ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

COMPARISON OF EFFICACY OF ULTRASOUND GUIDED SUBGLUTEAL SPACE INJECTION WITH PERINEURAL INJECTION BY BLOCK PERFORMANCE TIME, QUALITY OF SENSORY AND MOTOR BLOCKADE, HEMODYNAMIC CHANGES, PATIENT SATISFACTION AND COMPLICATION IN BELOW KNEE SURGERIES

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Received Date: 28/02/2024 Acceptance Date: 12/03/2024

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Abstract

Background: Ultrasound guided sciatic nerve block has been proved to be effective in pain control for lower limb surgeries fortunately, it can be performed at different levels via different approaches. In this prospective, randomized, observational study, we compared the efficacy of ultrasound guided Subgluteal space injection versus Perineural space injection technique in posterior sciatic nerve group in patients undergoing below knee surgeries. **Methodology**- The study was conducted in the Department of Anaesthesiology at Bhagwan Mahaveer Jain Hospital, Bengaluru which included 60 ASA grade I and III patients between the ages of 18 and 80 who underwent below knee **surgeries.** After obtaining ethical committee clearance and informed consent, the patients were randomly allocated into two groups of 30 each by a computer generated random table to receive 25 ml of 0.75% ropivacaine with 45mcg of clonidine in Group I and in Group II. The **onset time of sensory and motor blockade** were observed between the groups. **Results** :-The total anesthesia related time was faster in Group II when compared to Group I ($p<0.0001$). There were no significant **haemodynamic changes** in the study **group. Conclusion-** Perineural space injection (Group II) in Posterior sciatic nerve block has shorter onset and total anesthesia related time in comparison to Subgluteal space injection (Group I).

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

Keywords- Perineural injection, Posterior Sciatic nerve block, Sub gluteal space, knee surgeries, Ropivacaine,

Introduction

Peripheral nerve blockade is now a well-accepted concept for comprehensive anesthetic care. Peripheral nerve blocks are ideally suited for lower extremity surgery because of the peripheral location of the surgical site and the potential to block pain pathways at multiple levels. In contrast to other anesthetic techniques, such as general or spinal anesthesia, properly conducted peripheral nerve blocks avoid hemodynamic instability and pulmonary complications, facilitate post-operative pain management and timely discharge.[1] Additional advantages of peripheral nerve blocks are that they can be used in patients having lumbosacral disease and avoid the need for airway instrumentation.[2] Blockade of the sciatic nerve may be used to provide anesthesia to the foot and the lower extremity upto knee. The sciatic nerve can be approached at the pelvic level with the patient supine (anterior approach) or in the Sims position (posterior approach). Various factors have been shown to affect the success rate in sciatic nerve blockade. These include the intensity of the current at which peripheral nerve stimulation is achieved, the type of evoked motor response following nerve stimulation, the approach, number of injections, use of additives, as well as the concentration and volume of the injected local anesthetic. Postoperative analgesia is an integral part of pain management. Various local anaesthetics, opioids and adjuvants have been used for the same.

Ropivacaine has properties of fast onset of action, long duration of analgesia, less cardio toxicity, less central nervous system side effects and stable hemodynamics.[3] Clonidine, an alpha 2-adrenoceptor agonist, has been used for many years as an additive to short, intermediate, and long-acting local anesthetics. Meta- analysis and systematic reviews clearly show an analgesic benefit from the addition of clonidine to local anesthetics.[4] Utilization of visual and palpable anatomical landmarks in localizing deep-seated peripheral nerves has long been the mainstay of regional anesthesia, using a peripheral nerve stimulator (PNS) attached to a probing needle, allows for exact localization of a nerve by electrical stimulation of its motor component. The success of this block relies on proper nerve localization, needle placement and local anesthetic injection. Ultrasound guidance for regional anesthesia became popular owing to detection of anatomical variants, painless. The success of this block relies on proper nerve localization, needle placement and local anesthetic injection. Ultrasound guidance for regional anesthesia became popular owing to detection of anatomical variants, painless performance and more accurate needle placement. The needle tip can be guided toward the neuro-vascular bundle to avoid injury to arteries, veins and other adjacent structures. It also helps to monitor the spread of local anesthetic solution in the appropriate tissue planes and thereby reduce the incidence of arterial puncture and direct nerve damage.

The above study was conducted to study and compare the efficacy of Ultrasound guided sub-gluteal space injection with perineural injection by Block performance time, quality of sensory and motor blockade, hemodynamic changes, patient satisfaction and complication in patients below knee surgeries.

