

**Comparison of Effects of Clonidine and Dexmedetomidine as an Adjuvant to Ropivacaine in Sciatic Femoral Block in Lower Limb Surgeries**N Manoj<sup>1</sup>, Jeyarani B<sup>2</sup>, Rajesh Khanna T<sup>3</sup>, J Vasanthi MDDA<sup>4</sup><sup>1</sup>Assistant Professor, Department of Anesthesiology, Kalaingar Centenary Super Speciality Hospital, Chennai<sup>2</sup>Professor, Department of Anesthesiology, Thanjavur Medical College Hospital, Thanjavur<sup>3</sup>Assistant Professor, Department of Anesthesiology, Government Ariyalur Medical College Hospital, Ariyalur<sup>4</sup>Senior Assistant Professor, Department of Anesthesiology, Thanjavur Medical College Thanjavur

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Conflict of interest: Nil

**Abstract:**

Below knee and foot surgery is associated with severe pain that can extend significantly up to 48 hours and often requires larger amounts of parenteral opioids. Femoral and popliteal nerve blockade reduces postoperative pain after major foot and ankle surgery with minimal side effects. However, the maximum duration of effective analgesia with long-acting local anesthetics after a single injection technique is only 8–24 hours. Therefore, local anesthetics in combination with adjuvants were often used in attempts to prolong the duration of a single-shot popliteal fossa block (SSPFB). In this study we assess the efficacy of the addition of an alpha - 2 adrenergic agonist, Clonidine and Dexmedetomidine to local anaesthetic solution in sciatic femoral block in below knee surgeries.

**Keywords:** Clonidine, Dexmedetomidine, Ropivacaine, Sciatic Femoral Block, Lower limb surgeries.

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**Introduction**

Pain is a fundamental biological phenomenon. The international association for the study of pain has defined pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage”. Pain is always underestimated and under treated. The pain relief during surgery is the main part of anaesthesia.

Below knee and foot surgery is associated with severe pain that can extend significantly up to 48 hours and often requires larger amounts of parenteral opioids. Femoral and popliteal nerve blockade reduces postoperative pain after major foot and ankle surgery with minimal side effects. However, the maximum duration of effective analgesia with long-acting local anesthetics after a single injection technique is only 8–24 hours. Therefore, local anesthetics in combination with adjuvants were often used in attempts to prolong the duration of a single-shot popliteal fossa block (SSPFB).

Ropivacaine, a long-acting local anaesthetic agents used for peripheral nerve block as it exerts differential motor blockade. But due to its delayed onset of action and incomplete patchy analgesia, many drugs like Dexamethasone, Neostigmine, Clonidine, Midazolam, Dexmedetomidine etc.,

have been added to improve the quality and duration of action and postoperative analgesia. When patients undergoing below knee surgeries, experience pain as one of the most common significant and unpleasant postoperative events. Postoperative pain when poorly managed lead to prolonged hospital stay, cardiopulmonary complications, side effects related to opioid and unplanned readmission to the hospital.

Poorly controlled post-operative pain negatively affects quality of life, function, and functional recovery and finally leads on to chronic pain or opioid addiction. Popliteal block decreases postoperative pain following foot surgery effectively, but analgesia achieved by SSPFB technique is of relatively short duration. Hence in order to prolong the duration of analgesia following SSPFB, various adjuvants were used.

Hence, we designed this double-blind randomized study, to study the efficacy of Clonidine and Dexmedetomidine as an adjuvant to ropivacaine in femoro-popliteal nerve block for below knee surgeries. Sciatic nerve has a wide sensory distribution; hence it can be used together with saphenous or femoral nerve block for any below knee

surgeries. This form of anaesthesia avoids sympathectomy associated with neuraxial blockade and may therefore be advantageous when any shift in hemodynamics could be deleterious. This study is designed to assess the efficacy of the addition of an alpha-2 adrenergic agonist, Clonidine and Dexmedetomidine to local anaesthetic solution in sciatic femoral block in below knee surgeries.

### Aim & Objectives

Aim is to study the effects of Clonidine and Dexmedetomidine as an adjuvant to Ropivacaine in sciatic femoral block in lower limb surgeries.

