Effectiveness of Ultrasound-Guided versus Anatomical Landmark Guided Genicular Nerve Block for the Treatment of Chronic Knee Osteoarthritis: A Retrospective Cohort Study

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Abstract

Objectives: Genicular nerve block (GNB) has been used for the treatment of chronic knee osteoarthritis (OA), however its effectiveness among the Malaysian population is limited. This study aims to determine and compare the effectiveness of GNB administered using anatomical landmarks and USG guided techniques for the treatment of chronic knee OA.

Methods: A retrospective cohort study was conducted among 40 patients with chronic knee OA of which half received GNB via USG and anatomical landmark guided techniques respectively. Pain, stiffness and functional limitation scores were assessed using the Western Ontario and McMaster Universities Osteoarthritis Index Questionnaire (WOMAC) and Numeric Rating Scale (NRS -11) at baseline and post treatment day one, 3 weeks and 6 weeks.

Results: Both groups reported significant reduction in WOMAC and NRS -11 scores post treatment intervals compared to baseline. A higher reduction in WOMAC and NRS-11 scores was observed among patients receiving GNB via USG guided compared to anatomical landmark guided techniques, with statistically significant reduction being observed at 6-week post treatment (p=0.026).

Conclusions: GNB administration using both USG and anatomical landmark guided techniques was both effective in significantly reducing pain, stiffness, functional limitation as soon as day 1 to 6-week post treatment among patients suffering from chronic knee OA. However, USG guided GNB administration appears to be more effective in the treatment of chronic knee OA compared to anatomical landmark guided GNB administration. Nevertheless, anatomical landmark GNB administration would be a viable effective treatment modality especially in healthcare settings with limited to no USG facilities.

Keywords: Genicular Nerve Block; Knee Osteoarthritis; Ultrasound; Anatomical Landmark; Malaysia.

Introduction

Osteoarthritis (OA) is the commonest form of degenerative joint disease that most frequently affects the knees, hands and hips.[1–3]OA is a multifactorial disease with several demographic (i.e. advancing ages and

female gender), genetic and metabolic risk factors.[2–4] Knee OA occurs when the cartilage within the knee joint begins to break down resulting in underlying bony changes. The process of OA generally develops gradually and progressively worsen over time resulting in joint related pain, stiffness and swelling.[5] In addition, individuals suffering from severe knee OA may experience reduction in functional mobility of the knee joint which could affect their activities of daily living and may even render them disable.[4] Globally the prevalence of OA has increased by 113.25% from 1990 (247.51 million) to 2019 (527.81 million) respectively, where in, knee OA accounts for almost four fifths of the burden of OA worldwide.[4] Consistent with global trends, Malaysia is also facing an increasing prevalence of OA owing to a combination of risk factors such as advancing age and obesity, both of which are increasingly prevalent in Malaysia.[6]

Currently there are several pharmacological treatments for knee OA which include analgesia, intra-articular injections and visco supplements.[7] However, when pharmacological intervention fails or become suboptimal then surgical interventions would be the next modality of treatment. However not all individuals who require surgical interventions may be suitable for surgery due to their underlying medical comorbidities and risk of surgery.[8] In addition, patients may not be keen for invasive surgical procedure and may resort to traditional and complementary medicine to treat knee OA.[9] In such case the administration Genicular Nerve Block (GNB) which is a treatment modality that temporarily blocks the painful genicular nerve signals in the knee appears to be a viable intervention which has been shown effective in alleviating pain in chronic knee OA especially in these sub set of patients that are unfit or unwilling to undergo surgical procedure.[10–12] The genicular nerves are the main articulating nerve branches of the knee, where in there are four nerves which are the superomedial genicular nerve (SMGN), superolateral genicular nerve (SLGN), inferomedial genicular nerve (IMGN) and inferolateral genicular nerve (ILGN). The course of these nerves has been well described in previous studies.[13] The SLGN courses around the femur shaft to pass between the vastus lateralis and the lateral epicondyle. It accompanies the superior lateral genicular artery.[13] While the SMGN courses around the femur shaft, following the superior medial genicular artery, to pass between the adductor magnus tendon and the medial epicondyle below the vastus medialis.[13] The IMGN courses horizontally below the medial collateral ligament between the tibial medial epicondyle and the insertion of the collateral ligament. It accompanies the inferior medial genicular artery.[13] The genicular nerves are accompanied by its corresponding artery and lay on the bony surface connected to the periosteum (11). Therefore, the GNB consist of injections at three nerves which are the SMGN, SLGN and IMGN.

Traditionally, the anatomical landmark technique has been utilized when administering GNB to patients suffering from chronic knee OA. However recent advances have seen a shift towards the use of fluoroscopy and ultrasound (USG) guided GNB to increase the accuracy of the procedure.[14] With fluoroscopy we are able to clearly visualize the bony landmarks for GNB however it has the disadvantage of exposing patients to radiation. Contrary, the use of USG will aid in visualization of the genicular arteries and sometimes the genicular nerves without exposing patients to radiation. The anatomical landmark guided technique is useful in clinical setting with no USG or fluoroscopy facilities. As each technique of administering GNB has its own advantages and disadvantages, it is important to determine and compare the effectiveness of these techniques in alleviating chronic knee pain, stiffness and functional limitations among patient suffering from knee OA. This area is critical as not all treatment facilities are equipped with USG or fluoroscopy, therefore treating practitioners may still have to rely on traditional anatomical landmark techniques to administer GNB.