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Materials And Methods

Study place- The study was conducted in the Department of Anaesthesiology at Bhagwan Mahaveer Jain Hospital, Bengaluru for 12 months (August 2018 to July 2019).

Study design- Prospective randomized observational study.

Inclusion criteria-Patients in age group of 18 – 80 years, ASA grade I - III patients of either gender, undergoing below knee surgeries, with BMI between 20-35 kg/m2 and ready to give consent for participation.

Exclusion criteria-Patients below 18 years and more than 80 years, receiving anticoagulants, with infection/local pathology at the site of administration with coagulation disorders of block, allergic to local anaesthetic agents, significant neurological and psychiatric disorders and those refusing to give consent.

Sample size- 60 patients were included in the study. 30 in group 1 and 30 in group 2.

GROUP 1(S): Patients who were given ultrasound guided subgluteal space posterior sciatic nerve block with 25 ml of 0.75% Ropivacaine with 45 mcg clonidine.

GROUP 2(P): Patients who were given ultrasound guided perineural space posterior sciatic nerve block with 25ml of 0.75% Ropivacaine with 45 mcg clonidine.

Data analysis- The Excel and SPSS (SPSS Inc, Chicago v 18.5) software packages were used fordata entry and analysis respectively.

Ethical consideration- Clearance from the Institutional Ethics Committee was taken before beginning the study.

A pre-operative assessment was done for all the patients in this study and a well-informed written consent for the procedure was taken before the procedure in their own language. One day prior to surgery blood investigations like CBC, ECG, chest x-ray and urine were done. After skin disinfection, local skin infiltration with Inj. 2% lignocaine, a 10cm long 21-G insulated needle was inserted from the lateral extremity ofthe probe, in-plane with the ultrasound beam.

Test injection of 1 ml of local anaesthetic preparation was injected in both the groups (group 1-subgluteal space and group 2- perineural space.)

Needle was withdrawn after the block and patient is now placed in supine position.

Sensory blockade onset was graded as

GRADE	Interpretation
A	No sensation to touch and pain
P	Sensation present in all dermatomes

Motor blockade was evaluated by the movement of the lower limb.

Muscle power grading was marked from grade 0-4.

All vital parameters were monitored every 2 mins immediately after the block for the first 20 mins.

The surgery was allowed after confirming a complete sensory and motor block, 50 -100 µg fentanyl were given as supplemental analgesia as required. All patients were observed for any side‑effects and complications like symptoms of local anesthetic toxicity (peri-oral numbness, seizures, cardiovascular changes, unconsciousness),

ISSN: 0975-3583,0976-2833 VOL15, ISSUE 03, 2024

nausea, vomiting, dryness of mouth, haematoma, and post‐block neuropathy in the intra‐and 24 h post‐operative periods.

Result

Table 1: Evaluation of block performance time (in mins) in between 2 study groups

Group	**N**	**Mean**	**SD**	**Median**	**Min.**	**Max.**	**'p' value***
Group 1	30	17.5	2.543	17.5	15	20	***0.014***
Group 2	30	19.0	2.034	20.0	15	20	

*Student 't' test

In the present study, the time taken for block performance is 17.5± 2.543 min in Group 1 and 19± 2.034 min in Group 2. The time taken for performance of the block is significantly prolonged in Group 2 when compared to Group 1, the p value being 0.014.

Table 2: Evaluation of onset of sensory blockade (in min) in the 2 study groups

Group	N	Mean	SD	Median	Min.	Max.	'p' value*
Group 1	30	17.0	0.718	17.0	16	18	***<0.001***
Group 2	30	14.4	0.855	15.0	13	15	

*Student 't' test

In the present study, the time taken for sensory block onset is 17 ± 0.738min in Group 1 and 14.4 ± 0.855min in Group 2. The time taken for onset of sensory block is significantly prolonged in Group 1 when compared to Group 2, the p value being < 0.001.

Table 3: Evaluation of onset of motor blockade (in min) in the 2 study groups

Group	N	Mean	SD	Median	Min.	Max.	'p' value*
Group 1	30	26.4	1.732	25.0	25	30	***<0.001***
Group 2	30	20.8	1.234	20.0	20	25	

*Student 't' test

In the present study, the time taken for motor block onset is 26.4±1.732min in Group 1 and 20.8± 1.234min in Group 2.The time taken for onset of motor block is significantly prolonged in Group 1 when compared to Group 2, the p value being <0.001.

