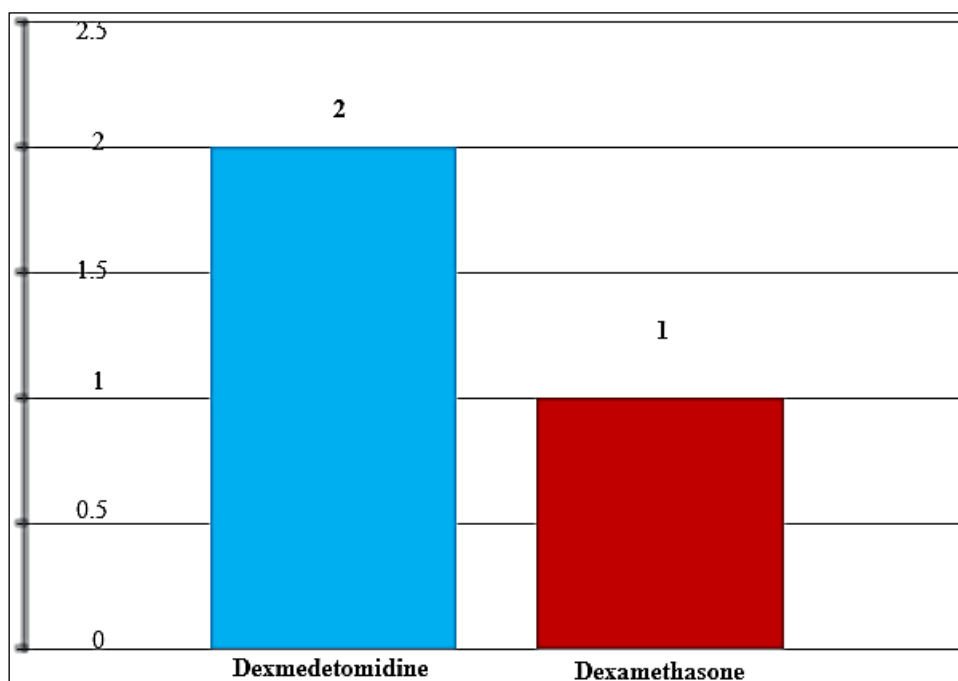
**Figure 2: Mean duration of action of block (in hrs)**

The mean duration of block was significantly higher in dexmedetomidine group.



**Figure 3: Analgesic supplement requirement during first 48hrs after surgery**

Analgesic consumption during the first 48hrs was noted as 18.8hrs in dexamethasone group while in dexmedetomidine group it was 34.9hrs. (p value >0.05 using t-test)



**Figure 4: Post op sedation score**

### Discussion

The demographic variables and clinical parameters were comparable in our study; between both the groups, there was no significant difference in terms of demographic data (age, sex) or vitals (HR, SBP, DBP, SPO2).

Mean VAS score was lower in dexmedetomidine group compared with dexamethasone group, with significant differences between the groups at 2, 4, 6, 12, 18, 24, 30, 36, 42, 48hrs after block placement. The mean duration of action of block was significantly longer in the dexmedetomidine group compared with

dexamethasone group. The comparison between two groups in regards with the duration of effect of block was highly significant in our study ( $p$  value  $> 0.05$ ).

Singh *et al.* discovered that 1  $\mu\text{g}/\text{kg}$  dexmedetomidine and 8 mg dexamethasone when used as adjuvants to ropivacaine for SCBP block, delay onset time and prolong block duration. In the comparative meta-analysis of the two drugs<sup>16</sup>.

Song *et al.* concluded that the analgesic effects of dexamethasone and dexmedetomidine in peripheral nerve blocks are equivalent.<sup>17</sup>

Venkatraman's research results present different views. In brachial plexus block, 8 mg dexamethasone is an ideal adjuvant to ropivacaine to prolong postoperative analgesia without adverse effects. However, 50  $\mu\text{g}$  dexmedetomidine has a quicker sensory and motor blockade onset.<sup>18</sup>

Yaghoobi *et al.* discovered no significant difference in postoperative pain intensity between the 8 mg Dexamethasone and 1  $\mu\text{g}/\text{kg}$  dexmedetomidine. However, dexmedetomidine demonstrated a longer sensory block duration than dexamethasone as a lidocaine adjuvant in the infraclavicular block. We consider that the dose may be the important factor affecting the results.<sup>19</sup>

Requirement of additional analgesic after giving the peripheral nerve block was noted to be earlier in dexamethasone group as compared to dexmedetomidine group which shows the better analgesic efficacy of peripheral nerve block using Ropivacaine with dexmedetomidine.

No significant adverse events were noted in two groups. The postoperative sedation score (ram say hunt score) was 2 in dexmedetomidine group (drowsy but responsive to verbal stimuli), while the postop sedation score was 1 in dexamethasone group (spontaneous eye opening).

Our study was in accordance with study conducted by Sana *et al.* the duration of analgesia in group dexmedetomidine was higher as compared to group dexamethasone. It was 16.17 h in group dexmedetomidine and 12.53 h in group dexamethasone, whereas with plain bupivacaine 0.25%, it was 8.23 h.  $P < 0.001$  implying that the difference was highly significant between the groups. They concluded that dexmedetomidine as an adjunct to bupivacaine in FICB provided better post-operative analgesia as compared to dexamethasone.<sup>20</sup>

## Conclusion

In our study it was noted that Dexmedetomidine when added to ropivacaine prolongs the duration of analgesia and decreases analgesic consumption compared to dexamethasone with ropivacaine.

Dexmedetomidine has been used in many studies as an additive to local anaesthetics for peripheral nerve blocks with good results. In this study, longer duration of analgesia and lesser opioid consumption was seen with Dexmedetomidine.

Better analgesia, lower opioid consumption, better ambulation and minimal adverse effects are the possible contributory factors for higher satisfaction.

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