

# Comparative Evaluation of 0.75% Ropivacaine with Ropivacaine 0.75% and Dexmedetomidine in Combined Peripheral Nerve Stimulator Guided Sciatic-Femoral Nerve Block for Lower Limb Surgeries

Dr. D. S. Negi<sup>1</sup>, Dr. Atul Kumar Singh Patel<sup>2</sup>

<sup>1</sup>Designate Professor, Department of Anaesthesia, Mayo Institute and Medical Sciences, Barabanki, U. P., India

<sup>2</sup>Assistant Professor, Department of Anaesthesia, Mayo Institute and Medical Sciences, Barabanki, U. P., India

Corresponding Author's Email id: [drdevendranegi\[at\]gmail.com](mailto:drdevendranegi[at]gmail.com)

**Abstract:** ***Background:** The purpose of this study is to evaluate the effect of dexmedetomidine when added to 0.75% ropivacaine on onset and duration of sciatic-femoral nerve block for lower limb surgeries. **Method:** 80 patients randomized and allocated in two groups. Sciatic-femoral block was performed using study drug in 32 ml syringe. In Group R patients received sciatic femoral block with 30 ml of ropivacaine 0.75% and 2ml of normal saline (20ml for sciatic and 12 ml for femoral block) whereas in Group RD Dexmedetomidine 2mcg/kg diluted with normal saline to make volume of 2 ml and added to 30 ml of ropivacaine 0.75%. A blind observer recorded the vitals, onset and duration of blockade, hemodynamic alteration, VAS score, requirement of rescue analgesia and complication if any occur. **Result:** All patients had successful sciatic-femoral block. There were significant difference in onset, duration of sensory and motor blockade, duration of analgesia, VAS score, required amount of rescue analgesic and hemodynamic parameters. **Conclusion:** Addition of dexmedetomidine to ropivacaine in sciatic-femoral block prolongs the duration of sensory and motor blockade and lesser requirement of rescue analgesic and better hemodynamic stability.*

**Keywords:** Sciatic-femoral block, Dexmedetomidine, Ropivacaine, Peripheral nerve stimulator

## 1. Introduction

The Sciatic-femoral nerve blocks are typically used together for procedures on lower extremities and very useful in numerous procedures involving thigh, knee, particularly knee arthroscopy, patellar surgery, total knee arthroplasty, and even procedures distal to knee. Below knee surgery often results in severe and long lasting post-operative pain that requires large doses of opiates.<sup>1</sup> Few studies have evaluated peripheral nerve blocks for lower extremity surgery and compared them with spinal anaesthesia.<sup>2-3</sup> The sciatic-femoral nerve blocks were associated with significantly lower pain scores during the early post-operative hours.<sup>4</sup> Several studies were done in which peri neural adjuvant medications were used to increase the duration of post operative analgesia. However, only a few of these studies examined the effect following Sciatic-Femoral nerve block.<sup>5-6</sup> Dexmedetomidine is a highly specific and selective  $\alpha$ -2 adrenoceptor agonist.<sup>7-8</sup> Systemic administration of Dexmedetomidine has been the focus of interest for their sedative, analgesic, perioperative sympatholytic, and cardiovascular stabilising effects with reduced anesthetic requirements.<sup>9</sup> Some studies have shown that perineural Dexmedetomidine as an adjuvant to local anesthetics for peripheral nerve blocks can prolong the duration of the blockade and postoperative analgesia.<sup>10, 11</sup> Opioids administration is associated with frequent dose dependent adverse effects including nausea, vomiting, pruritus, sedation, respiratory depression.<sup>12</sup> Ropivacaine S (-

) enantiomer, the n-propyl homologue of bupivacaine, is a long acting local anesthetic and has got all the advantages of bupivacaine and also lesser cardiotoxic than bupivacaine.<sup>13</sup> To potentiate the quality of block, a variety of drugs, such as opioids and  $\alpha$ -2 agonists have been tried as an adjuvant

In this study, it was hypothesized that addition of dexmedetomidine 2  $\mu$ gm/kg to ropivacaine 0.75%, would lengthen the time to the first request for post-operative analgesia, shorten onset time of sensory and motor block, increase the duration of sensory and motor blockade.

