



## A Study On Clonidine As An Adjuvant To Ropivacaine In Sciatic Femoral Block For Lower Limb Surgery

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### Abstract

**Background:** Lower limb surgery is associated with severe pain that can extend significantly up to 48 hours and often requires large amounts of parenteral opioids. Sciatic 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. Pharmacodynamics and pharmacokinetics of dexamethasone (DXM) and clonidine administered in regional nerve blocks are not yet fully understood; however, quite some literature has been published concerning the prolonged effect of DXM and clonidine on block characteristics.

**Aim of the study:** To assess the efficacy of clonidine as an adjuvant to ropivacaine in sciatic femoral nerve block .

**Methods:** This study was conducted at Government Stanley Medical College, Chennai, Tamil Nadu, India in the year between 2021-2022. The inclusion criteria being 60 patients of ASA grade I or II of either sex and age more than 20 years undergoing lower limb surgery (mostly orthopedic, vascular and general surgeries). In GROUP R: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml normal saline. In this mixture 18 ml is given in sciatic nerve block and 12 ml in femoral nerve block. In GROUP RC: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml clonidine (60 microgram). In this mixture 18 ml is given in sciatic nerve block and 12 ml in femoral nerve block. Patients with allergy to local anesthetics, peripheral nerve injury, bleeding diathesis, local sepsis, patient refusal, contraindications to clonidine and patients in whom the block was unsuccessful due to total failure of missed dermatomes which needed intravenous supplementation of opioids or general anesthesia were excluded from the study.

**Results:** In group R, 8 patients were ASA I and 22 patients were ASA II. In Group RC, 8 patients were ASA I and 22 patients were ASA II. Both the groups were comparable in respect to ASA classification with a “p” value of 1.0 which is statistically insignificant. Time taken for the onset of sensory blockade in group R varied from 7 to 12 minutes with standard deviation of 1.6. In group RC it varied from 8 to 14 minutes with standard deviation of 1.8 with a “p” value of 0.2605 which is statistically insignificant. Onset of motor block varied from 10 to 15 minutes with standard deviation of 1.2. In group RC it varied from 10 to 18 minutes with standard deviation of 1.96 with a “p” value of 0.1414 which is statistically insignificant. Duration of sensory block in the Ropivacaine group was  $12.01 \pm 0.9$  hours and in the Ropivacaine & clonidine group it was  $15.18 \pm 0.78$  hours. Similarly, duration of motor blocks in the two groups were  $10.06 \pm 0.82$  hours and  $12.69 \pm 0.89$  hours. Duration of analgesia was significantly longer in the Ropivacaine - Clonidine group ( $16.07 \pm 0.68$  hours) than in the Ropivacaine group ( $12.87 \pm 0.67$  hours). ‘p’ value was 0.0001. The difference between the two groups were statistically significant. All the cases in the Ropivacaine group had a sedation score of 1. But only 7 cases in Ropivacaine & Clonidine group had a score of 1 and the remaining 23 had a score of 2. The difference between

the two groups is statistically significant with a “p” value of 0.0001. Differences in the mean SpO<sub>2</sub> values of the two groups were 99.25 and 99.31 with a “p” value of 0.7768 which is statistically insignificant.

**Conclusion:** The addition of clonidine to ropivacaine in sciatic femoral nerve block shows no difference in the onset of sensory and motor blockade but prolongs the duration of both sensory and motor blockade and post operative analgesia, when compared to ropivacaine alone.

**Keywords:** Anesthetics, Local, Clonidine, Peripheral Nerves, Immunologic Adjuvants, Pharmaceutical Adjuvants

## 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 relief of pain during surgery is the main part of anaesthesia. After introduction of barbiturate and cyclopropane, the enthusiasm for block anaesthesia waned in early 1940s. In current recent years however, the technique has had resurgence, due in large part to increased understanding of neural plasticity and the possibility of minimizing hospital stay length by effective use of regional block anaesthesia. Several techniques have been used to prolong the duration of regional anaesthesia.[1] The continuous infusion of local anaesthetics through catheters in nerve blocks are extensively studied and recently opioids as adjuvants to local anaesthetic solutions were used. Surgery in the leg results in severe and sustained postoperative pain. This postoperative pain is difficult to control with oral medications. Single shot nerve block is very effective for postoperative pain control in orthopaedic and surgical procedures.[2] Sciatic nerve has a wide sensory distribution, hence it can be used together with saphenous or femoral nerve block for any surgical procedures below the knee. This form of anaesthesia avoids sympathectomy associated with neuraxial blocks and may therefore be advantageous when any shift in hemodynamics could be deleterious. Several experimental and clinical studies have shown that Alpha - 2 adrenergic agonists like clonidine were able to prolong sensory and motor blockade.[3] This study is designed to assess the efficacy of the addition of an alpha -2 adrenergic agonist, Clonidine to local analgesic solution in sciatic femoral block for lower limb surgery.[4]