Several studies conducted internationally have found that the administration of GNB using both USG guided and anatomical landmark techniques were able to reduce chronic knee pain, stiffness and eventually improve functionality with significant improvements being observed with the use of USG guided techniques.[1,15] In Malaysia, at the beginning of COVID-19 pandemic all elective orthopedics surgeries were postpone or delayed. As a result, patients suffering from knee OA scheduled for surgeries were treated with GNB instead. However, to date in Malaysia there are no published studies that have determine and compare the effectiveness of GNB based on technique of administration. Generalizing findings of international studies to the local context may be inaccurate due to variations in sociodemographic, economic and healthcare characteristics. Therefore, the primary objective of this study is to determine the effectiveness of GNB administered using anatomical landmarks and USG guided techniques in the treatment of chronic knee pain, stiffness and improving functional limitation among patients suffering from OA of the knee. Secondly, this study compares the effectiveness of GNB administered using anatomical landmarks and USG guided techniques in the treatment of OA of the knee. To achieve the study objectives, a retrospective cohort

of patients suffering from knee OA was recruited to participate in this study. Subsequently patients were divided into two groups based on the treatment modalities and outcomes such as knee pain, stiffness and functional limitations were assessed at 1 day, 3 weeks and 6 weeks post treatment. We hypothesized that both the USG guided and anatomical landmarks for GNB would be able to alleviate pain, stiffness and functional limitation in chronic knee OA, with higher success by the use of USG guided techniques. Evidence generated from this study would be pivotal in making evidence informed decision for the administration of GNB especially in setting with no to limited USG facilities.

Methods

This study utilizes a retrospective cohort design which was conducted from July to August 2022 involving patients suffering from chronic knee OA from two General Hospitals in the Northern region of Peninsular Malaysia. Both Hospitals were tertiary hospitals which offered a wide range of specialized medical services and were also referral centers within the respective states. Patients recruited in the study was divided into two groups namely those who received GNB using anatomical landmark and ultrasound guided techniques. Following which, relevant data on these patients were retrospectively retrieved from the respective Hospital electronic medical record system up to 6 weeks post treatment. Since this study was conducted retrospectively, the required number of patients who met the study criteria was obtained successfully within the planned study period, hence there was no requirement to extend the duration of the study. Furthermore, the follow-up period after treatment was established as 6 weeks since prior evidence suggests that the effectiveness of GNB treatment in alleviating knee OA symptoms is generally noticeable during this time frame.

The sample size for this study was estimated based on the study objectives and the largest sample estimated was used as the final study sample. To assess the OA related pain score at baseline and post treatment intervals across both groups, the sample size was estimated using the Open Epi software version 3.01 by means of the sample size for comparing two means statistical test (available at https://www.openepi.com/Menu/OE_Menu.htm). Where in for the mean difference in Numeric Pain Rating Scale (NSF-11) scores across both groups the following parameters in Open Epi software was used $\alpha = 0.05$, 80% power, and mean NSF-11 scores across both group was 32 (Sd 6.1) and 26 (Sd 5.5) respectively based on a study by Cankurtaran et al.[1] The total estimated sample size was 30 with 15 samples in each group (Table 1). While for the mean difference in the Western Ontario and McMaster Universities Osteoarthritis Index Questionnaire (WOMAC) scores across both groups the following parameters in Open Epi software was used $\alpha = 0.05$, 80% power, and mean WOMAC scores across each group was 1.25 (Sd 0.72) and 2.11 (Sd 0.96) respectively based on a study by Cankurtaran et al.[1] The total estimated sample size was 32 with 16 samples in each group (Table 2). An attrition rate of 20% was accounted for, which resulted in a final sample size of 40 with 20 samples in each group, which is compatible with similar previous studies.[1,15]

Table 1: Sample size based on NSF-11 score difference using Open Epi.

Sample Size For Comparing Two Means

Input Data

Confidence Interval (2-sided)	95%
Power	80%
Ratio of sample size (Group 2/Group 1)	1

	Group 1	Group 2	Difference*
Mean	32	26	6
Standard deviation	6.1	5.5	
Variance	37.21	30.25	

Sample size of Group 1	15
Sample size of Group 2	15
Total sample size	30

*Difference between the means

Results from OpenEpi, Version 3, open source calculator--SSMean
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

Table 2: Sample size based on WOMAC score difference using Open Epi.

Sample Size For Comparing Two Means

Input Data

Confidence Interval (2-sided)	95%
Power	80%
Ratio of sample size (Group 2/Group 1)	1

	Group 1	Group 2	Difference*
Mean	1.25	2.11	-0.86
Standard deviation	0.72	0.96	
Variance	0.5184	0.9216	

Sample size of Group 1	16
Sample size of Group 2	16
Total sample size	32

*Difference between the means

Results from OpenEpi, Version 3, open source calculator--SSMean
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or select text to copy and paste to other programs.

Participants were selected using simple random sampling, where in all patients receiving GNB for the treatment of chronic knee OA from 1st July 2022 to 31st August 2022 who fulfill the inclusion and exclusion criteria was obtained from the Hospital electronic medical record system (HIS) respectively. The inclusion criteria were patients aged between 50 to 80 years old, suffering from chronic knee pain for more than 3 months with radiological tibiofemoral OA Kellgren-Lawrence grade 2-4. [16] Patients with knee pain less than 3 months duration, had received Intraarticular knee injection during the previous 3 months, had history of knee surgery, with underlying inflammatory arthritis, connective tissue disease. spinal pathology, polyneuropathy and neurological disorders were excluded from the study. Patients where then categorized into two groups based on the mode of GNB administration which were anatomical landmark and USG guided techniques. Within each group 20 patients were selected from the list of patients meeting the inclusion and exclusion criteria using a simple random sampling method through the EXCEL rand function. The study flow chart is shown in Figure 1.