## 2. Material and Methods

This is a prospective, randomized, double blind, comparative study conducted in the department of anaesthesiology at Dr Ram Manohar Lohia Combined Hospital, Lucknow (U. P.) during a period of one year after the approval of ethical committee and written and informed consent from all patients. Total 80 patients were selected with 40 patients in each group. Pharmacy prepared the medication in 32 ml syringe and labelled as "study drug" to maintain blinding. The drugs were given in pre-filled unlabeled syringes while performing the block. In Group R, Patients received sciatic femoral block with 30 ml of ropivacaine 0.75% and 2ml of normal saline (20 ml for sciatic and 12 ml for femoral block) where as in Group RD, dexmedetomidine 2mcg/kg diluted with normal saline to make volume of 2ml and added to 30 ml of ropivacaine 0.75%. Patients with age group of 18 – 45

years, falling into American Society of Anaesthesiologists' (ASA) physical status I-II and undergoing elective lower limb surgeries under sciatic-femoral nerve block were enrolled for the study. Patients with history of cardiovascular disease, respiratory disease, amide group of local anaesthetic allergy, pulmonary and neurological diseases, psychological disorders, renal or hepatic failure, uncooperative patients, coagulation disorders, local infection at the site of block were excluded from the study. Written informed consent was taken and patients were advised pre-operative fasting status as per ASA guidelines. Patients were given Tab Ranitidine 150 mg a night before surgery and in the morning on the day of surgery. Injection Medazolam 1 mg was given just before procedure. For femoral nerve block patients were placed supine, femoral pulse and inguinal crease was palpated. The point of entry of nerve stimulator needle was 1-1.5 cm lateral to the artery in the inguinal crease and directed cephalad at approximately a 30-45 degree angle towards the centre of the inguinal ligament line. A brisk patellar snap with the current at 0.5 mA or less was indicative of very close proximity of femoral nerve and 12 ml of test drug was injected. For Sciatic nerve block, Labat's classic approach was used. Patient was placed in lateral decubitus position (operative side up) and the leg was flexed at the knee but if patient was unable to do so, the leg was extended at the hip as far as possible without producing discomfort. A line was drawn between greater trochanter to the posterior superior iliac spine. A second line was drawn from greater trochanter to the sacral hiatus (Winnie's modifications). Point of needle entry is decided by drawing a line perpendicular from the midpoint of the first line to its intersection with the second line. Successful needle placement in proximity to the sciatic nerve was observed with planter flexion / inversion (tibial nerve) or dorsiflexion / eversion (common peroneal nerve) with 0.5 mA or less current and at this point 20 ml of test drug was injected.

After the block was given, patients were evaluated for onset of sensory and motor blockade, quality of motor blockade, overall quality of the block, duration of sensory and motor blockade and hemodynamic variables. Sensory block was assessed by pin prick method and motor blockade was assessed by modified Bromage scale. Pain was assessed by Visual Analogue Scale of 0 to 10 at 1 hr, 2 hr, 4 hr, 6 hr, 8 hr, 16 hr and 24 hr post-operatively. When patients had VAS score more than 3, rescue analgesia in the form of injection Tramadol 50 mg intramuscular was given. The duration of sensory block was defined as time interval between local anesthetic administration and the complete resolution of anaesthesia on all nerves. The duration of motor blockade was defined as the time interval between local anesthetic administration and the recovery of complete motor function. Any adverse events like nausea, vomiting, hypotension and bradycardia were recorded during after operation. Hypotension defined as systolic blood pressure <100 mm Hg and Bradycardia was defined as heart rate <60 beats / min.

### 3. Results

The demographic data distribution in two groups showed no significant difference in mean age, mean height but for mean weight difference was significant with P value of 0.0354.