## Materials And Methods

This study was conducted at Government Stanley Medical College, Chennai, Tamil Nadu, India in the year between 2021-2022. The inclusion criteria being 60 patients of ASA grade I or II of either sex and age more than 20 years undergoing lower limb surgery (mostly orthopedic, vascular and general surgeries). In GROUP R: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml normal saline. In this mixture 18 ml is given in sciatic nerve block and 12 ml in femoral nerve block. In GROUP RC: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml clonidine (60 microgram). In this mixture 18 ml is given in sciatic nerve block and 12 ml in femoral nerve block. Patients with allergy to local anesthetics, peripheral nerve injury, bleeding diathesis, local sepsis, patient refusal, contraindications to clonidine and patients in whom the block was unsuccessful due to total failure of missed dermatomes which needed intravenous supplementation of opioids or general anesthesia were excluded from the study. After ethical committee approval, informed consent was obtained from the patients. No premedication was given to the patients. Intravenous access was obtained, Anaesthesia machine checked, resuscitative equipments and drugs were kept ready. Sciatic femoral block was performed by posterior Labats approach after confirmation with nerve stimulator. In GROUP R: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml normal saline. In this mixture 18 ml is given in sciatic nerve block and 12 ml in femoral nerve block. In GROUP RC: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml clonidine (60 microgram). In this mixture 18 ml is given in sciatic nerve block and 12 ml in femoral nerve block. Care was taken so that the toxic doses of the local anaesthetics were not exceeded according to the weight of the patients.

**Data Analysis**

The information collected regarding all the selected cases were recorded in a master chart. Data analysis was done with the help of computer using Epidemiological Information Package (EPI 2010) developed by centre for disease control, Atlanta. Using this software range, frequencies,

**Results**

percentages, means, standard deviations, chi square and 'p' values were calculated. Kruskal Wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's chi square test for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

**Table :1 Age Group**

| Age group     | Ropivacaine group                      |      | Ropivacaine & Clonidine group |      |
|---------------|--|------|-------------------------------|------|
|               | No                                     | %    | No                            | %    |
| Upto 30 years | 2                                      | 6.7  | 1                             | 3.3  |
| 31-40 years   | 5                                      | 16.7 | 3                             | 10   |
| 41-50 years   | 12                                     | 40   | 9                             | 30   |
| 51-60 years   | 10                                     | 33.3 | 14                            | 46.7 |
| Above 60      | 1                                      | 3.3  | 3                             | 10   |
| Total         | 30                                     | 100  | 30                            | 100  |
| Range         | 25-65 years                            |      | 30-65 years                   |      |
| Mean          | 48 years                               |      | 51 years                      |      |
| SD            | 9.4 years                              |      | 8.5 years                     |      |
| 'p'           | <b>0.173</b><br><b>NOT SIGNIFICANT</b> |      |                               |      |

Age distribution in the group R varied from 25-65 years with mean age of 48 years and standard deviation of (9.4). In group RC age varied from 30 to 60 years with mean value of 51 years and standard deviation of (8.5) with a "p" value of 0.173 which is statistically insignificant. In group R 20 patients were male 10 patients were female. In group RC 23 patients were male and 7 patients were female. There was no statistically significant difference in the sex composition of the two groups ("p" = 0.5667).

**Table :2 Asa Status**

| ASA | Ropivacaine group | Ropivacaine & Clonidine group |
|-----|-------------------|-------------------------------|
|     |                   |                               |

|       | No                                   | %    | No | %    |
|-------|--------------------------------------|------|----|------|
| I     | 8                                    | 26.7 | 8  | 26.7 |
| II    | 22                                   | 73.3 | 22 | 73.3 |
| Total | 30                                   | 100  | 30 | 100  |
| 'p'   | <b>1.0</b><br><b>Not significant</b> |      |    |      |

In group R, 8 patients were ASA I and 22 patients were ASA II. In Group RC, 8 patients were ASA I and 22 patients were ASA II . Both the groups were comparable in respect to ASA classification with a “p” value of 1.0 which is statistically insignificant.