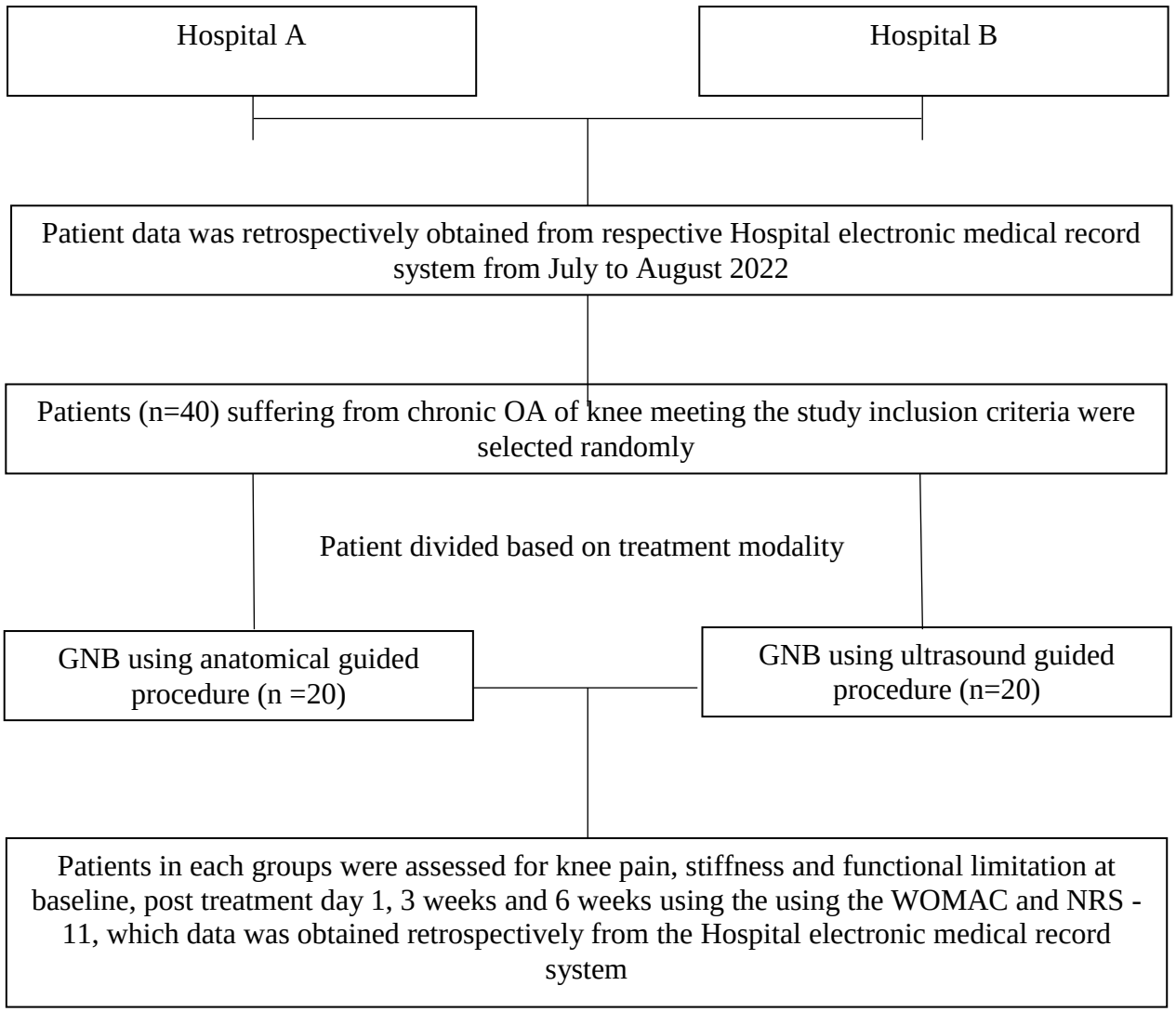


Figure 1: Study flow chart.

Data was sourced from the Hospital electronic medical record system (HIS) for the respective hospitals using a data collection form from 1st July 2022 to 31 August 2022. The HIS is an electronic data base system that captures patient related data for the purpose of record keeping. The data collection form extracted data relating to patient sociodemographic, clinical and intervention information such as gender, age, years, Body Mass Index (BMI), duration of knee OA, underlying co morbidities, Kellgren Lawrence: Grade 2/3/4, GNB procedure technique administered (USG or anatomical guided) and complication post GNB procedure.

In addition, the data regarding the overall knee pain, stiffness, functional limitation score was extracted periodically at baseline and post GNB procedure intervals at 1 day, 3 weeks and 6 weeks by clinic interview. Knee pain, stiffness and functional limitation score was assessed using the WOMAC and NRS -11, both of which are reliable and valid instrument for use to assess pain score among patient suffering from knee OA.[17,18] The WOMAC consists of 24 questions with 5 pain, 2 joint stiffness, and 17 functional limitation questions respectively. All questions are scored on a scale of 0 to 4. The WOMAC questionnaire total scores for pain ranged from 0 to 20, stiffness ranged from 0 to 8, physical function ranged from 0 to 68 giving a grand total score that ranged from 0 to 96, with higher scores indicating more pain, joint stiffness and functional limitations. In this study the overall WOMAC score was used for analysis to represent the overall knee pain, stiffness, functional limitation. In addition, pain intensity was assessed using the NRS-11 score in which 0 meant no pain and 10 is worst pain perceivable.[17]

The contents of the GNB injection solution were 2ml of Lignocaine 2%, 5ml of Bupivacaine 0.5% with adrenaline (1:200000) and 2ml of Triamcinolone Acetonide (20mg). Total volume was 9mls and each injection site received 3mls using a Vygon 22G x 50mm Echoplex+ needle (Ref 6194.503, France). No analgesia or sedative was administered to the patients prior to the procedure. Patient were placed in supine position. The respective knee was clean and draped under aseptic technique.

The anatomical landmark guided technique for GNB used in this study is based on the technique described by Cankurtaran et al.[1] In which three lines were used to determine the injection points for the procedure without imaging. While the knee was in full extension, the first line was drawn longitudinally through the fibular head extending superiorly along the femur to a level 4 cm superior to the tip of the lateral femoral epicondyle. The second line was drawn horizontally between the medial and lateral femur epicondyles. Lastly a third line was drawn from the femur medial epicondyle to the tibial medial epicondyle as depicted in Figure 2. Subsequently 1ml of 2% lignocaine was then given at the skin of each target point. The injection needle was then advanced into the point for SMGN, SLGN and IMGN deep enough to contact the underlying bone. Following this the needle was slightly retracted then aspiration was done to confirm the position and the injection was administered.

