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A Comparative Study Between The Outcome Or Effectiveness Of Ultrasound Guided V/S External Anatomical Landmark Technique For Femoral Nerve Block In A Isolated Lower Limb Injuries

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I. Introduction:

Emergency physicians frequently come across patients who require intravenous and intramuscular pain relievers in order to treat acute traumatic injuries prior to initial care procedures like transfer from stretcher to stretcher, imaging, fracture reduction, joint dislocation reduction, wound care, and pain relief. In such cases, regional nerve blocks can provide sufficient and quick pain relief. Ambrose Pare, a French surgeon, developed a conventional kind of regional anaesthesia in the 16th century by compressing peripheral nerves during a protracted time of intense analgesia distal to the point of compression. In the late 19thand early 20th centuries, specialised needles and catheters for regional nerve blocks were initially developed. The accuracy and safety of peripheral nerve blocks and neuraxial treatments have increased thanks to more recent technical developments including nerve stimulation and ultrasound guidance.[1]

Emergency medical professionals use a specific localised anaesthetic technique called as a femoral nerve block to deliver anaesthesia and analgesia for the injured leg, to ease pain from the fracture, and to make it simpler to fit the injured limb into a splint. Femoral nerve blocks can be performed with either anatomical or ultrasonographic guidance. The intrinsic benefits of visual sight of the nerves and surrounding anatomy, ongoing inspection of the needle tip, and local anaesthetic distribution make ultrasound-guided regional anaesthesia particularly alluring.[2]

However, ultrasound-guided FNB is a rarely used technique for treating lower limb injuries. Lack of training, participants' trust in providing an efficient and secure FNB block blindly, and time restrictions were the biggest barriers to adopting ultrasonography for FNB.

There must also be proof of higher benefits and fewer issues in the cost-conscious health-care environment and to persuade sceptics. [3]

Anecdotal reports of successful US-guided nerve blocks being utilised at university emergency departments are becoming more and more common. However, to date, there hasn'tbeen a randomised controlled trial in the ED setting comparing FNB given blindly or under ultrasound guidance. Ultrasound-guided FNB has a quicker onset of action than FNB administered anatomically or with a nerve stimulator (NS), is more effective and safe, and probably needs a lower dose of local anaesthetic.

In this study, we compare the efficacy and safety of USG guided femoral nerve block with anatomical femoral nerve block for the treatment of pain in patients with isolated lower limb injuries.

II. Aim And Objectives

Aim

to evaluate the effectiveness and safety of ultrasound versus anatomical femoral nerve block in emergency rooms for isolated lower limb injuries in order to increase patient cooperation during immobilisation and radiological examinations.

Objectives

1. To compare and assess how well the femoral nerve block treated pain in both groups.
2. To compare how long it took for each group to reach its peak efficiency.
3. To assess complications between the two groups.

III. Materials And Methods

Ethics and consent: - "Institute Ethics Committee Clearance obtained before startof study". Written and informed consent obtained from all patients. The patients wereinformed regarding the purpose, procedures, risks and benefits of the study.

Sample Size - 60 patients. All the patients who gave consent and willing to participateare included in our study.

Methodology - Prospective comparative analytical study.

Place of study - Study conducted on the patients in the department of emergency medicine at Mahatma Gandhi Mission Medical College and Hospital, Kamothe, Navi Mumbai.

Period of study - Study conducted from December 2020 to July 2022

Inclusion criteria –

1) Patients giving informed consent
2) Age above 18
3) Patients with isolated lower limb fractures.
4) ASA grade I-II-III

Exclusion criteria –

1) Age<18
5) Pregnant women
6) Polytrauma/head/abdominal injury
7) Hemodynamically unstable patients,
8) Local infection.
9) Patient susceptive of compartment syndrome.