Primary objective is to compare the effects of clonidine and dexmedetomidine as an adjuvant to ropivacaine in sciatic femoral block in lower limb surgeries in terms of onset of sensory and motor blockade, duration of sensory and motor blockade and post-operative analgesia.

Secondary Objective is to compare the adverse effects of clonidine and dexmedetomidine as an adjuvant to ropivacaine in sciatic femoral block in lower limb surgeries.

### Materials and Methods

It is a prospective randomized double blinded study conducted in Thanjavur medical college and hospital from January 2021 to January 2022 in Patients scheduled for elective below knee surgeries in orthopaedic and general surgery department.

### Inclusion Criteria

1. ASA Physical status I and II
2. Age between 18-60 years
3. All elective below knee surgeries

### Exclusion Criteria

1. Patient's refusal
2. History of allergy to study drugs
3. Pregnancy
4. Pre-existing coagulopathy, Cardiac, liver, kidney disease or Neurological disorder
5. Post spinal surgeries, spinal deformity.

**Sample Size:** Sample size was calculated using prior power analysis. We did a pilot study in which the average mean duration of analgesia for Ropivacaine plus clonidine and Ropivacaine plus dexmedetomidine were 17.5 hours and 18.5 hours respectively. Common standard deviation was 2 hours. With available variables and assuming 95% confidence limits and Alpha error of 0.05 and Beta error of 0.10, we arrived at a sample size of 70(35 for each group). Institutional Ethical committee was obtained I.E. C. No-816/2021. After obtaining informed written consent from all the patients, patients were allocated to one of the two groups, Group C and Group D, with

35 patients in each group.

The syringes containing the local anaesthetic solution were prepared in a double blinded fashion by one of the anaesthesiologist. He/she was not involved in further patient evaluation.

**Group C** - Received 0.5% Ropivacaine with Clonidine 0.1µg/kg, 12ml for femoral nerve block and 18 ml for popliteal sciatic nerve block.

**Group D** - Received 0.5% Ropivacaine with Dexmedetomidine 1µg/kg, 12ml for femoral nerve block and 18 ml for popliteal sciatic nerve block.

### Observation and Results

Parameters observed were time of onset of sensory and motor block, duration of motor blockade, and sensory blockade, duration of post-operative analgesia.

This study shows that.

- The mean onset of sensory block was  $10.8 \pm 1.05$  minutes in group C compared to  $8.48 \pm 1.06$  minutes in the group D. This difference in means was found to be statistically significant ( $p < 0.0001$ ), suggesting statistically significant reduction in time of onset of sensory block with dexmedetomidine compared to clonidine
- The mean onset of motor block was  $14.5 \pm 1.31$  minutes in group C compared to  $11.5 \pm 1.1$  minutes in the group D. Dexmedetomidine when used as an adjuvant reduced the time of onset of motor block compared to clonidine, which was statistically significant ( $p < 0.0001$ )
- Duration of sensory block in the group C was  $966 \pm 63.6$  minutes and in the group, D was  $1110 \pm 70.2$  minutes. Dexmedetomidine prolonged the duration of sensory block when compared with clonidine.
- Duration of motor block in group C was  $876 \pm 56.4$  minutes and in group D was  $1008 \pm 66$  minutes. Dexmedetomidine prolonged the duration of motor block.
- Duration of postoperative analgesia in group C was  $1032 \pm 57$  minutes and in the group D was  $1201.2 \pm 76.2$  minutes. Dexmedetomidine prolonged the duration of post-operative analgesia when compared with clonidine.
- There were no side effects like hypotension and bradycardia in both groups.
- There were no significant side effects in both except for light sedation (RASS -2) in both groups P value was 0.053 1724 and clinically insignificant.