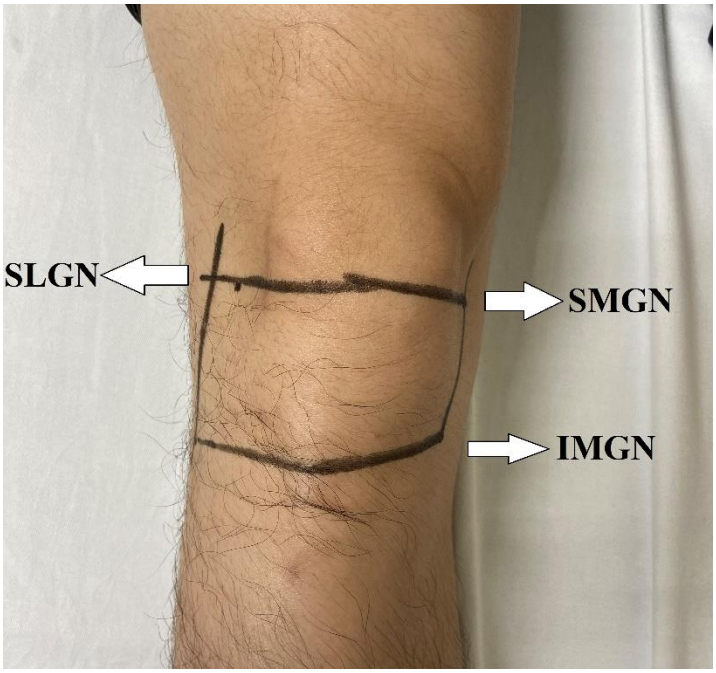


Figure 2: Anterior view of the Right knee. The lines that were drawn for the anatomical landmark guided technique. The GNB consists of injections at 3 nerves which are the SMGN, SLGN and IMGN.

A 12-MHz linear transducer (LOGIQ e; GE Medical Systems China Co., Ltd) was used in this study. The transducer was wrapped in sterile covering. With the knee flexed over a pillow, the transducer was first placed on the junctions between the shaft of femur, and medial and lateral epicondyles of femur, and junction between the shaft of tibia and the tibia epiphysis. The transducer was then moved proximally and distally to identify the genicular arteries which was near the periosteum. This was confirmed by color Doppler USG. The SLGN, SMGN and IMGN travel alongside their respective genicular arteries (15) as depicted in Figure 3 and 4. Subsequently, 1ml of 2% lignocaine was then given at the skin of each target point. The needle was inserted along the long axis of the transducer using in plane technique. Once the needle tip was next to the genicular artery, aspiration was done to confirm the position and the injection was administered.

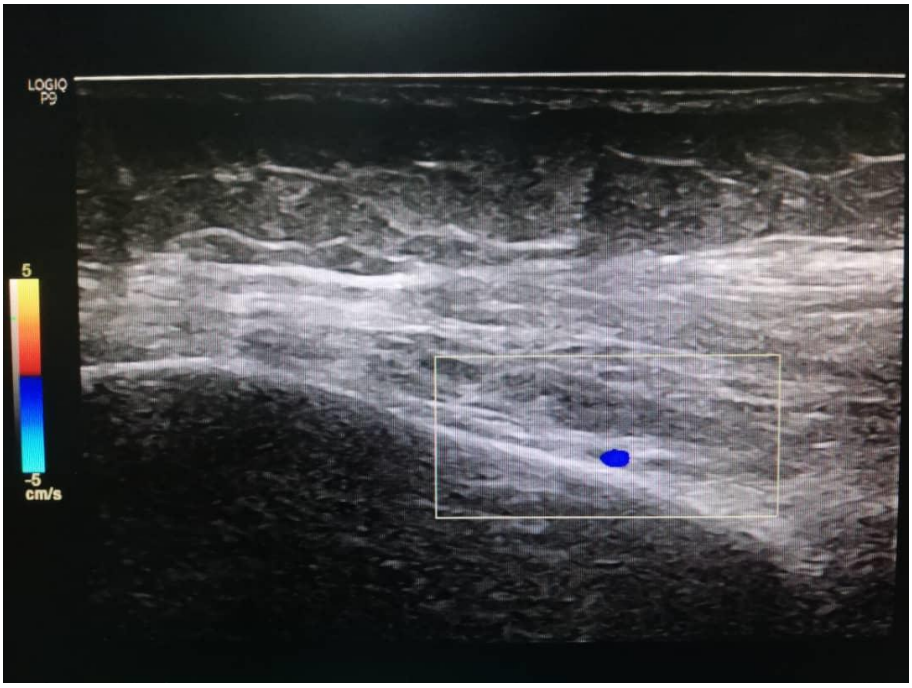


Figure 3: Ultrasound image of the Superomedial Genicular artery in the coronal plane.

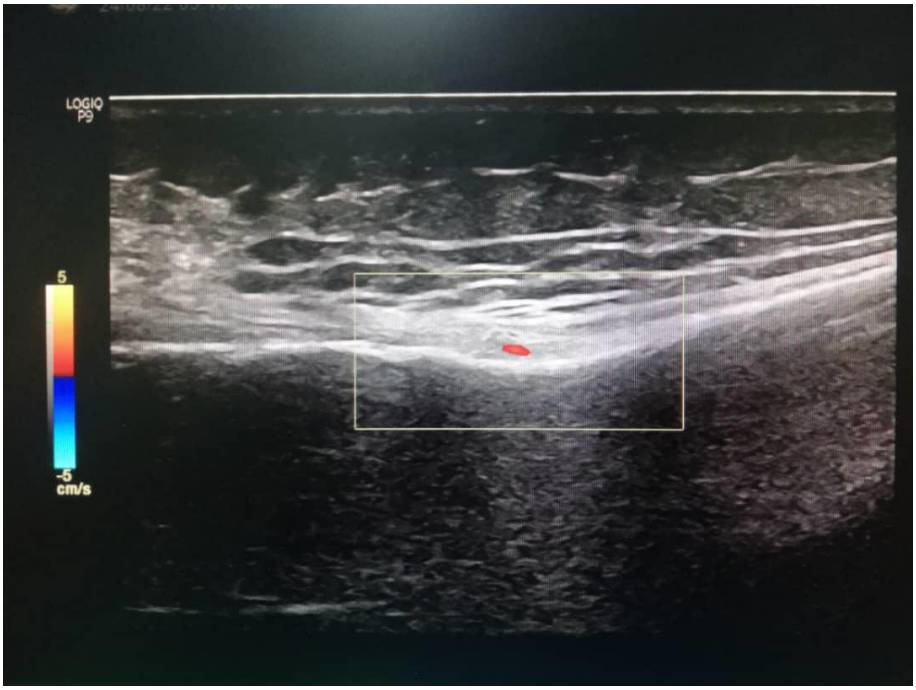


Figure 4:. Ultrasound image of the Inferomedial Genicular artery in the coronal plane.