Way of study -

The study was include patients who present to the emergency department of MGM hospital with isolated lower limb injuries from December 2020 to July 2022

1. Patients are divided into 2 groups of 30 each:

Group A: Patients in whom USG femoral nerve block is given. Group B: Patients in whom anatomical femoral nerve block is given

2. The basis for classification into group A and group B was basis of random selection using chit block method.
3. The study conducted as follows.

a) Details of Demographic data (Name, age, gender, address, mobile number) will benoted.
b) Patients will be assessed (primary assessment) for their chief complaints andsymptoms.
c) History of comorbidities noted
d) The following vital signs noted

Pulse Rate

i. Respiratory Rate
ii. Blood Pressure
iii. Saturation %.
iv. Visual analogue scale (VAS)(1-10)

e) Femoral nerve block will be administered and efficacy will be evaluated using VAS both at rest and during movement.
f) Pain relief and vitals recorded as per proforma attached.(at 0 mins, 10 mins,20 mins, 30 mins, 1 hour, 2 hours, 3 hours and 4 hours)
g) Rescue analgesia in the form of injection Tramadol 30 mg I.M. administered ifVAS > 4/10 is observed.
h) Patient evaluated for any complications like local anaesthetic toxicity, allergicreactions to local anaesthetic, any vascular injury while administering the block.

Ultrasound guided technique

1. Position the patient supine with leg extended and slightly externally rotated
2. Operator stands next to the side where the block is administered
3. Ultrasound screen will be on the opposite side of the patient

4. Under all aseptic precautions USG imaging will be performed with high frequency linear probe (7-12MHz).
5. USG imaging: Femoral artery will be identified as a round pulsating non compressiblevessel and vein as an oval and compressible vessel. Doppler will be used to confirm theartery. Femoral nerve is located lateral to the artery. Nerve appears as a triangular or elliptical hyperechoic structure immediately lateral to femoral artery.
6. Insertion of needle will be done inplane approach.
7. Fifteen mL 2% lignocaine with adrenaline (not exceeding dose of 3mg/kg) will be injected after confirmation of needle position and repeated aspiration.

Anatomical femoral nerve block

1. Position the patient supine with leg extended and slightly externally rotated
2. Palpate the femoral artery pulsation
3. 1 cm lateral to femoral artery pulsation fifteen mL of 2% lignocaine with adrenaline(not exceeding dose of 3mg/kg) will be injected after repeated aspiration

Observation for efficacy, time taken for maximum pain relief and complications

1. Femoral nerve block is considered efficacious if VAS scale < 4/10 or if VAS reducedby more than 4cm.
2. Time taken for block to reach maximum efficacy should be less than 40 minutes.
3. Complications assessed will be:

i. Local anaesthetic toxicity
ii. Allergic reactions to local anaesthetic
iii. Hematoma formation
iv. Any vascular injury

Monitoring:

Post-Procedure evaluation: Group A: Ultrasound guided femoral nerve block)

Time	Pulse	B. P	SpO2	R.R	VAS		Complications	Rescue analgesia
					Rest	Movement		
0 min								
10 mins								
20 mins								
30 mins								
1 hour								
2 hours								
3 hours								
4 hours								

Post procedural: Group B: Anatomical femoral nerve block)

Time	Pulse	B. P	SpO_2	R.R	VAS		Complications	Rescue analgesia
					Rest	Movement		
0 min								
10 mins								
20 mins								
30 mins								
1 hour								
2 hours								
3 hours								
4 hours								

Statistical Analysis of Results:

1. Collected data coded and entered in Microsoft Excel sheet.
2. Statistical analysis carried out using software SPSS- statistical package forsocial sciences version 20.0.
3. Quantitative variables expressed by using mean, median, and standard deviation.
4. Qualitative variables expressed by using frequency and percentage (%).
5. The estimated sample size is around 100 for my study but as per my inclusion criteriaestimated sample size is around 60.
6. Data analysed using Paired T test and Independent T test.

IV. Results:

Patients are divided into 2 groups of 30 each:

Group 1: Patients in whom anatomical femoral nerve block is givenGroup 2: Patients in whom USG femoral nerve block is given.

Table 1: Distribution of the study participants according to their age group

AGE GROUP		GROUP		TOTAL	P VALUE
		1	2		
21-30	Count	8	6	14	0.570
	%	26.7%	20.0%	23.3%	
31-40	Count	8	9	17	
	%	26.7%	30.0%	28.3%	
41-50	Count	7	4	11	
	%	23.3%	13.3%	18.3%	
>50	Count	7	11	18	
	%	23.3%	36.7%	30.0%	
MEAN+SD		43.67+17.53	45.93+16.59	44.80+16.96	

26.7% of the study participants in group 1 belonged to the age group 21-30 and 31-40 years respectively. 30% and 20% of the study participants in group 2 belonged to the age group 31-40 years and 21-30 years respectively. The association was not found to be statistically significant between the age group and the 2 groups of the study. The mean age of the study participants in group 1 and 2 were found to be 43.67+17.53 and 45.93+16.59 respectively.