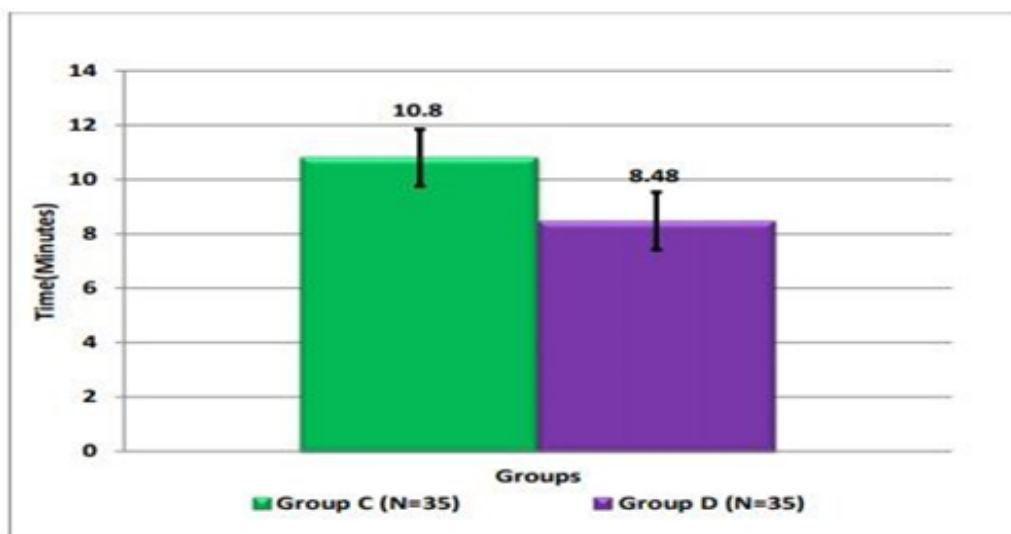


Figure 1: Comparison of Onset of Sensory Blockade

Table 1:

S. No	Parameter	Group C (N =35)	Group D (N =35)	T value	Df	P Value
1	Duration of sensory block (minutes)	10.8± 1.05	8.48 ± 1.06	9.13	68	<0.0001*

The mean onset of sensory block was 10.8± 1.05 minutes in Group C compared to 8.48 ± 1.06 minutes in the Group D. This difference in means was found to be statistically significant (p<0.0001), suggesting statistically significant reduction in time of onset of sensory block with dexmedetomidine compared to clonidine. Data were expressed as mean with SD. Unpaired 't' test was used to compare the means between the groups. \*indicates p<0.05 and considered statistically significant.

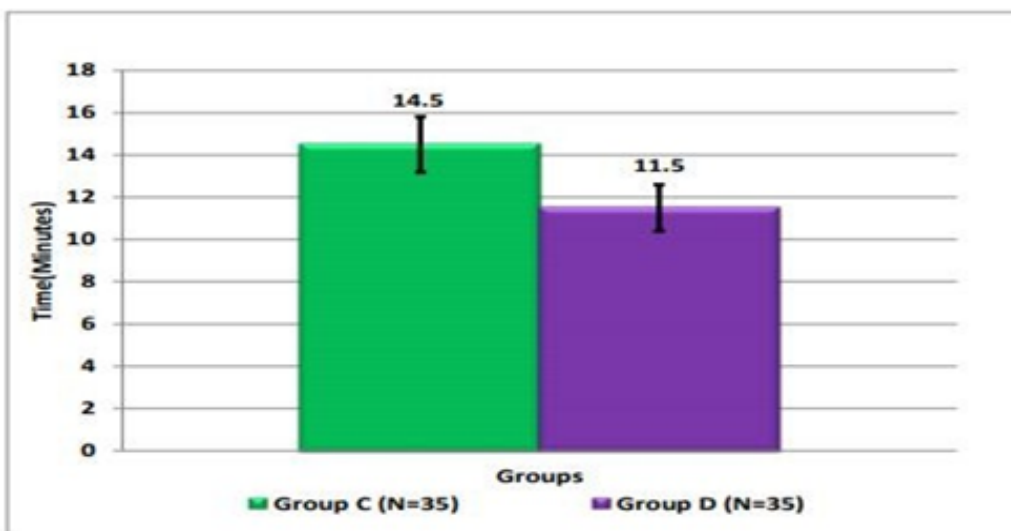


Figure 2: Comparison of Onset of Motor Blockade

Table 2:

S. No	Parameter	Group C (N =35)	Group D (N =35)	T value	Df	P Value
1	Duration of sensory block (minutes)	14.5± 1.31	11.5 ± 1.1	10.28	68	<0.0001*

The mean onset of motor block was 14.5 ± 1.31 minutes in Group C compared to 11.5 + 1.1 minutes in the Group D. Dexmedetomidine when used as an adjuvant reduced the time of onset of motor block compared to clonidine,

which was statistically significant ( $p < 0.0001$ ). Data were expressed as mean with SD. Unpaired 't' test was used to compare the means between the groups. \*indicates  $p < 0.05$  and considered statistically significant.