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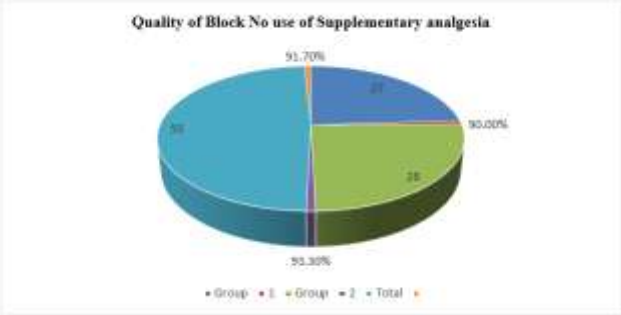

Figure 1: Comparison of quality of block in between 2 study groups

90% of patients in group 1 and 93.3% of patients in group 2 achieved a score of 1 (no supplementary analgesia used, quality of block score 1). Supplementary analgesia was used (quality of block score 2) in 10% of patients in group 1 and 6.7% of patients in group 2. The quality of block between both the groups was not statistically different.

Table 4: Assessment of Heart rate (in beats per min) in timeline of patients studied

	Group	N	Mean	SD	Min.	Max.	p value*
0 min	Group 1	30	82.5	13.736	60	108	0.637
	Group 2	30	84.3	16.118	60	116	
5 min	Group 1	30	80.4	12.569	62	105	0.404
	Group 2	30	83.5	15.798	62	114	
15 min	Group 1	30	79.0	12.297	59	104	0.220
	Group 2	30	83.6	16.019	60	115	
30 min	Group 1	30	79.3	11.674	64	105	0.298
	Group 2	30	82.8	14.482	62	113	
45 min	Group 1	30	77.5	11.831	62	101	0.139
	Group 2	30	82.7	14.542	62	110	
60 min	Group 1	30	77.7	11.429	63	102	0.242
	Group 2	30	81.8	15.187	61	112	
75 min	Group 1	30	77.8	11.910	60	100	0.162
	Group 2	30	82.6	14.395	62	112	
90 min	Group 1	30	77.5	11.506	62	106	0.129
	Group 2	30	82.6	13.841	62	106	
105 min	Group 1	30	76.8	11.531	61	103	0.082
	Group 2	30	82.6	13.793	60	108	
120 min	Group 1	30	77.7	11.847	60	104	0.234
	Group 2	30	81.7	13.814	61	107	

*Student ‘t test

The Mean heart rate at baseline, over interval of 15 min till 120 min between the two groups was not statistically significant.

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Table 5: Assessment of systolic blood pressure (in mm hg) in timeline of patients studied

Time	Group	N	Mean	SD	Min.	Max.	p value*
0 min	Group 1	30	136.6	23.292	90	176	0.484
	Group 2	30	132.4	23.264	96	176	
5 min	Group 1	30	137.2	23.252	95	177	0.448
	Group 2	30	132.7	22.398	98	175	
15 min	Group 1	30	136.6	22.800	91	175	0.441
	Group 2	30	132.1	22.137	97	173	
30 min	Group 1	30	136.3	23.054	93	173	0.572
	Group 2	30	133.0	22.362	99	177	
45 min	Group 1	30	137.4	23.093	98	175	0.493
	Group 2	30	133.4	21.747	101	175	
60 min	Group 1	30	136.6	22.471	96	175	0.637
	Group 2	30	133.8	22.214	98	176	
75 min	Group 1	30	136.7	22.903	97	177	0.529
	Group 2	30	133.0	22.339	97	176	
90 min	Group 1	30	137.2	23.252	95	177	0.448
	Group 2	30	132.7	22.398	98	175	
105 min	Group 1	30	136.3	23.054	93	173	0.572
	Group 2	30	133.0	22.362	99	177	
120 min	Group 1	30	137.1	22.468	100	176	0.347
	Group 2	30	130.8	28.586	57	176	

*Student t- test

The Mean (SD) systolic blood pressure at baseline, over interval of 15 minutes till 120 minutes between the two groups was not statistically significant.

Table 6:Assessment of Diastolic blood pressure (in mm hg) in timeline of patients studied

Time	Group	N	Mean	SD	Min.	Max.	p value*
0 min	Group 1	30	78.0	7.801	56	88	0.147
	Group 2	30	74.4	10.615	56	95	
5 min	Group 1	30	76.8	10.488	51	93	0.218
	Group 2	30	73.6	9.807	55	93	
15 min	Group 1	30	77.2	9.678	55	91	0.121
	Group 2	30	73.1	10.317	53	95	
30 min	Group 1	30	76.8	9.713	56	95	0.130
	Group 2	30	72.9	9.934	57	96	
45 min	Group 1	30	77.5	9.328	54	93	0.118
	Group 2	30	73.5	9.874	56	97	
60 min	Group 1	30	78.0	9.428	56	96	0.124
	Group 2	30	74.2	9.581	54	95	