**Table 1:** Demographic data and operative characteristics, gender distribution and ASA score-

Variable	Group R	Group RD	T Value	P value
	MEAN±SD	MEAN±SD		
Age (year)	33.53±8.27	32.70±6.06	0.5090	0.6122
Weight (kg)	65.33±7.82	61.75±7.10	2.1408	0.0354
Height (cm)	162.68±9.17	164.38±8.06	0.8807	0.3812
Duration of surgery (mins)	66.98±55.40	63.38±15.87	1.0295	0.3064
Gender distribution				
Male	23 (57.5%)	28 (70%)		1.0000
Female	17 (42.5%)	12 (30%)		
Total	40 (100%)	40 (100%)		
ASA Score				
ASA Score I	29	32		1.0000
ASA Score II	11	8		
Total	40	40		

**Table 2:** Sensory and Motor Block Characteristics-

Variables	Group R	Group RD	T value	P value
	Mean±SD	Mean±SD		
Onset of sensory block (mins)	4.30±1.49	2.95±0.88	4.9443	<0.0001
Complete sensory block (mins)	10.05±1.13	5.40±0.90	20.3440	<0.0001
Onset of motor block (mins)	14.25±2.43	7.83±0.90	15.6995	<0.0001

**Table 3:** Duration of sensory, motor block and analgesia

Variables	Group R	Group RD	T value	P value
	Mean±SD	Mean±SD		
Duration of sensor block (mins)	333.65±36.77	405.65±19.06	10.9948	<0.0001
Duration of motor block (mins)	348.48±37.66	424.55±18.96	11.4120	<0.0001
Time to request first analgesia (mins)	404.83±44.30	478.60±19.80	9.6155	<0.0001
Total analgesic dose (mg in 24 hours)	96.25±36.49	71.25±25.03	3.5729	0.0006

Onset of sensory block was 4.30±1.79 and 2.95±0.88 (min), complete sensory block was 10.05±1.13 and 5.40±0.90 (min) and onset of motor block 9 time to reach Bromage 3) was 14.25±2.43 and 7.83±0.90 min for group R and group RD respectively.

**Table 4:** Baseline Hemodynamic Parameters

Baseline	Group R	Group RD	T value	P value
	MEAN±SD	MEAN±SD		
SBP	121.68±7.25	124.73±6.41	1.9938	0.0497
DBP	70.10±4.72	76.68±6.66	5.0946	<0.0001
MAP	87.28±5.11	92.60±5.38	4.5385	<0.0001
HR	72.58±6.12	81.95±7.53	6.1108	<0.0001

Mean systolic blood pressure of patients was 121.68±7.25 and 124.73±6.41 mm Hg, mean diastolic blood pressure was 70.10±4.72 and 76.68±6.66 mm Hg, mean arterial pressure was 87.28±5.11 and 92.60±5.38 mm Hg, and mean heart rate was 72.58±6.12 and 81.95±7.53 pulse/minute of patients of group R and group RD respectively.