Data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 26.0 by the International Business Machines, IBM Corp. Released 2019 from Armonk, NY, United States of America. Prior to analysis, data pre-processing was done to check for missing values, duplicate values, abnormal values, and outliers. There was no missing, duplicate, abnormal values. Data was analyzed descriptively using percentages and frequencies for categorical variables and mean, standard deviation (Sd) for continuous variables.

Dependent T-Test was used to determine the reductions in WOMAC and NRS-11 scores post treatment day 1, 3 weeks and 6 weeks respectively compared to baseline pain scores among all patients and based on each group (GNB administration technique). Significance was set at 0.05. Assumption of dependent T-Test was tested prior to analysis to ensure all assumption were sufficiently satisfied. These include the assumption of (a) normality in the differences between the dependent variables which was tested using the Shapiro–Wilk test, wherein p values < 0.05 indicate a normal distribution; (b) dependent variable was measured on a continuous scale; (c) presents of outliers in the dependent was tested using box plots, where in observation beyond the upper and lower quartile limits of the interquartile range were considered as outliers.

Independent T-test was used to determine the difference in WOMAC and NRS-11 scores between both groups (GNB administration technique) at day 1, 3 weeks and 6 weeks respectively. Assumption of Independent T-Test was tested prior to analysis to ensure all assumption were sufficiently satisfied. These include the assumption of (a) to (c) as mention above, additionally independence of observation and homogeneity of variance between the two groups was tested using Chi-square test and Levene's test for categorical and continuous variables respectively.

Results

The sample size consisted of 40 patients of which gender representation was equal. The mean age of the patients were 68.2 years with mean BMI levels being reported at 29.9. In average patients had been suffering with OA for a duration of 86 months, with majority categorized with Kellgren Lawrence grade 4 (82.5%) and slightly more than half having underlying co-morbidities (62.5%). One patient had complication post procedure which was hypopigmentation at the injection site. A total of 20 patients received the USG guided GNB and 20 patients received anatomical landmark guided technique for GNB treatment respectively. There were no significant differences in characteristics among participants across both groups. Table 3 summarizes the characteristics of the study participants.

Table 3: Characteristic of study participants.

		Overall (n=40)	**Anatomical landmark guided (n=20)**	**USG guided (n=20)**	
Characteristic		Frequency N (%)	Frequency N (%)	Frequency N (%)	P-value
Gender	Male	20 (50.0)	11 (55.0)	9 (45.0)	0.527
	Female	20 (50.0)	9 (45.0)	11 (55.0)	
Age, years (mean, sd)		68.2 (8.5)	71.2 (7.3)	65.1 (8.7)	0.195
BMI (mean, sd)		29.9 (4.1)	29.5 (3.7)	30.3 (4.5)	0.378
Osteoarthritis duration, months (mean, sd)		86.8 (74.2)	82.5 (88.5)	91.2 (58.6)	0.327
Kellgren Lawrence grade	3	7 (17.5)	2 (10.0)	5 (25.0)	0.212
	4	33 (82.5)	18 (90.0)	15 (75.0)	
Co morbidity	Yes	25 (62.5)	15 (75.0)	10 (50.0)	0.102
	No	15 (37.5)	5 (25.0)	10 (50.0)	
Complication	Yes	1 (2.5)	1 (5.0)	0 (0.0)	0.311
	No	39 (97.5)	19 (95.0)	20 (100.0)	

Note. *P-value <0.05 indicate of significant difference between anatomical landmark and USG guided groups; Chi-square test was used for categorical variables and Independent T test was used for continuous variables.

a) All participants (n=40)

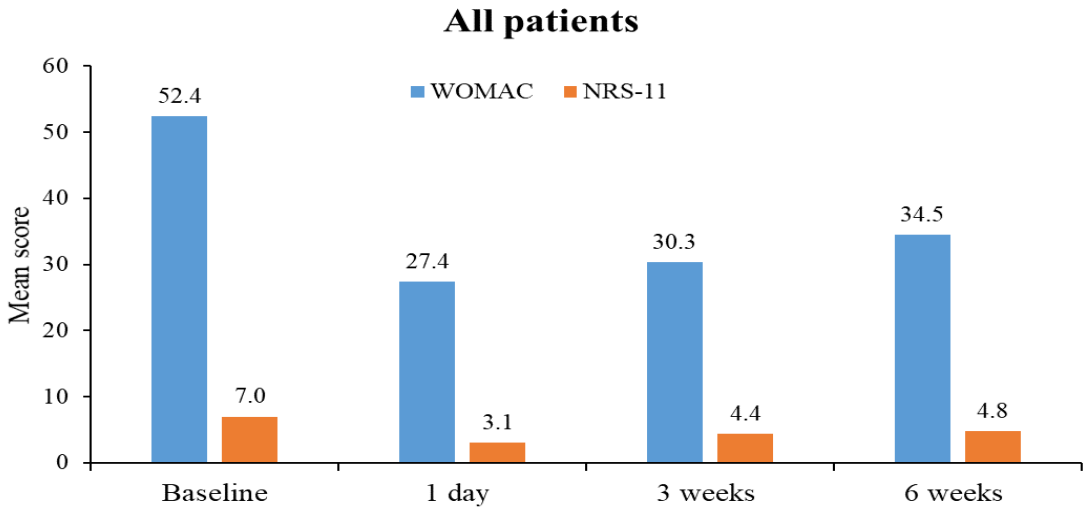
The mean overall pain, stiffness and functional score assessed using the WOMAC scale was 52.4, 27.4, 30.3 and 34.5 at baseline, post treatment day 1, 3 weeks and 6 weeks respectively. WOMAC scores reduced by 47.7% (post treatment day 1), 42.2% (post treatment 3 weeks) and 34.2% (post treatment 6 weeks) compared to baseline pain score. Significant reduction in WOMAC scores compared to baseline was observed at each interval post treatment (Table 4 and Figure 5). The mean pain score assessed using the NRS-11 scale was 7.0, 3.1, 4.4 and 4.8 at baseline, post treatment day 1, 3 weeks and 6 weeks respectively. Pain scores reduced by 55.7% (post treatment day 1), 37.1% (post treatment 3 weeks) and 31.4% (post treatment 6 weeks) compared to baseline pain score. The highest reduction in pain scores was observed post treatment day 1 followed by 3 weeks. Significant reduction in pain scores compared to baseline was observed at each interval post treatment (Table 4 and Figure 5).

