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A Study On Clonidine As An Adjuvant To Ropivacaine InSciatic Femoral Block For Lower Limb Surgery.

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ABSTRACT

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. The 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. To assess the efficacy of clonidine as an adjuvant to ropivacaine in sciatic femoral nerve block. This study was conducted at Government Stanley Medical College, Chennai, Tamil Nadu, India in the year 2021-2022. The inclusion criteria were 60 patients of ASA grade I or II of either sex and age of 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 of normal saline. In this mixture, 18 ml is given in the sciatic nerve block and 12 ml in the femoral nerve block. In GROUP RC: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml clonidine (60 micrograms). In this mixture, 18 ml is given in the sciatic nerve block and 12 ml in the femoral nerve block. 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 a standard deviation of 1.6. In group RC it varied from 8 to 14 minutes with a standard deviation of 1.8 with a "p" value of 0.2605 which is statistically insignificant. The onset of motor block varied from 10 to 15 minutes with a standard deviation of 1.2. In group RC it varied from 10 to 18 minutes with a 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, the duration of motor blocks in the two groups was 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 was statistically significant. All the cases in the Ropivacaine group had a sedation score of 1. But only 7 cases in the Ropivacaine & Clodinine 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_2 values of the two groups were 99.25 and 99.31 with a "p" value of 0.7768 which is statistically insignificant. 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

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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 undertreated. The relief of pain during surgery is the main part of anesthesia. After the introduction of barbiturates and cyclopropane, the enthusiasm for block anesthesia waned in the early 1940s. In recent years however, the technique has had a 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 anesthesia [1]. The continuous infusion of local anesthetics through catheters in nerve blocks is extensively studied and recently opioids as adjuvants to local anesthetic solutions were used. Surgery in the leg results in severe and sustained postoperative pain. This postoperative pain is difficult to control with oral medications. A single-shot nerve block is very effective for postoperative pain control in orthopedic and surgical procedures [2]. The sciatic nerve has a wide sensory distribution, hence it can be used together with saphenous or femoral nerve block for any surgicalprocedures below the knee. This form of anesthesia 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 - 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 a local analgesic solution in the 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 2021-2022. The inclusion criteria were 60 patients of ASA grade I or II of either sex and age of 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 of normal saline. In this mixture, 18 ml is given in the sciatic nerve block and 12 ml in the femoral nerve block. In GROUP RC: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml clonidine (60 micrograms). In this mixture, 18 ml is given in the sciatic nerve block and 12 ml in the 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, the Anaesthesia machine was checked, and resuscitative equipment and drugs were kept ready. The sciatic femoral block was performed by posterior Labats approach after confirmation with a nerve stimulator. In GROUP R: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml of normal saline. In this mixture, 18 ml is given in the sciatic nerve block and 12 ml in the femoral nerve block. In GROUP RC: Patients received 30 ml of 0.75% ropivacaine with 0.4 ml clonidine (60 micrograms). In this mixture, 18 ml is given in the sciaticnerve block and 12 ml in the femoral nerve block. Care was taken so that the toxic doses of the local anesthetics were not exceeded according to the weight of the patients.

DATA ANALYSIS

The information collected regarding all the selected cases was recorded in a master chart. Data analysis was done with the help of a computer using the Epidemiological Information Package (EPI 2010) developed by the Centre for Disease Control, Atlanta. Using this software range, frequencies, percentages, means, standard deviations, chi-square, and 'p' values were calculated. Kruskul Walli's chi-square test was used to test the significance of the difference between quantitative variables and Yate's chi-square test for qualitative variables. A 'p' value less than 0.05 is taken to denote a significant relationship.