**Table 4:** Intra operative mean of mean arterial pressure

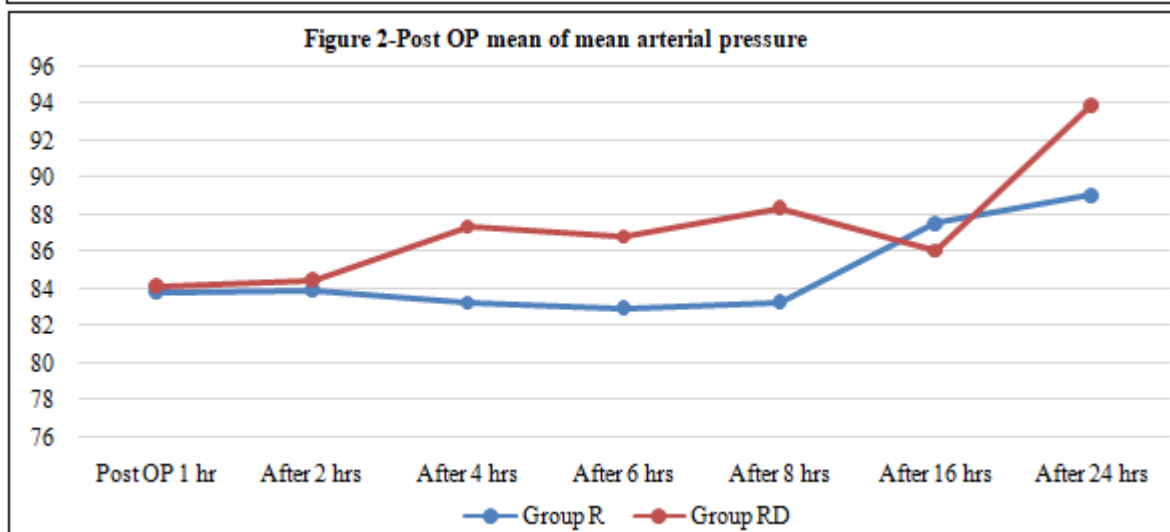
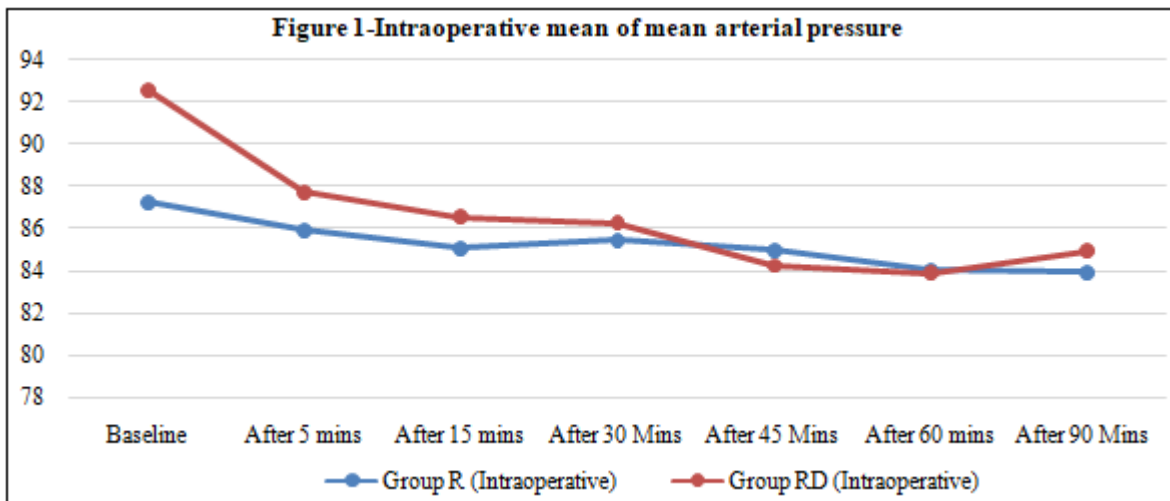
MAP (mm of Hg)	Group R		Group RD		T value	P value
	Mean	SD	Mean	SD		
Baseline	87.28	5.11	92.60	5.38	4.5385	<0.0001
After 5 mins	86.43	4.74	87.73	4.25	1.2910	0.2005
After 15 mins	85.10	3.81	86.58	4.32	1.6199	0.1093
After 30 mins	85.48	3.86	86.28	4.55	0.8487	0.3986
After 45 mins	85.03	3.71	84.25	4.55	0.8348	0.4064
After 60 mins	84.05	3.61	83.90	4.53	0.2727	0.7858
After 90 mins	83.95	3.28	84.95	5.37	1.0046	0.3182

of the two groups was 87.28±5.11 and 92.60±5.38 mm Hg, MAP after 15 min for the two groups respectively.