Figure *1*: Distribution of the study participants according to their age group

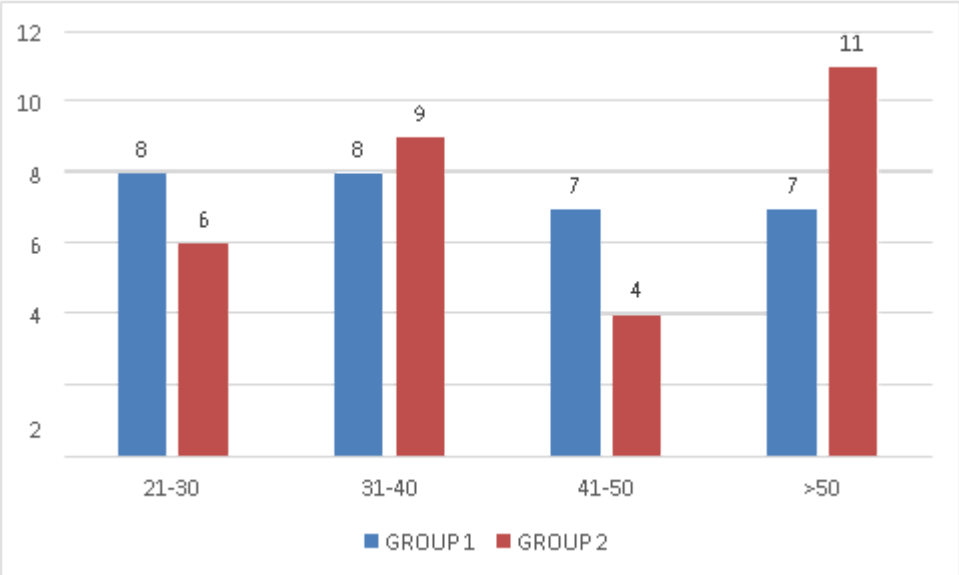
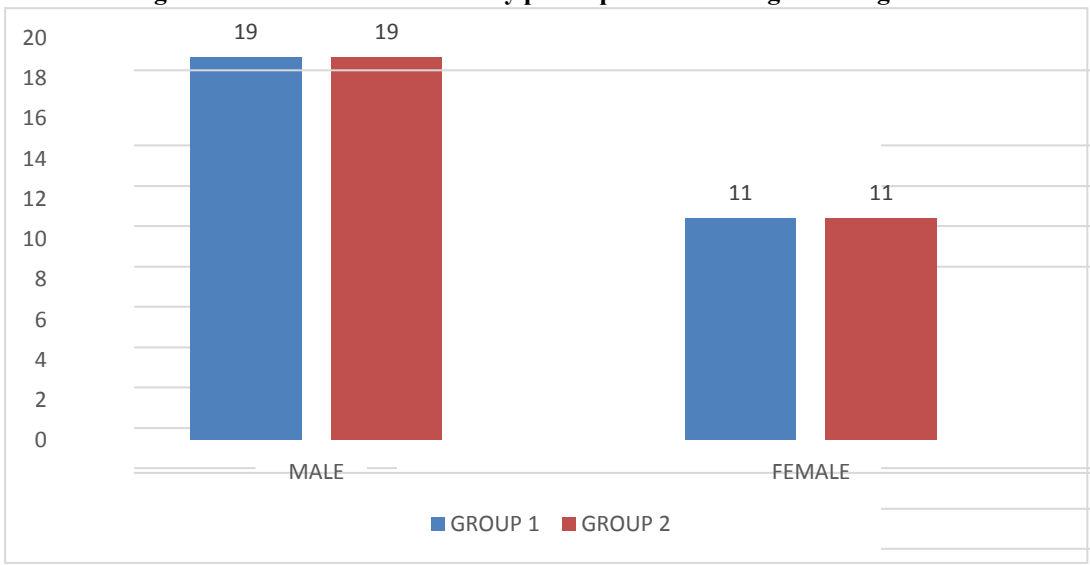


Table 2: Distribution of the study participants according to their gender:

GENDER		GROUP		TOTAL	P VALUE
		1	2		
MALE	Count	19	19	38	0.605`
	%	63.3%	63.3%	63.3%	
FEMALE	Count	11	11	22	
	%	36.7%	36.7%	36.7%	