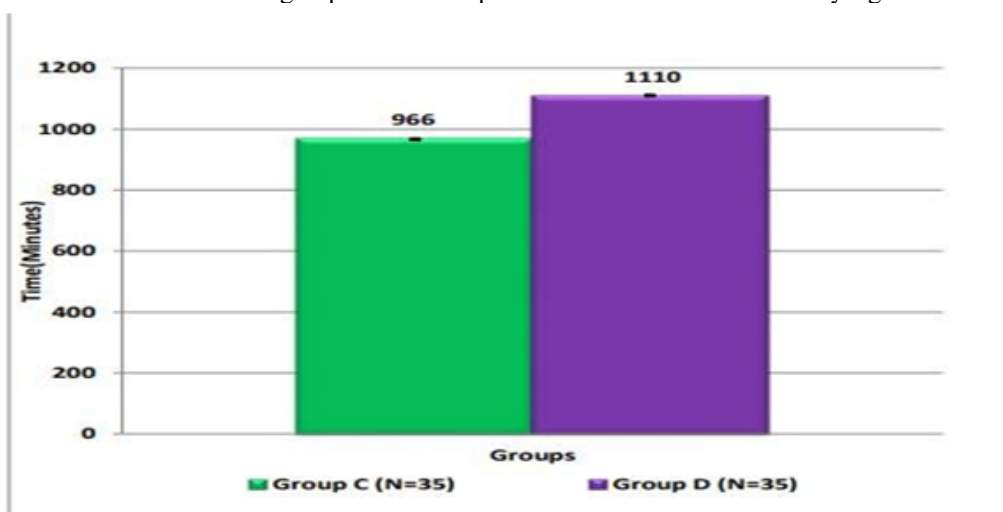


Figure 3: Comparison of duration of sensory blockade in two groups

Table 3:

S. No	Parameter	Group C (N =35)	Group D (N =35)	T value	Df	P Value
1	Duration of sensory block (minutes)	966 ± 63.6	1110 ± 70.2	8.95	68	<0.0001*

Duration of sensory block in the Group C was  $966 \pm 63.6$  minutes and in the Group D was  $1110 \pm 70.2$  minutes. Dexmedetomidine prolonged the duration of sensory block when compared with clonidine. Data were expressed as mean with SD. Unpaired 't' test was used to compare the means between the groups. \*indicates  $p < 0.0001$  considered statistically extremely significant.

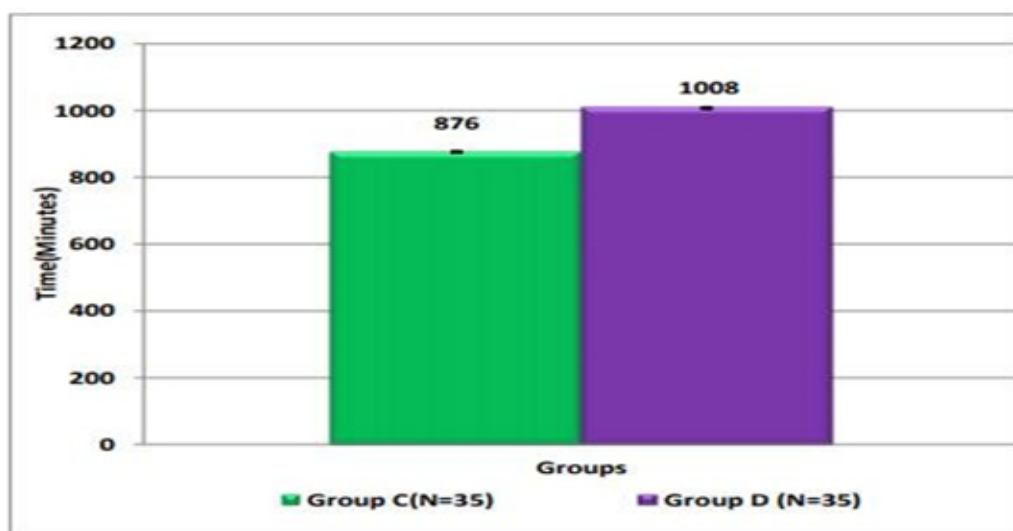


Figure 4: Comparison of duration of motor blockade between the two groups

Table 4:

S. No	Parameter	Group C (N =35)	Group D (N =35)	T value	Df	P Value
1	Duration of sensory block (minutes)	876 ± 56.4	1008 ± 66	8.99	68	<0.0001*

Duration of sensory block in the Group C was  $876 \pm 56.4$  minutes and in the Group D was  $1008 \pm 66$  minutes. Dexmedetomidine prolonged the duration of sensory blockade when compared with clonidine. Data were expressed as mean with SD. Unpaired 't' test was used to compare the means between the groups. \*indicates  $p < 0.0001$  considered statistically extremely significant.

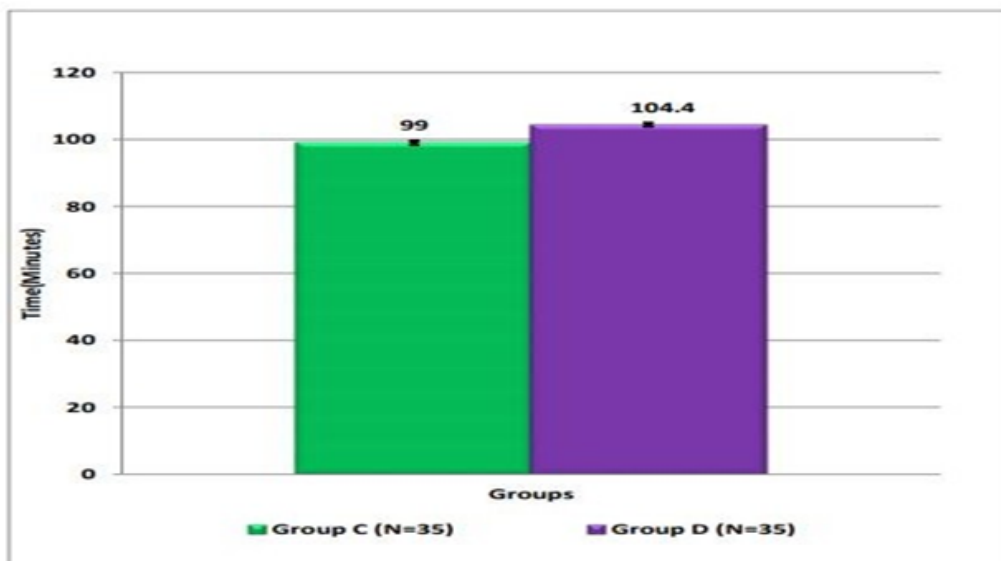


Figure 5: Comparison of Duration of Surgery

Table 5:

S. No	Parameter	Group C (N =35)	Group D (N =35)	T value	Df	P Value
1	Duration of sensory block (minutes)	99 ± 35.4	104.4 ± 30.6	0.652	68	0.517(NS)

Data were Expressed as mean with SD. Unpaired 't' test was used to compare the means between the groups. NS = not significant