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RESULTS

TABLE 1: AGE GROUP

Age group	Ropivacaine group		Ropivacaine & Clonidine group	
	No	%	No	%
Up to 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'	**0.173 Not Significant**			

Age distribution in group R varied from 25-65 years with a mean age of 48 years and a standard deviation of (9.4). In group RC age varied from 30 to 60 years with a 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 nostatistically 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'	**1.0 Not significant**			

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
P	**0.2605 Not significant**	

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

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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'	**0.1414 Not significant**	

The onset of motor block varied from 10 to 15 minutes with a standard deviation of 1.2. In group RC it varied from 10 to 18 minutes with a 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 Significant**		**0.0001 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, the duration of motor blocks in the two groups was 10.06 ±0.82 hours and 12.69 ±0.89 hours. The differences between the two groups were statistically significant concerning the 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)	
	Ropivacainegroup	Ropivacaine & Clonidine group
Range	12-14	15-17.5
Mean	12.87	16.07
SD	0.63	0.68
'p'	**0.0001 Significant**	

Table 6: Duration of analgesia was significantly longer in the Ropivacaine - Clodinine 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 was 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
Total	**30**	**100**	**30**	**100**

All the cases in the Ropivacaine group had a sedation score of 1. But only 7 cases in the Ropivacaine & Clodinine 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.

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Table 8: Saturation

Parameter	SPO2 %	
	Ropivacainegroup	Ropivacaine & Clonidine group
Range	98.4-100	98.6-99.9
Mean	99.25	99.31
SD	0.54	0.45
'p'	0.7768 Not Significant	

Differences in the mean SpO_2 values of the two groups were 99.25and 99.31 with a "p" value of 0.7768 which is statistically insignificant.

DISCUSSION

Alpha-2- 2 antagonists like clonidine assumes greater importance as an anesthetic adjuvant and analgesic. Its primary effect is sympatholytic. 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 mechanisms and directly in spinal preganglionic sympathetic neurons [5]. Traditionally, it was used as an antihypertensive drug, but uses based on sedative, anxiolytic, and analgesic properties are being developed. In this study, 60 micrograms of clonidine added to a combined sciatic femoral block showed no statistically significant difference between the two groups concerning age, sex, weight, and ASA status. The onset of sensory and motor blocks occurred in 9.93 ±1.6 minutes and 13 ±1.2 minutes respectively in the ropivacaine group. The onset of sensory and motor block occurred in 10.53 ± 1.8 minutes and 13.56 ± 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. The 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 correlate with studies conducted by Casti et all, in which the duration of sensory block was 10-13 hours in the ropivacaine group and it was 12-16 hours in the ropivacaine clonidine group [7]. The mean duration of motor block in the ropivacaine group was 10.06 ±0.82 hours and in the ropivacaine clonidine group was 12.69 ⍰0.89 hours. Thedifference between the two groups was **statistically significant** with a p-value of 0.0001 (P<0.05). These results correlate with studies conducted by Casti et all, in which the duration of motor block was 8-14 hours in the ropivacaine group and it was 8.5-22 hours in the ropivacaine clonidine group. The addition of clonidine to a local anesthetic solution has significantly prolonged the duration of sensory and motor blockade. This is because clonidine blocks the conduction of C and A gamma fibers increases 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 ±0.68 hours) than in the ropivacaine group (12.87 ±0.67 hours). The difference between the two groups was statistically significant with a p- value of .0001<(p0.05). Clonidine has been demonstrated to inhibit the action potential of A- alpha and C fibers in unsheathed sciatic nerves. The α2 adrenergic receptors activated by clonidine are located on primary afferent terminals, neurons in the superficial laminae of the spinal cord, and brain stem nuclei implicated in analgesia. Inhibition of noradrenaline release, mediated by an interaction with α2 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 α2-adrenoreceptor mediated local release of an enkephalin-like substance [9]. The sedation scores in both groups are noted. In the 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 concerning 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. The low dose of clonidine produces sedation without any respiratory compromise. Hence the addition of a low dose of clonidine in nerve blocks will provide sedation and prolongation of postoperative analgesia without any systemic side effects [13,14].

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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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