Figure 2: Distribution of the study participants according to their gender:

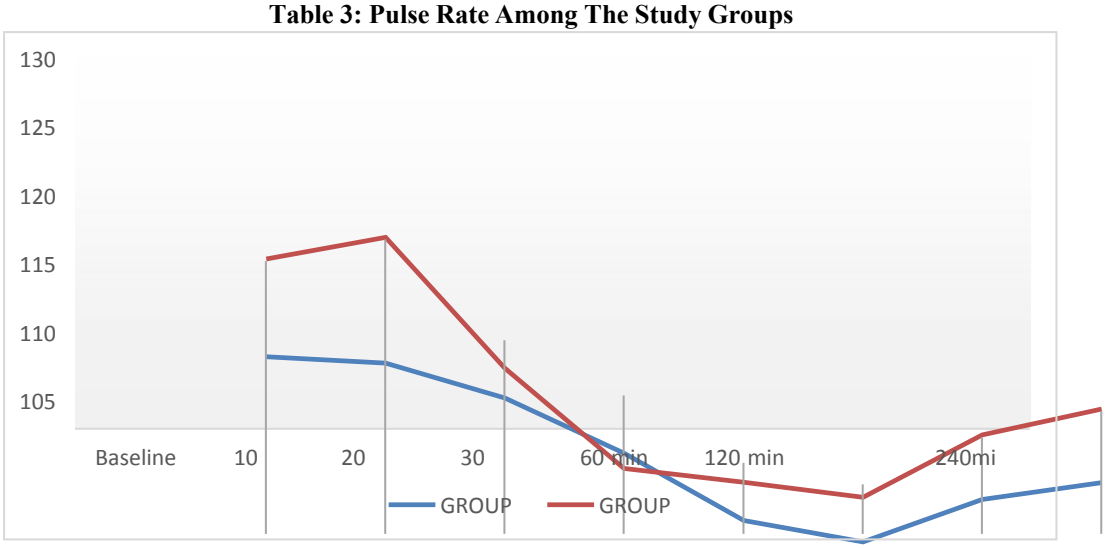


Majority of the study participants were males (63.3%) with females contributing to36.7% of study population in both the groups. The association was not found to be statistically significant between the gender and the 2 groups of the study.

Table 3: Pulse Rate Among The Study Groups

PULSE RATE									
GROUP		**Baseline**	**10 min**	**20 min**	**30 min**	**60 min**	**120 min**	**180min**	**240min**
1	Mean	119.03	118.53	115.67	111.20	105.77	104.03	107.47	108.83
	S. D	6.805	6.230	6.625	6.925	5.418	5.282	4.953	4.814
2	Mean	122.13	123.87	113.27	105.13	104.00	102.80	107.87	109.93
	S. D	7.754	7.352	6.203	6.118	5.458	5.768	6.078	6.113
Total	Mean	120.58	121.20	114.47	108.17	104.88	103.42	107.67	109.38
	S. D	7.400	7.271	6.477	7.164	5.465	5.518	5.501	5.484
P VALUE		0.105	**0.004**	0.153	**0.001**	0.213	0.391	0.781	0.442

Table 3: Pulse Rate Among The Study Groups



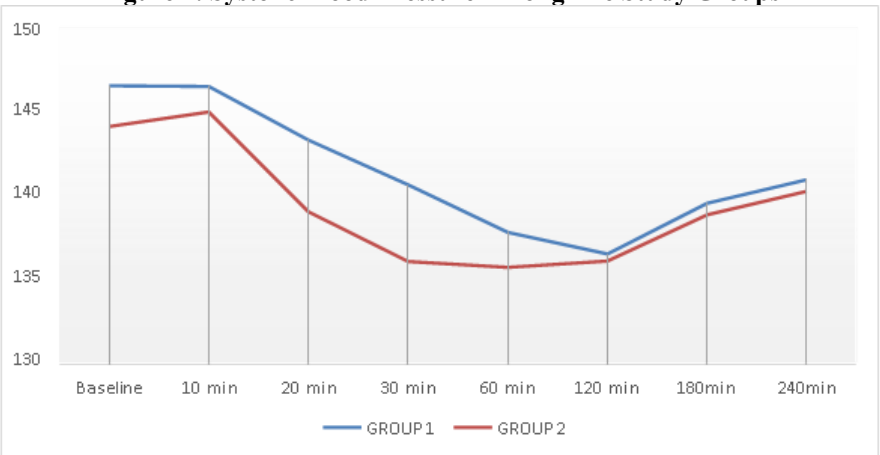
The mean values of PR of Group 1 were found to be higher than group 2 at baseline, 10th minute, 180th minute and 240th minute. The mean values of PR of Group 2 were found tobe higher than group 1 at baseline, 20th minute, 30th minute and 60th minute and 120th minute.The association was found to be statistically significant