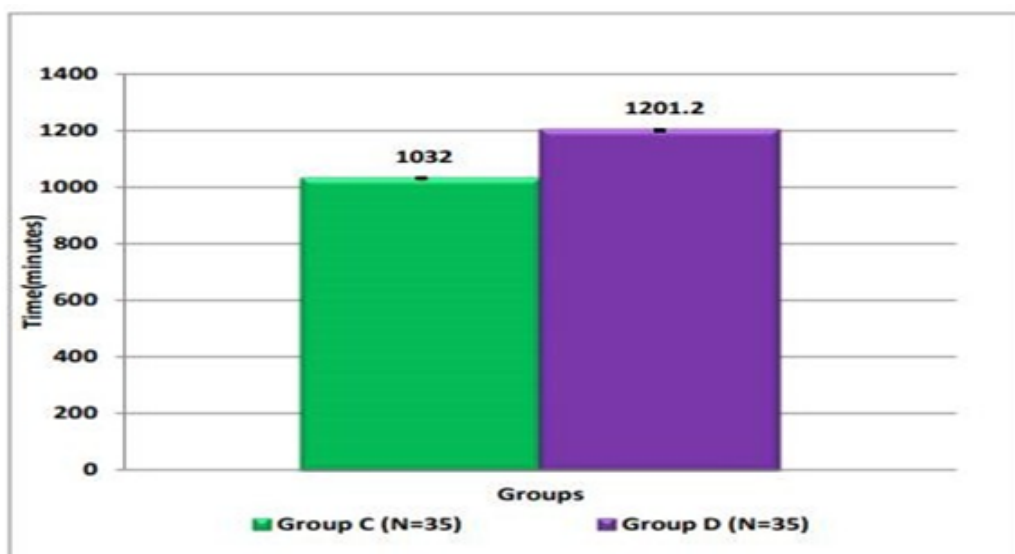


Figure 6: Comparison of Duration of Post-Operative Analgesia

Table 6:

S. No	Parameter	Group C (N =35)	Group D (N =35)	T value	Df	P Value
1	Duration of sensory block (minutes)	1032 ± 57	1201.2±76.2	10.63	68	<0.0001

The mean duration of postoperative analgesia in Group C was 1032 ± 57 minutes and in the Group D was 1201.2 ± 76.2 minutes. Dexmedetomidine prolonged the duration of post-operative analgesia when compared with clonidine. Data were expressed as mean with SD. Unpaired 't' test was

used to compare the means between the groups. \*indicates p<0.0001 considered statistically extremely significant

**Discussion**

This prospective randomized double-blind study

was done in patients undergoing elective lower limb below knee surgeries under combined femoral and popliteal sciatic block. Postoperative analgesia provides not only pain relief but also inhibits trauma induced nociceptive impulses to blunt autonomic reflexes. It allows the patients to breathe and move freely to enhance early restoration of normal function. Drugs such as opioids, dexamethasone, vasoconstrictors, midazolam, clonidine, dexmedetomidine, sodium bicarbonate etc., are used as adjuvants to prolong the duration of analgesia. Of these drugs clonidine and dexmedetomidine have been studied as an adjuvant extensively when used both intravenously and perineural.

In  $\alpha_2$  agonists, clonidine is frequently used as an adjuvant, but recently dexmedetomidine finds its place as an adjuvant in peripheral nerve block due to the lesser side effect profile when compared to its congener clonidine. Inadequate postoperative pain relief produce long term consequences like alteration in sleeping pattern and increased pain perception during subsequent painful experiences. Untreated postoperative pain will produce several detrimental acute and chronic effects. Neuroendocrine response to pain result in increased sympathetic tone, increased catecholamine release and catabolic hormone secretions and decreased secretion of the anabolic hormones.

By performing combined femoral and popliteal sciatic nerve block for lower limb surgeries, adequate postoperative analgesia can be given. Pain is an important factor for any cardiovascular disease patient undergoing surgery in the lower limb.

Postoperative pain produces tachycardia, which could be deleterious to the patients hence combined femoral and popliteal sciatic nerve block can be performed for this cardiovascular disease and high risk patients that can provide prolonged postoperative analgesia and comfort to the patient. Adjuvants like Clonidine and Dexmedetomidine will prolong the duration of postoperative analgesia.

There are very fewer studies that compare the efficacy of clonidine and dexmedetomidine in peripheral nerve blocks. Most of the studies published comparing their efficacies are done in the brachial plexus block only. Hardly any study could be found comparing the role of clonidine and dexmedetomidine as adjuvants with ropivacaine in combined femoral and popliteal sciatic block for below knee surgeries. Hence, our study was taken up for assessing the efficacy of clonidine and dexmedetomidine, when used as an adjuvant to ropivacaine in combined femoral and popliteal sciatic block for below knee surgeries on the onset of sensory and motor block, duration of sensory and motor block and postoperative analgesia.

## Conclusion

From our study we conclude that Dexmedetomidine when used as an adjuvant to 0.5% Ropivacaine had a faster onset of sensory and motor blockade, prolonged duration of sensory block, motor block and post-operative analgesia when compared to Clonidine as an adjuvant to 0.5% Ropivacaine for combined femoral and popliteal sciatic nerve block in lower limb surgeries.

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