**Table :3 Onset Of Sensory Block**

| Onset of sensory block | Group R (minutes)             | Group RC (minutes) |
|------------------------|-------------------------------|--------------------|
| Range                  | 7-12                          | 8-14               |
| Mean                   | 9.93                          | 10.53              |
| SD                     | 1.6                           | 1.8                |
| <b>P</b>               | <b>0.2605 Not significant</b> |                    |

Time taken for the onset of sensory blockade in group R varied from 7 to 12 minutes with standard deviation of 1.6 . In group RC it varied from 8 to 14 minutes with standard deviation of 1.8 with a “p” value of 0.2605 which is statistically insignificant.

**Table :4 Onset Of Motor Block**

| Onset of motor block | Group R (minutes)             | Group RC (minutes) |
|----------------------|-------------------------------|--------------------|
| Range                | 10-15                         | 10-18              |
| Mean                 | 13.0                          | 13.56              |
| SD                   | 1.2                           | 1.96               |
| 'p'                  | <b>0.1414 Not significant</b> |                    |

Onset of motor block varied from 10 to 15 minutes with standard deviation of 1.2. In group RC it varied from 10 to 18 minutes with standard deviation of 1.96 with a “p” value of 0.1414 which is statistically insignificant.

**Table:5 Duration Of Sensory And Motor Block**

| Parameter | Duration (in hours) of |                               |                       |                               |
|-----------|------------------------|-------------------------------|-----------------------|-------------------------------|
|           | Sensory block          |                               | Motor block           |                               |
|           | Ropivacaine group      | Ropivacaine & Clonidine group | Ropivacaine group     | Ropivacaine & Clonidine group |
| Range     | 10-13                  | 14-16.5                       | 9-11.8                | 11.5 – 14                     |
| Mean      | 12.01                  | 15.18                         | 10.06                 | 12.69                         |
| SD        | 0.9                    | 0.78                          | 0.82                  | 0.89                          |
| ‘p’       | 0.0001<br>Significant  |                               | 0.0001<br>Significant |                               |

TABLE :5 Duration of sensory block in the Ropivacaine group was 12.01 +0.9 hours and in the Ropivacaine & clonidine group it was 15.18 +0.78 hours. Similarly duration of motor blocks in the two groups were 10.06 +0.82 hours and 12.69 +0.89 hours. The differences between the two groups were statistically significant in respect to duration of sensory blockade with a “p” value of 0.0001 and the duration of motor blockade with a “p” value of 0.0001.

**Table :6 Duration Of Analgesia**

| Parameter | Duration of analgesia (in hours) |                               |
|-----------|----------------------------------|-------------------------------|
|           | Ropivacaine group                | Ropivacaine & Clonidine group |
| Range     | 12-14                            | 15-17.5                       |
| Mean      | 12.87                            | 16.07                         |
| SD        | 0.63                             | 0.68                          |
| ‘p’       | 0.0001<br>Significant            |                               |

TABLE:6 Duration of analgesia was significantly longer in the Ropivacaine - Clonidine group (16.07 +0.68 hours) than in the Ropivacaine group (12.87 +0.67 hours). ‘p’ value was 0.0001. The difference between the two groups were statistically significant

**Table :7 Sedation Score**

| Sedation score | Ropivacaine group |            | Ropivacaine & Clonidine group |            |
|----------------|-------------------|------------|-------------------------------|------------|
|                | No                | %          | No                            | %          |
| 1              | 30                | 100        | 7                             | 23.13      |
| 2              | -                 | -          | 23                            | 76.7       |
| <b>Total</b>   | <b>30</b>         | <b>100</b> | <b>30</b>                     | <b>100</b> |

All the cases in the Ropivacaine group had a sedation score of 1. But only 7 cases in Ropivacaine & Clonidine group had a score of 1 and the remaining 23 had a score of 2. The difference between the two groups is statistically significant with a “p” value of 0.0001.

**Table :8 Saturation**

| Parameter | SPO2 %                                  |                               |
|-----------|---|-------------------------------|
|           | Ropivacaine group                       | Ropivacaine & Clonidine group |
| Range     | 98.4-100                                | 98.6-99.9                     |
| Mean      | 99.25                                   | 99.31                         |
| SD        | 0.54                                    | 0.45                          |
| ‘p’       | <b>0.7768</b><br><b>Not Significant</b> |                               |

Differences in the mean SpO2 values of the two groups were 99.25 and 99.31 with a “p” value of 0.7768 which is statistically insignificant.