between the pulse rate and the 2 groups of study participants at 10th minute and 30th minute.

Table 4: Systolic Blood Pressure Among The Study Groups

SYSTOLIC BLOOD PRESSURE									
GROUP		**Baseline**	**10 min**	**20 min**	**30 min**	**60 min**	**120 min**	**180min**	**240min**
1	Mean	144.00	143.93	138.33	133.67	128.73	126.47	131.73	134.20
	S. D	7.575	6.817	7.448	7.029	7.834	7.802	6.802	5.857
2	Mean	139.73	141.27	130.87	125.67	125.07	125.73	130.53	133.00
	S. D	8.399	8.329	5.673	4.816	5.552	6.209	4.725	5.139
Total	Mean	141.87	142.60	134.60	129.67	126.90	126.10	131.13	133.60
	S. D	8.216	7.665	7.567	7.208	6.981	7.000	5.838	5.496
P VALUE		**0.043**	0.180	**0.000**	**0.000**	**0.041**	0.689	0.431	0.402

Figure 4: Systolic Blood Pressure Among The Study Groups



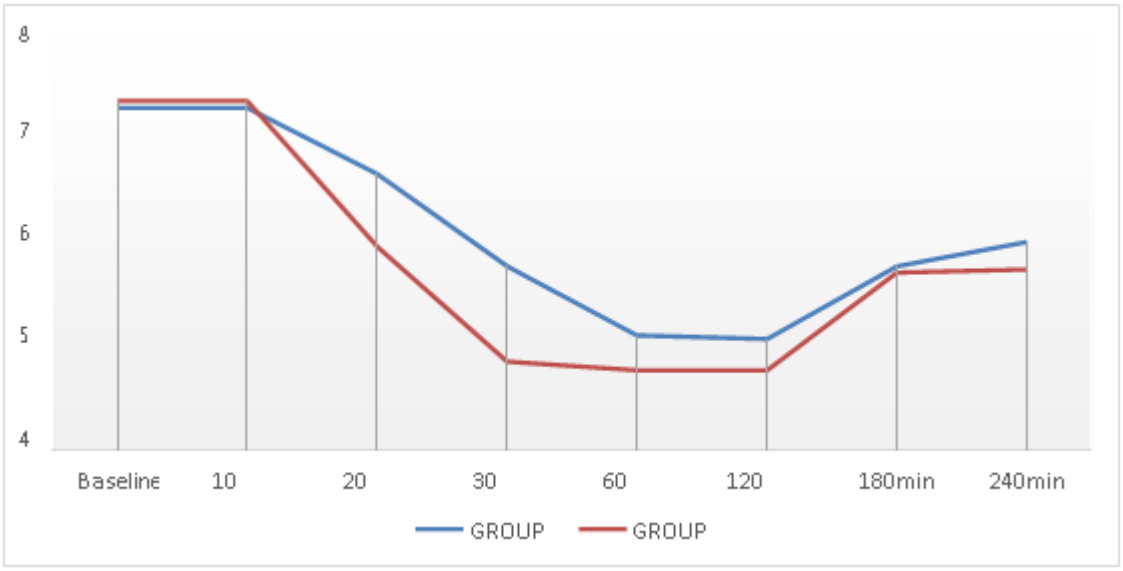
The mean values of SBP of Group 1 were found to be higher than group 2 at all timesof measurement. The association was found to be statistically significant between the SBP and the 2 groups of study participants at baseline, 20th minute 30th minute and 60th minute.