**Table 6:** Postoperative Mean of mean arterial pressure

MAP	Group R		Group RD		T value	P value
	Mean	SD	Mean	SD		
Post-op 1hour	83.33	3.32	84.13	4.46	0.2845	0.7768
2 hour	83.98	3.20	84.48	4.30	0.5904	0.5566
4 hour	83.28	3.22	87.38	4.37	4.7766	<0.0001
6 hour	83.00	2.93	86.83	4.53	4.4828	<0.0001
8 hour	83.35	3.06	88.38	4.59	5.7571	<0.0001
16 hour	87.58	4.67	86.05	4.04	1.5616	0.1224
24 hours	89.10	4.55	93.98	5.62	4.2625	<0.0001

Table 5 shows intraoperative mean of mean arterial pressure and its standard deviation at different time intervals for patients of group R and RD. Mean baseline arterial pressure

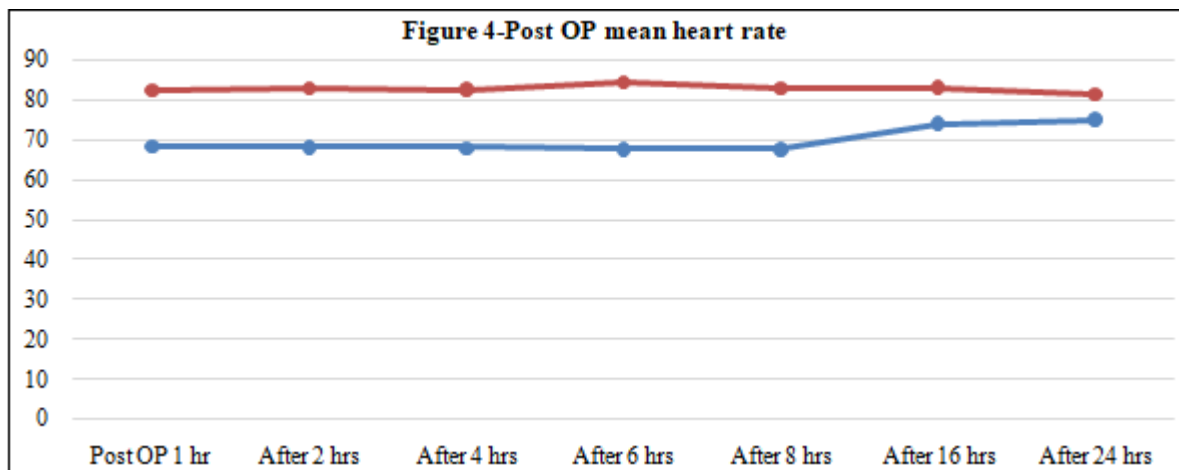
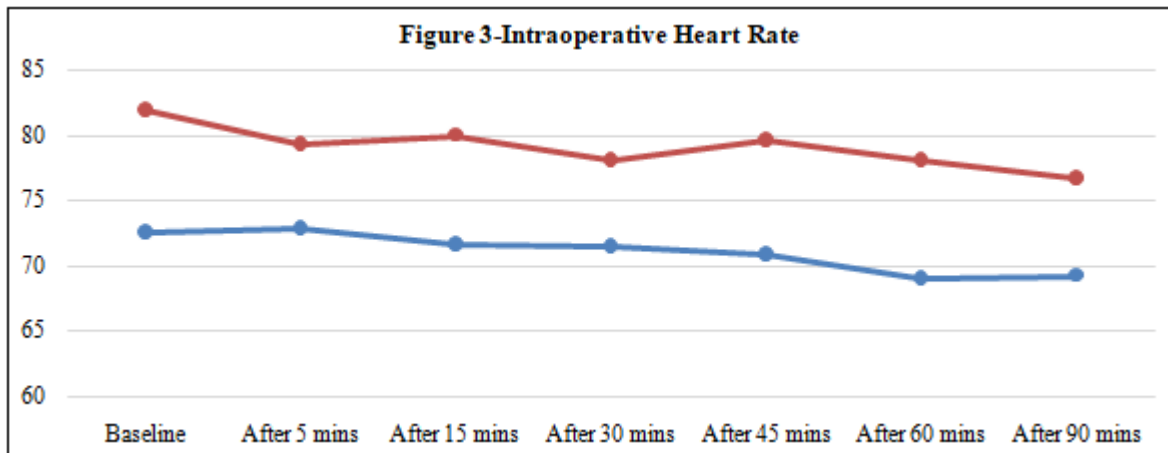