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75 min	Group 1	30	78.1	9.479	58	95	0.147
	Group 2	30	74.3	10.514	57	96	
90 min	Group 1	30	77.6	9.231	56	94	0.231
	Group 2	30	74.5	10.368	55	98	
105 min	Group 1	30	78.6	8.287	58	90	0.078
	Group 2	30	74.3	10.059	55	96	
120 min	Group 1	30	77.2	9.678	55	91	0.121
	Group 2	30	73.1	10.317	53	95	

*Student ‘t- test

The Mean (SD) diastolic blood pressure at baseline, over interval of 15 minutes till 120 minutes between the two groups was not statistically significant.

Table 7: Assessment of SPo2 in timeline of patients studied

Time	Group	N	Mean	SD	Min.	Max.	p value*
0 min	Group 1	30	98.1	1.224	95	100	0.499
	Group 2	30	97.9	1.423	95	100	
5 min	Group 1	30	98.3	1.048	96	100	0.605
	Group 2	30	98.4	1.406	96	100	
15 min	Group 1	30	98.9	1.143	97	100	0.078
	Group 2	30	98.4	1.163	96	100	
30 min	Group 1	30	99.1	1.008	97	100	0.269
	Group 2	30	98.8	1.073	96	100	
45 min	Group 1	30	99.5	0.937	96	100	0.100
	Group 2	30	99.1	0.917	97	100	
60 min	Group 1	30	99.2	1.008	97	100	0.459
	Group 2	30	99.0	1.073	96	100	
75 min	Group 1	30	99.3	0.837	97	100	0.195
	Group 2	30	99.0	0.932	97	100	
90 min	Group 1	30	98.6	0.964	97	100	0.418
	Group 2	30	98.7	0.935	97	100	
105 min	Group 1	30	99.2	0.925	97	100	0.257
	Group 2	30	98.9	1.098	96	100	
120 min	Group 1	30	99.3	0.837	97	100	0.195
	Group 2	30	99.0	0.932	97	100	

*Student ‘t test

The Mean SpO2 at baseline, over interval of 10 minutes till 120 minutes between the two groups was not statistically significant.

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Figure 2: Patient satisfaction

There was 100% satisfaction among both the study groups

Discussion

In Rania Maher Hussein *et al.*[5] study block performance time in subgluteal group was 18.15 ± 4.7 min, while in Karmakar *et al.*[6] study it was 15-20 min and whereas in our study it was 19.0 ± 2.034 which was consistent with other above conducted studies.

In the above study sensory block in group 1 was 17.00±0.718 and in group 2 was 14.4±0.815.The onset of motor blockade in group 1 was 26.4±1.732 min and in group 2 was 20.8±1.234 min which is statistically significant. Early onset of motor blockade in Group 2 which is consistent with studies conducted by Rania Maher Hussaien *et al.* 2018.[5] In their study, they found that the subgluteal block took longer duration to perform block (18.15±4.7min) when compared to popliteal block (11±3.8 min). The onset of motor block was slower in subgluteal group (26.63±2.57 min) than the popliteal group (23±1.5 min). Also, the onset of sensory blockade in popliteal group (12.3±1.3 min) was faster than the subgluteal group (17.2±1.61 min).

In above study, total duration of the block for subgluteal space injection was 11 ± 1.102 while in Rania Maher Hussein *et al.*[5] study it was 10.04±1.39 hrs. Longer duration in our study is due to Ropivacaine and use of adjuvant clonidine.

The above study did not show statistically significant changes in systolic blood pressure, diastolic blood pressure and heart rate, mean arterial pressure and spo2 intra-operatively. The blood pressure, pulse rate was significantly stable in both the groups and oxygen saturation remained almost same in both groups.

In Pia di Benedetto *et al.*[7] study patient satisfaction was 77% in group 1 and 94% in group 2, while in Manuel Taboada *et al.*[8] study in group 1 92% and group 2 96% they were landmark guided approaches. But the above study had 100% patient satisfaction which was consistent with Rania Maher Hussein *et al.*[5] study which were done using ultrasound guidance which reinforces the decrease in number of needle pricks due to needle visualization and better drug placement.

Conclusion

Based on the observations from the study it was concluded, that time of onset of sensory and motor blockade was significantly shorter with perineural space injection in posterior sciatic nerve block. Mean block performance was faster in sub-gluteal group and duration of the block was longer in perineural group. There was no significant hemodynamic changes and complications in the study groups.

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