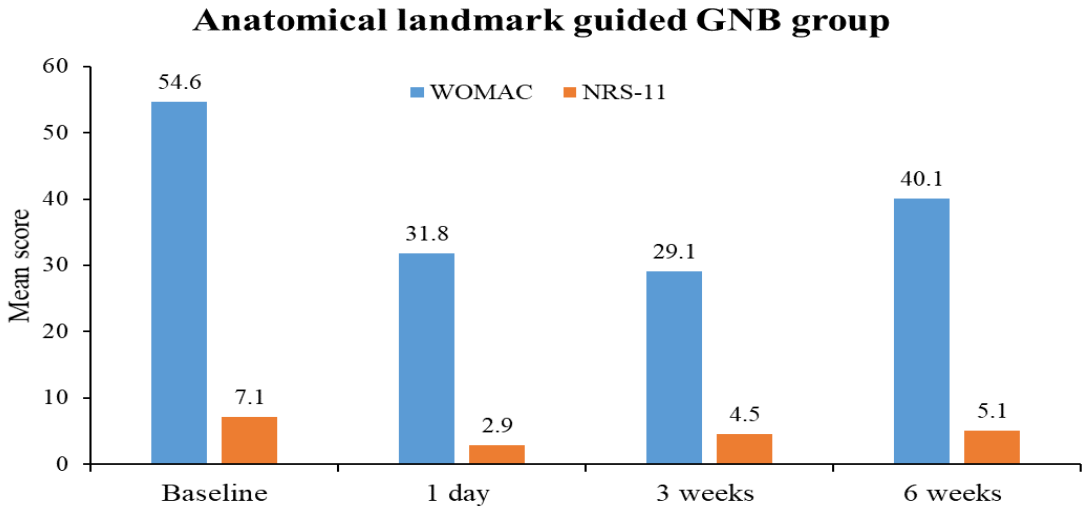
Table 4: WOMAC and NRS-11 scores at baseline and post treatment intervals (1 day, 3 weeks and 6 weeks).

Scale	**All patients (n=40)**						
		Post treatment					
	Baseline (Sd)	1 day (Sd)	t (p-value)*	3 weeks (Sd)	t (p-value)*	6 weeks (Sd)	t (p-value)*
WOMAC	52.4 (14.7)	27.4 (15.3)	11.3 (<0.001)	30.3 (15.3)	8.1 (<0.001)	34.5 (18.4)	6.8 (<0.001)
NRS-11	7.0 (1.3)	3.1 (1.8)	14.7 (<0.001)	4.4 (2.1)	8.4 (<0.001)	4.8 (2.3)	6.7 (<0.001)
Scale	**Anatomical landmark guided GNB group (n=20)**						
		Post treatment					
	Baseline (Sd)	1 day (Sd)	t (p-value)*	3 weeks (Sd)	t (p-value)*	6 weeks (Sd)	t (p-value)*
WOMAC	54.6 (16)	31.8 (18.5)	6.1 (<0.001)	29.1 (16.5)	6.0 (<0.001)	40.1 (22.2)	3.2 (<0.004)
NRS-11	7.1 (1.5)	2.9 (2.1)	9.4 (<0.001)	4.5 (2.5)	4.5 (<0.001)	5.1 (2.4)	3.5 (<0.002)
Scale	**USG guided GNB group (n=20)**						
		Post treatment					
	Baseline (Sd)	1 day (Sd)	t (p-value)*	3 weeks (Sd)	t (p-value)*	6 weeks (Sd)	t (p-value)*
WOMAC	50.3 (12.4)	22.9 (9.9)	12.0 (<0.001)	31.5 (14.3)	5.4 (<0.001)	28.2 (10.6)	7.6 (<0.001)

NRS-11	6.9 (1.1)	3.2 (1.5)	12.4 (<0.001)	4.3 (1.7)	10.0 (<0.001)	4.4 (2.1)	3.2 (<0.001)

Note. * Comparison post treatment intervals with baseline WOMAC and NRS-11 scores, wherein significant is set at p <0.05; t denotes the dependent t statistic





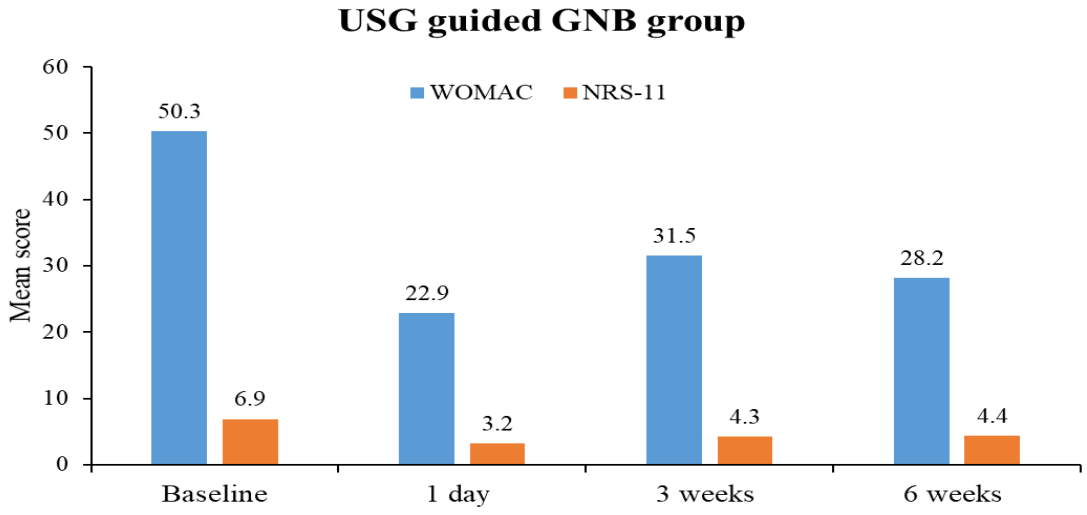


Figure 5: WOMAC and NRS-11 score (assessed using WOMAC and NRS-11) comparison at baseline and post treatment intervals among all patients, anatomical and USG guided GNB groups.