**Table 7:** Intraoperative mean Heart Rate

HR	Group R		Group RD		T Value	P Value
	Mean	SD	Mean	SD		
Baseline	72.58	6.12	81.95	7.53	6.1108	<0.0001
After 5 mins	72.88	4.72	79.28	7.62	4.5151	<0.0001
After 15 mins	71.58	4.09	80.00	7.46	6.2643	<0.0001
After 30 mins	71.48	4.36	78.08	7.39	4.8636	<0.0001
After 45 mins	70.83	4.05	79.68	7.50	6.5654	<0.0001
After 60 mins	69.00	3.57	78.13	7.40	7.0246	<0.0001
After 90 mins	69.23	4.09	76.70	7.08	5.7841	<0.0001

**Table 8:** Postoperative Mean Heart Rate

HR	Group R		Group RD		T Value	P Value
	Mean	SD	Mean	SD		
Post-Op 1 hour	68.40	3.56	82.45	7.19	11.0776	<0.0001
2 hour	68.05	3.30	82.98	7.21	11.8977	<0.0001
4 hour	67.90	3.39	82.55	7.39	11.3928	<0.0001
6 hour	67.75	2.96	84.38	7.32	13.3236	<0.0001
8 hour	67.63	2.48	83.05	7.35	12.5803	<0.0001
16 hour	73.93	5.11	83.10	6.44	7.0604	<0.0001
24 hour	74.95	3.62	81.42	6.59	5.4847	<0.0001



**Table 9:** Visual Analogue Scale

Post-op VAS Score	Group R		Group RD		T Value	P Value
	Mean	SD	Mean	SD		
0 hr	0.00	0.00	0.00	0.00	-	-
1hr	0.00	0.00	0.00	0.00	-	-
2 hr	0.00	0.00	0.00	0.00	-	-
4 hr	0.00	0.00	0.00	0.00	-	-
6 hr	0.65	1.21	0.00	0.00	3.3975	0.0011
8 hr	3.83	0.87	2.88	0.69	5.4074	<0.0001
16 hr	4.00	0.55	2.73	0.60	9.8809	<0.0001
24 hr	3.23	0.80	2.65	0.66	3.5012	0.0008

**Table 10:** Side effects of the drugs

Side effects	Group R	Group RD	P-value
Nausea	3	4	>0.0500
Vomiting	1	2	>0.0500
Hypotension	0	0	-
Bradycardia	0	0	-

#### 4. Discussion

Post-operative pain is the most common clinical problem in hospital among the surgical patients and is attributed as main reason for overnight hospital stay in 17-41 % of surgical day care patients.<sup>16, 17</sup> Inadequate post-operative pain control leads to several unwanted adverse events like patients discomfort, thromboembolic events and pulmonary complications.<sup>18</sup> Opioids although provide satisfactory analgesia, they are associated with unwanted side effects.<sup>19</sup> Sciatic-Femoral nerve block is a peripheral nerve block that involves innervations of the lower limb derived from L2-S3.

It provides adequate post-operative pain control following the various lower limb surgeries.<sup>20, 21</sup>

In this study the demographic characteristics like mean age, gender, ASA score, mean height and duration of surgery were comparable in both groups and there was no statistical significant difference with p-value >0.0500 but difference in mean weight was significant with p-value 0.0354.