Table 5: Visual Analogue Score - Rest Among The Study Groups

VISUAL ANALOGUE SCORE - REST									
GROUP		**Baseline**	**10 min**	**20 min**	**30 min**	**60 min**	**120 min**	**180min**	**240min**
1	Mean	6.57	6.57	5.30	3.53	2.20	2.13	3.53	4.00
	S. D	0.774	0.774	0.651	1.074	1.270	1.252	0.776	0.695
2	Mean	6.70	6.70	3.90	1.70	1.53	1.53	3.40	3.47
	S. D	0.702	0.702	0.712	0.466	.507	0.507	0.498	0.507
Total	Mean	6.63	6.63	4.60	2.62	1.87	1.83	3.47	3.73
	S. D	0.736	0.736	0.978	1.236	1.016	.994	0.650	0.660
P VALUE		0.487	0.487	**0.000**	**0.000**	**0.010**	**0.018**	0.432	**0.001**

The mean values of VAS at rest of Group 1 were found to be higher than group 2 at baseline and 10th minute. The mean values of VAS at rest of Group 2 were found to be higherthan group 1 at 20th minute, 30th minute and 60th minute and 120th minute, 180th minute and 240th minute. The association was found to be statistically significant between the VAS at rest and the 2 groups of study participants at baseline, 20th minute, 30th minute, 60th minute, 120th minute and 240th minute.

Figure 5: Visual Analogue Score - Rest Among The Study Groups



V. Discussion:

The ability to appropriately identify the nerves involved in surgery and place an adequate amount of local anaesthetic around them to achieve a thorough impregnation of all affected nerves was essential for the effectiveness of peripheral nerve blocks. The techniques for determining the location of a nerve relied on either inducing paresthesia or identifying theappropriate motor response to nerve stimulation. According to reports, neither of these two methods is very sensitive to the presence of a needle in a nerve.

The use of ultrasound guidance has been made more common in clinical settings as a potential method for locating peripheral nerves, with the potential benefit of optimising the distribution of the local anaesthetic solution around the nerves while the procedure is being seen sonographically. However, just a few research have compared ultrasonic guidance with electrical nerve stimulation, and randomised controlled trials are necessary to assess the potential benefits of sonographic guidance..

Prospective comparative analytical study was done, a total 60 patients were divided into 2 groups of 30 each. Patients with isolated lower limb fracture with ASA grade I-II-III were included in the study.

Group 1: Patients in whom anatomical femoral nerve block is givenGroup 2: Patients in whom USG femoral nerve block is given.

Distribution of the study participants according to their age group:

In the present study 26.7% of the study participants in group 1 belonged to the age group 21- 30 and 31-40 years. 30% and 20% of the study participants in group 2 belonged to the age group 31-40 years and 21-30 years respectively. The mean age of the study participants in group 1 and 2 were found to be 43.67+17.53 and 45.93+16.59 respectively. In a study done by Janagal A et al[40], mean age of participants in both group were 61.38±15.05 years. This difference is due to type of surgery done was different. Similarly In a study done by PattajoshiB et al [41]. The mean age of the study subjects was found to be 46.13 ± 10.23 years in groupA and 42.30 ± 7.64 years in group B. Local nerve block provides better Anaesthesia for minorprocedures, which is being commonly used.

Distribution of the study participants according to their gender:

In the present study majority of the study participants were males (63.3%) with femalescontributing to 36.7% of study population in both the groups. In a study done by Janagal A etal [40] & Pattajoshi B et al [41] there was equal representation of both genders for maintainingcomparability between groups.

Pulse Rate Among The Study Groups

In the present study the mean values of PR of Group 1 were found to be higher than group 2 atbaseline, 10^{th} minute, 180^{th} minute and 240^{th} minute. The mean values of PR of Group 2 werefound to be higher than group 1 at baseline, 20^{th} minute, 30^{th} minute and 60^{th} minute and 120^{th}minute. Similarly In a study done by Pattajoshi B et al [41]. The association was found to be statistically significant between the pulse rate and the 2 groups of study participants at 10^{th} minute and 30^{th} minute. Oxygen saturation levels, however, were more in group A as comparedto group B and this was statistically significant

Systolic Blood Pressure Among The Study Groups

The mean values of SBP of Group 1 were found to be higher than group 2 at all times of measurement. The association was found to be statistically significant between the SBP andthe 2 groups of study participants at baseline, 20th minute 30th minute and 60th minute. Similarly, in the study done by Janagal A et al[40], Hemodynamic parameters during surgery were comparable between the groups. Similar numbers of patients in both groups experiencedbradycardia or hypotension, perhaps as a result of the effects of spinal anaesthesia.