b) Anatomical landmark guided GNB group (n=20)

The mean overall pain, stiffness and functional score assed using the WOMAC scale was 54.6, 31.8, 29.1 and 40.1 at baseline, post treatment day 1, 3 weeks and 6 weeks respectively. WOMAC scores reduced by 41.7% (post treatment day 1), 46.7% (post treatment 3 weeks) and 26.6% (post treatment 6 weeks) compared to baseline pain score. Significant reduction in WOMAC scores compared to baseline was observed at each interval post treatment (Table 4 and Figure 5). The mean pain score assessed using the NRS-11 scale was 7.1, 2.9, 4.5 and 5.1 at baseline, post treatment day 1, 3 weeks and 6 weeks respectively. Pain scores reduced by 59.2% (post treatment day 1), 36.6% (post treatment 3 weeks) and 28.2% (post treatment 6 weeks) compared to baseline pain score. The highest reduction in pain scores was observed post treatment day 1 followed by 3 weeks. Significant reduction in pain scores compared to baseline was observed at each interval post treatment (Table 4 and Figure 5).

c) USG guided GNB group (n=20)

The mean overall pain, stiffness and functional score assed using the WOMAC scale was 50.3, 22.9, 31.5 and 28.2 at baseline, post treatment day 1, 3 weeks and 6 weeks respectively. WOMAC scores reduced by 54.5% (post treatment day 1), 37.4% (post treatment 3 weeks) and 43.9% (post treatment 6 weeks) compared to baseline pain score. The highest reduction in WOMAC scores was observed post treatment day 1 followed by 6 weeks. Significant reduction in WOMAC scores compared to baseline was observed at each interval post treatment (Table 4 and Figure 5). The mean pain score assessed using the NRS-11 scale was 6.9, 3.2, 4.3 and 4.4 at baseline, post treatment day 1, 3 weeks and 6 weeks respectively. Pain scores reduced by 53.6% (post treatment day 1), 37.7% (post treatment 3 weeks) and 36.2% (post treatment 6 weeks) compared to baseline pain score. The highest reduction in pain scores was observed post treatment day 1 followed by 3 weeks. Significant reduction in pain scores compared to baseline was observed at each interval post treatment (Table 4 and Figure 5).

The overall pain, stiffness and functional limitation score assessed using the WOMAC scale reported a higher reduction in mean overall pain, stiffness and functional score of 8.9 and 12.8 at day 1 and 6 weeks post treatment respectively among those receiving USG guided GNB compared to Anatomical landmark guided. Pain scores assessed using the NRS-11 scale reported a higher reduction in mean pain scores of 0.3 and 0.7 at 3 weeks and 6 weeks post treatment respectively among those receiving USG guided GNB compared to Anatomical landmark guided (Table 5). Overall higher reduction in mean WOMAC and NRS-11 scores was observed among patients receiving USG guided compared to Anatomical landmark guided GNB, with statistically significant reduction being observed for 6-week post treatment (p=0.026).

Table 5: Comparison of WOMAC and NRS-11 scores between the USG and anatomical landmark guided GNB groups post treatment.

Duration post treatment	Group	Scale	Mean	Mean difference*	P value
Day 1	Anatomical landmark guided	WOMAC	31.85	8.950	0.065
	USG guided		22.90		
	Anatomical landmark guided	NRS-11	2.95	0.300	0.609
	USG guided		3.25		
3 weeks	Anatomical landmark guided	WOMAC	29.10	2.400	0.627
	USG guided		31.50		

	Anatomical landmark guided	NRS-11	4.55	0.300	0.669
	USG guided		4.25		
6 weeks	Anatomical landmark guided	WOMAC	40.95	12.80	0.026**
	USG guided		28.15		
	Anatomical landmark guided	NRS-11	5.15	0.750	0.302
	USG guided		4.40		

Note. * Difference between the USG guided pain mean scores compared to Anatomical landmark guided mean pain scores; **significance set at $p<0.005$

Discussion

This study determines the effectiveness of GNB in reducing knee pain, stiffness and improving functional limitation among patients suffering from OA of the knee. Wherein this study found that overall GNB treatment modality had significantly reduced knee pain, stiffness and functional limitation scores by 34.2% to 47.7% for the WOMAC scale and reduced knee pain scores by 31.4% to 55.7% for the NRS-11 scale post treatment compared to baseline scores among all patients. Similar findings have been reported by previous studies conducted in Korea, Turkey, Spain and United States.[1,15,16,19,20] Several reasons could attribute to this findings, the GNB treatment modality directly blocks the painful genicular nerve signals temporarily in the knee nerves that supplies the knee joint.[10] This would reduce knee pain, which would then allow patients to mobilize the knee joint resulting in improved functional mobility. GNB has a fast mode of action and the effects are observed as soon as one-day post treatment. [21]

Furthermore, this study found that the administration of GNB using anatomical landmark technique had significantly reduced knee pain, stiffness and functional limitation scores by 26.6% to 46.7% for the WOMAC scale and reduced knee pain by 36.2% to 53.6% for the NRS-11 scale post treatment compared to baseline scores among all patients. While the administration of GNB using USG techniques had significantly reduced knee pain, stiffness and functional limitation scores by 37.4% to 54.5% for the WOMAC scale and reduced knee pain scores by 28.2% to 59.2% for the NRS-11 scale post treatment compared to baseline scores among all patients.