Onset of sensory block was 4.30±1.49 min for R group and 2.95±0.88 min for RD group which was extremely significant with p-value <0.0001. Complete sensory block was 10.05±1.13 min in R group and 5.40±0.90 min in RD group which was extremely significant. Onset of motor block was 14.25±2.43 min in R group and 7.89±0.90 min in RD group which extremely significant with p-value <0.0001. Duration of sensory block 333.65±36.77 min in R group and 405.65±19.06 min in RD group and duration of motor block was 348.48±37.66 min in R group and 424.55±18.96 min in RD group, difference in both parameters in groups were highly significant with p-value <0.0001. Time of first rescue analgesia 404.83±44.30 min in R group and in RD group this duration was 478.60±19.80 min with highly significant difference (p-value <0.0001). The mean total dose of inj-Tramadol required in 24 hr was 96.25±36.49 mg in R group and 71.25±25.03 mg for RD group, the difference is highly significant with p-value 0.0006. The variation in mean VAS score was statistically significant after 6 hr post-operative period with p-value 0.0011 and highly significant after 8 hr and 16 hr post-operative period with p-value <0.0001, and even at 24 hr it



has been found to be highly significant with p-value 0.0008. Similar to these findings, many investigators reported that the addition of Dexmedetomidine to different types of local anesthetic agents in various types of peripheral nerve blocks resulted in prolongation of analgesic effect.<sup>10, 14, 15, 22, 23, 24, 25</sup>

Preoperative baseline parameters, Mean systolic blood pressure of patients was  $121.68 \pm 7.25$  and  $124.73 \pm 6.41$  mm Hg, mean diastolic blood pressure was  $70.10 \pm 4.72$  and  $76.68 \pm 6.66$  mm Hg, mean arterial pressure was  $87.28 \pm 5.11$  and  $92.60 \pm 5.38$  mm Hg, and mean heart rate was  $72.58 \pm 6.12$  and  $81.95 \pm 7.53$  pulse/minute of patients of group R and group RD respectively. Differences in baseline diastolic blood pressure, mean arterial pressure and heart rate in both groups were extremely significant with p-value  $< 0.0001$ . This can be due to small sample size used in this study. The intra-operative and post-operative change in systolic blood pressure, diastolic blood pressure and heart rate between both groups have been found extremely significant with p-value  $< 0.0001$ . This observation is similar with Rancourt MP et al.<sup>130</sup> study in which systolic and diastolic blood pressure were stable throughout the study period. In our study, side effects like nausea, vomiting, hypotension and bradycardia are not significant in both the groups with p-value  $> 0.0500$ .

## 5. Conclusion

Addition of dexmedetomidine to ropivacaine in Sciatic-Femoral nerve block confers better pain control and decreases total dose of analgesic requirement in post-operative period. Addition of dexmedetomidine enhances quality of block by faster onset of sensory and motor blockade along with hemodynamic stability. The addition of dexmedetomidine in a dose of  $2 \mu\text{g}/\text{kg}$  has no significant side effects.

## 6. Limitations of the Study

Single centric study, small sample size, ropivacaine was not used as per kg body weight and dependence on landmark guided nerve block using peripheral nerve stimulator.