**Discussion**

Alpha- 2agonist like clonidine assumes greater importance as anaesthetic adjuvant and analgesic. Its primary effect is symphatholytic. It reduces peripheral norepinephrine release by stimulation of

prejunctional inhibitory alpha-2 adrenoreceptors. It inhibits central neural transmission in the dorsal horn by presynaptic and postsynaptic mechanism and directly in spinal preganglionic sympathetic neurons. [5]Traditionally it was used as antihypertensive drug,

but uses based on sedative, anxiolytic and analgesic properties are being developed. In this study 60 microgram of clonidine added to combined sciatic femoral block has showed no statistically significant difference between the two groups as regard to age, sex, weight and ASA status. Onset of sensory and motor blocks occurred in  $9.93 \pm 1.6$  minutes and  $13 \pm 1.2$  minutes respectively in the ropivacaine group. Onset of sensory and motor block occurred in  $10.53 \pm 1.8$  minutes and  $13.56 \pm 1.96$  minutes in the ropivacaine clonidine group. The addition of clonidine has not shown much effect on the onset of sensory and motor block. Duration of surgery was comparable in both groups. [6]The difference between the two groups was **statistically significant** with a p value of 0.0001 ( $P < 0.05$ ). These results correlates with studies conducted by casti et all, in which the duration of sensory block was 10-13 hours in ropivacaine group and it was 12-16 hours in ropivacaine clonidine group.[7]Mean duration of motor block in ropivacaine group was  $10.06 \pm 0.82$  hours and in ropivacaine clonidine group was  $12.69 \pm 0.89$  hours. The difference between the two groups was **statistically significant** with a p value of 0.0001 ( $P < 0.05$ ). These results correlates with studies conducted by casti et all, in which the duration of motor block was 8-14 hours in ropivacaine group and it was 8.5-22 hours in ropivacaine clonidine group. The addition of clonidine to local anaesthetic solution has significantly prolonged the duration of sensory and motor blockade. This is because clonidine blocks the conduction of C and A gamma fibres and increase the potassium conductance in isolated neurons and intensifies the conduction of local anesthetics[8].Duration of analgesia was significantly longer in the ropivacaine - clonidine group ( $16.07 \pm 0.68$  hours) than in the ropivacaine group ( $12.87 \pm 0.67$  hours). The difference between the two groups was **statistically significant** with a p value of  $.0001 < (p < 0.05)$ . Clonidine has been demonstrated to inhibit the action potential of A- alpha and C fibres in desheathed sciatic nerves. The  $\alpha_2$  adrenergic receptors activated by clonidine are located on primary afferent terminals, neurons in the superficial laminae of the spinal cord and in brain stem nuclei implicated in analgesia. Inhibition of noradrenaline release, mediated by an interaction with  $\alpha_2$  adrenergic presynaptic receptors is responsible for the enhancing effect of the peripheral administration

of clonidine. Peripheral antinociception induced by clonidine has also been related to an  $\alpha_2$ -adrenoreceptor mediated local release of enkephalin like substance.[9]The sedation score in both groups are noted. The sedation score in ropivacaine group was 1.0, in ropivacaine clonidine group was  $2.4 \pm 0.5$ . The sedation score between the two groups was **statistically significant** with a “p” value of 0.0001. In clonidine group since the sedation score was not more than 3, the respiratory function was not compromised. In this study, no significant difference was observed with respect to the pulse rate, systolic and diastolic blood pressure and saturation.[10]By performing sciatic femoral nerve block for lower limb surgeries, adequate postoperative analgesia can be given. Pain is an important factor for any cardiovascular disease patients undergoing surgery in the lower limb. Postoperative pain produces tachycardia, which could be deleterious to the patients.[11] Hence sciatic femoral nerve block can be performed for these cardiovascular disease and high risk patients that can provide prolonged postoperative analgesia and comfort to the patient.[12]Clonidine like adjuvants will prolong the duration of postoperative analgesia. Low dose of clonidine produces sedation without any respiratory compromise. Hence the addition of low dose of clonidine in nerve blocks will provide sedation and prolongation of postoperative analgesia without any systemic side effects.[13,14]

### Conclusion

The addition of clonidine to ropivacaine in sciatic femoral nerve block shows no difference in the onset of sensory and motor blockade but prolongs the duration of both sensory and motor blockade and post operative analgesia, when compared to ropivacaine alone.

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