The post treatment mean pain, stiffness and functional limitations scores at 1 day, 3 weeks and 6 weeks were significantly lower compared to the baseline score for the WOMAC and NRS-11 scale in all patient as well as in both groups of patients which received USG guided and anatomical landmark guided technique for GNB in this study. In addition, the highest reduction in scores were observed one-day post treatment all patient as well as in both groups of patients which received USG guided and anatomical landmark guided technique for GNB in this study. Following which at weeks 3 and 6 post treatment the scores had slightly risen when compared to day 1 post treatment but was still consistently below baseline scores. These findings do not come as a surprise as the additive effect of both the short and long acting local anesthetic used in the GNB would result in the highest pharmacological efficacy immediately post administration which result in the highest reductions in pain score as soon as one-day post treatment.[22] With the passing of time, the waning effects of the short term analgesic may become apparent resulting in a lower reduction of pain scores at 3 and 6 weeks compared to one-day post procedure.[22] These findings provide evidence that the GNB treatment modality administered using both the anatomical landmark and USG guided techniques are effective in reducing knee pain, stiffness and functional limitation at day 1, 3 weeks and 6 weeks post treatment compared to baseline. This is an important finding as it provides evidence for the use of GNB treatment in patients suffering from chronic knee OA.

When comparing the effectiveness of the anatomical landmark and USG guided techniques in administering GNB to alleviate knee pain, stiffness and functional limitation, this study found that USG guided technique had resulted in a higher reduction of pain, stiffness and functional limitation compared

to administering GNB using the anatomical landmark technique. This reduction was consistently observed across each interval post treatment, however was only significant at 3 weeks post treatment (p=0.026). This finding is in line with previous studies which points to the superiority of USG guided GNB compared to anatomical landmark techniques.[1] Several reasons can attribute to this finding, among them include increased procedural accuracy with the use of USG guidance techniques. The use of USG would enable accurate identification of genicular nerves therefore allowing for proper administration of GNB in a timely manner eventually reducing procedure time.[1,23] In addition, the use of USG guidance technique would prevent damage to surrounding structures which would reduce procedural related pain or complications; and also enable the detection of additional pathologies which may be difficult to detect or missed when using anatomical landmark techniques.[1,23] GNB is considered a safe and low risk procedure.[1,23] The risk of GNB injection described in previous literature include infection, bleeding, neuroma formation, hypopigmentation and allergic reactions.[1] In this study there was only one reported adverse effect which was hypopigmentation at the injection site in one of the patients from the anatomical landmark group. The comparison of the current study findings with previous studies is shown in Appendix 1. The current study provides baseline data on the effectiveness of GNB in treating knee OA among the Malaysian population which to date is lacking. Therefore, the findings of this study adds more data to literature with regards to this topic. In addition, this study also provides closer follow up intervals (3 and 6 weeks) compared to other similar studies done and therefore would yield additional valuable information to the existing body of evidence.

There are several limitations in this study among them include the use of a retrospective cohort design rather than a double-blind randomized design, which was due to personnel and budget constraints. The duration of follow up for the patients were up to 6 weeks post treatment. A longer duration of follow post treatment would enable for the assessment rebound of symptoms or worsening of pain scores. Another limitation of this study was the small sample size. Although the final sample size was extrapolated from statistical calculations, the underlying constraints were the suitability of the patients to meet the inclusion and exclusion criteria. Despite these limitations, this study is important with several strengths to it. To date this is the first study in Malaysia that determined and compared the effectiveness of GNB administered using anatomical landmarks and USG guided techniques in the treatment of chronic knee pain, stiffness and improving functional limitation among patients suffering from OA of the knee. This study therefore bridges this gap in literature and findings generated from this study is pivotal to enable clinicians to make timely evidence informed decision regarding the use GNB treatment for chronic knee OA within the local context. In addition, the methodological strengths of this study include sampling patients from two hospitals which would increase the generalization of study findings. Sourcing data from official hospital electronic record and matching baseline characteristics among patients in both groups ensured that the samples were reliable and comparable. In addition, all statistical assumptions were sufficiently meet prior to analysis to ensure valid results.

Conclusion

Both the USG and anatomical landmark guided GNB administration was effective in significantly reducing pain, stiffness, functional limitation as soon as day 1 to 6-week post treatment among patients suffering from chronic knee OA. When comparing the both, the USG guided technique appears to be more effective than the anatomical landmark guided technique in reducing pain, stiffness, functional limitation among patients suffering from chronic knee OA. In healthcare facilities where USG imaging are widely available then using USG guided GNB administration would be the suitable option compared to anatomical landmark techniques. Nevertheless, anatomical landmark GNB administration would be a viable effective treatment modality especially in healthcare setting with limited to no USG facilities.

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APPENDIX 1

Comparison of previous study findings with the current study using the WOMAC scores

WOMAC total score	**Baseline**	**3 weeks**	**4 weeks**	**6 weeks**	**12 weeks**
Kim et al (2018) (n=31) USG Guided Block	50.0 ± 20.6	-	34.2 ± 19.6	-	35.6 ± 18.5
Kim et al (2018) (n=30) Fluoroscopy Guided Block	48.7 ± 16.5	-	32.1 ± 16.0	-	39.6 ± 18.1
Yilmaz et al (2021) (n=20) USG Guided Block	54.26 ± 16.38	-	50.74 ± 15.98	-	48.74 ± 15.7
Current study (2022) (n=20) USG Guided Block	50.3 ± 12.4	31.5 ± 14.3	-	28.2 ± 10.6	-
Current study (2022) (n=20) Anatomical landmark Guided Block	54.6 ± 16	29.1 ± 16.5	-	40.1 ± 22.2	-

Comparison of previous study findings with the current study using the NRS scores

NRS score	Baseline	3 weeks	4 weeks	6 weeks	12 weeks
Kim et al (2018) (n=31) USG Guided Block	6.3 ± 1.6	-	3.8 ± 2.1	-	4.3 ± 2.1
Kim et al (2018) (n=30) Fluoroscopy Guided Block	6.7 ± 1.6	-	3.9 ± 1.9	-	4.9 ± 1.9
Current study (2022) (n=20) USG Guided Block	6.9 ± 1.1	4.3 ± 1.7	-	4.4 ± 2.1	-
Current study (2022) (n=20) Anatomical landmark Guided Block	7.1 ± 1.5	4.5 ± 2.5	-	5.1 ± 2.4	-