Visual Analogue Score - Rest Among The Study Groups

The mean values of VAS at rest of Group 1 were found to be higher than group 2 at baseline and 10th minute. The mean values of VAS at rest of Group 2 were found to be higherthan group 1 at 20th minute, 30th minute and 60th minute and 120th minute, 180th minute and 240th minute. The association was found to be statistically significant between the VAS at restand the 2 groups of study participants at baseline, 20th minute, 30th minute, 60th minute, 120th minute and 240th minute. In a study done by Gupta et al.[42] reported significant VAS reductionafter 5 minutes in a group receiving US-guided FNB in fracture femur surgeries Similarly, in the study done by Janagal A et al[40], In comparison to NS-guided FNB, we observed earlier pain alleviation at 5 and 10 minutes in US-guided FNB. This was most likely brought on by the careful positioning of the drug near the femoral nerve rather than its blind placement in group NS. After 15 minutes, however, the VAS reduction was equivalent amongst the groups.This indicates an early start with the US-led FNB strategy.

Visual Analogue Score - Movement Among The Study Groups

The mean values of VAS at movement of Group 1 were found to be higher than group2 at baseline and 10th minute. The mean values of VAS at rest of Group 2 were found to be higher than group 1 at 20th minute, 30th minute and 60th minute and 120th minute, 180th minute and 240th minute. The association was found to be statistically significant between the VAS atmovement and the 2 groups of study participants at baseline, 20th minute 30th minute, 60th minute, 120th minute and 240th minute.

Distribution of the study participants according to rescue analgesia:

In the present study 30% of the study participants in group 1 had the need for rescue analgesia and 10% of the study participants in group 2 had the need for rescue analgesia. The two research groups and the requirement for rescue analgesia were shown to be statistically associated. Similar results were seen in the study by Janagal A et al [40], where the prolongedtime of analgesia and lower total tramadol dose requirement in the US-guided technique further demonstrate how the placement of the local anaesthetic proximal to the nerve influences the results. Our results were comparable to those obtained by Jain et al.[43] using 0.5% ropivacainefor FNB. We had 7.7 hours of analgesia with US-guided FNB, compared to Gupta et al study hours, which may be explained by the use of several local anaesthetics. Singh et al. [45]foundthe duration of analgesia to be 6 hours with nerve stimulating technique of FNB using 0.2% ropivacaine, whereas it was 4.7 hours in our study. This may be due to the additive effect of 0.75% ropivacaine used intra-spinally and top-ups of 0.2% ropivacaine used intraoperatively by them.

Distribution of the study participants according to complications:

20% of the study participants in group 1 had complications. Local site hematoma contributed for 13.3% and arterial puncture contributed for 6.7% of complications. Like Janagal A. et alstudy[40], .'s our study's FNB-related problems were primarily vascular puncture and skin bruising in the case of NS method due to blind execution. The incidence ofvascular puncture after nerve stimulation technique of peripheral nerve blocks has been reported by various authors to range between 15% and 56.4%, compared to 5% by ultrasound modality. [44-49] The use of the NS approach does not ensure that the needle will not be inserted intraneurally. Although Schafhalter-Zoppoth et al.[46] reported nerve damage without significant negative outcomes when using ultrasonic method, we did not see any such consequence in any of the patients in our investigation.

VI. Conclusion:

Patients are divided into 2 groups of 30 each: Patients in whom anatomical femoral nerve block is given & Patients in whom USG femoral nerve block is given. The mean age ofthe study participants in group 1 and 2 were found to be 43.67+17.53 and 45.93+16.59

respectively. Majority of the study participants were males (63.3%) with females contributingto 36.7% of study population in both the groups. PR variations seen in both the groups. significant VAS reduction after 5 minutes in a group receiving US-guided FNB. 30% of the study participants in group 1 had the need for rescue analgesia and 10% of the study participants in group 2 had the need for rescue analgesia. 20% of the study participants in group 1 had complications. Local site hematoma contributed for 13.3% and arterial puncture contributed for 6.7% of complications.

Femoral nerve block provided effective analgesia during positioning of patients for spinal Anaesthesia

undergoing fracture femur surgery. But, an ultrasound-guided technique could be performed safely with better patient comfort and longer duration of analgesia than landmark nerves stimulation technique.

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