## References

- [1] Adali S, Erkalp K, Erden V, Cömlekci M, Bülbül M, Aldemir T. Spinal anesthesia and combined sciatic nerve/lumbar plexus block techniques in lower extremity orthopedic surgery. *Acta Orthop Traumatol Turc.*2011; 45: 225-32
- [2] Casati A, Cappelleri G, Fanelli G et al. Regional Anesthesia for outpatient knee arthroscopy: A randomized clinical comparison of two different anesthetic techniques. *Acta Anesthesiol Scand.*2000; 44: 543-70.
- [3] Montes FR, Zarate E, Grueso R et al. Comparison of spinal anesthesia with combined sciatic-femoral nerve block for outpatient knee arthroscopy. *J Clin Anesth.*2008; 20: 415-20
- [4] Casati A, Magistris L, Fanelli G, Aldegheri G et al. Small-dose clonidine prolongs postoperative analgesia after sciatic-femoral nerve block with 0.75% ropivacaine for foot surgery. *Anesth Analg.*2000; 91: 388-92
- [5] Helayel PE, Kroth L, Boos GL et al. Effects of intramuscular and perineural clonidine on sciatic nerve block with 0.5% ropivacaine. *Rev Bras Anesthesiol.*2005; 55: 483-90
- [6] Couture DJ, Cuniff HM, Maye JP et al. The addition of clonidine to bupivacaine in combined femoral-sciatic nerve block for anterior cruciate ligament reconstruction. *AAANA J.*2004; 72: 273-8
- [7] Boyd RE. Alfa 2 adrenergic receptor agonists as analgesics. *Curr Top Med Chem.*2001; 1: 193-7
- [8] Kamibayashi T, Maze M. Clinical uses of alpha 2 adrenergic agonists. *Anesthesiology.*2000; 93: 1345-9
- [9] Ammar AS, Mahmoud KM. Ultrasound-guided single injection infraclavicular brachial plexus block using bupivacaine alone or combined with dexmedetomidine for pain control in upper limb surgery: A prospective randomized controlled trial. *Saudi J Anesth.*2012; 6: 109-14
- [10] Marhofer D, Krtner SC, Pils S et al. Dexmedetomidine as an adjuvant to ropivacaine prolongs peripheral nerve block: A volunteer study. *Br J Anesth.*2013; 110: 438-42
- [11] Kathuria S, Gupta S, Dhawan I. Dexmedetomidine as an adjuvant to ropivacaine in supraclavicular brachial plexus block. *Saudi J Anesth.*2015; 9: 148-54
- [12] Paice JA, Gordon DB, Contreras J et al. Safe use of opioids in hospitals. *Sentinel Event Alert.*2012; 49: 12-5
- [13] Cederholm I. Preliminary risk-benefit analysis of ropivacaine in labour and following surgery. *Drug Safe.*1997; 16: 391-402
- [14] Rancourt MP, Albert NT, Bernard PM et al. *Anesth Analg.*2012 oct; 115 (4): 958-62
- [15] Esmaoglu A, Yegenoglu F, Akin A et al. Dexmedetomidine added to levobupivacaine prolongs axillary brachial plexus block. *Anesth Analg.*2010; 111: 1548-51
- [16] Lau H, Brooks DC. Predictive factors for unanticipated admissions after ambulatory laparoscopic cholecystectomy. *Arch Surg.*2001; 136: 1150-53
- [17] Chung F, Mezei G. What are the factors causing prolonged stay after ambulatory anesthesia? *Anesthesiology.*1998; 89: A3
- [18] Ganai S, Lee KF, Merrill A et al. Adverse outcomes of geriatric patients undergoing abdominal surgery who are at high risk for delirium. *Arch Surg.*2007; 142: 1072-8
- [19] Lo Y, Chia YY, Liu K, Ko NH. Morphine sparing with droperidol in patient-controlled analgesia. *J Clinical Anesth.*2005; 17: 271-5
- [20] Bind B Palkhiwala, Pauravi T Bhatt. Study of combined femoral and sciatic nerve blocks for lower limb surgical procedures. *Gujrat medical journal* march 2015; 70 No.1: 36-40
- [21] Raj Kumar, A Singh. Amputation of lower extremity in diabetic and high risk patients under peripheral nerve blocks (combined sciatic and 3-in-one femoral block). *Kuwait medical journal.*2001; 33 (4): 310-316
- [22] Almarakbi WA, Kaki AM. Addition of dexmedetomidine to bupivacaine in transversus abdominis plane block potentiates post-operative pain

relief among abdominal hysterectomy patients: A prospective randomized controlled trial. Saudi Journal of Anesthesia.2014; 8 (2): 161-166

- [23] Channabasappa SM, Shetty VR, Dharmappa SK, Sharma J. Efficacy and safety of dexmedetomidine as an additive to local anesthetics in peribulbar block for cataract surgery. Anesth Essays Res.2013; 7: 39-43
- [24] Agarwal S, Aggarwal R, Gupta P. Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block. Journal Anesthesiol Clin Pharmacol.2014; 30: 36-40
- [25] Masuki S, Dinunno FA, Joyner MJ, Eisenach JH. Selective  $\alpha_2$  adrenergic properties of dexmedetomidine over clonidine in the human forearm. J Appl Physiol.2005; 99: 587-592