OUTCOME OF ULTRASOUND GUIDED VERSUS ANATOMICAL LANDMARK GUIDED MEDIAL GENICULAR NERVE BLOCK IN CHRONIC OSTEOARTHRITIS OF KNEE JOINT

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ABSTRACT

Objectives: Even-though various conservative treatments are available , numerous patients with chronic knee OA suffer from unbearable knee pain prior to total knee joint arthroplasty .Medial genicular nerve block needs special attention because it is very effective technique in alleviating the knee pain in chronic OA .Fewer studies have demonstrated the effectiveness of different techniques used for administering Medial genicular nerve block (MGNB) for pain management of chronic knee osteoarthritis (OA) especially in Indian population. Hence in this study we aim to critically analyse and compare the effectiveness of GNB administered using two pain management techniques—ultrasound-guided (USG) versus anatomical landmark-guided (ALG) —for chronic knee OA.

Methods: This prospective cohort study included a total 79 patients with chronic knee OA who presented to our OPD during the study duration - April 2023 to February 2025. Among 79 patients, 29 of them were treated treatment with the USG guided technique and rest 50 with the anatomical landmark-guided technique. Pain assessment was done with VAS and functional outcome was assessed using the Western Ontario and McMaster Universities Osteoarthritis Index Questionnaire (WOMAC) and KSS at baseline and post-treatment one hour, 1 month, 3 month and 6 month.

Results: Both USG & ALG groups reported a significant reduction in Pain and improved functional outcome (WOMAC and KSS) following MGNB. With respect to pain relief, Both methods achieve significant short-term relief within the first month, but their efficacy diminishes over 3–6 months. MGNB improves knee functionality (WOMAC scores and KSS), though these effects also decline by six months.

Conclusions: MGNB administration using USG and ALG techniques are both effective in significantly reducing pain and improving functional outcomes in patients suffering from chronic knee OA. Statistical comparisons consistently indicate no significant difference in outcomes between ALG and USG approaches, supporting the conclusion that both methods are equally effective for pain management and functional improvement .The treatment is safe, and both methods are similarly effective, offering flexible choices for clinical application.

Keywords: Medial Genicular Nerve Block, Ultrasound-Guided (USG), Anatomical Landmark-Guided (ALG), VAS, WOMAC, KSS, Osteoarthritis (OA).

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INTRODUCTION

Osteoarthritis (OA) is endemic throughout the world. An estimated 300 million individuals worldwide are living with OA.[1,2] It is the leading cause of disability in older adults and leads to pain, loss of

function, and decreased quality of life.[3,4] Previously, OA was thought to be a simply a disease of "wear and tear." It is now known that OA is a much more complex process composed of inflammatory and metabolic factors.[5,6] Inflammation including active synovitis and systemic inflammation play a key role in the pathogenesis of OA. Successively, the disease can also go through stages or show gradual evolution over time, making the severity and symptoms of the disease worse [7]

Recommendations for OA treatment are often separated into non-pharmacological, pharmacological and surgical interventions[8,9]. Non pharmacological treatments include Education, advice, or information about the etiology, progression, prognosis, and treatment options of OA are recommended to be an ongoing and integral part of care. Weight loss (if overweight)[10] , exercise and walking aids/devices are recommended for both hip and knee OA[11]. Pharmacological Treatment typically includes the use of analgesics, including NSAIDs and intra-articular corticosteroid injections, viscosupplementation, acupuncture and prolotherapy. When conservative treatment fails, total knee joint arthroplasty may be an option; however, total knee arthroplasty can't be performed on all patients because some patients have comorbidities and the risk of surgery complications. Furthermore, knee replacement is conventionally performed in end-stage disease, after years of painful symptoms and loss of function and despite correctly conducted medical treatment[12]

Despite the availability of various conservative treatments, numerous patients with chronic knee OA suffer from unbearable knee pain prior to total knee joint arthroplasty [13]. Ever since Choi et al introduced genicular nerve block (GNB) and radiofrequency ablation of genicular nerves (RFGN), several reports have demonstrated their effectiveness in alleviating pain and improving knee functionality in patients with chronic knee OA . These interventions have thus been considered a new option for alleviating chronic knee pain.[14,15].

Ultrasound (USG) has been the most used imaging to aid in landmark targeting and procedural accuracy in recent studies. The genicular nerves are the main innervating articular branches for the knee joint, and as they are adjacent to the periosteum, connecting the bone, they can be located using bony landmarks. Superomedial, inferomedial, and superolateral genicular nerve (SMGN, IMGN, and SLGN) branches have been targeted for these treatment options in previous studies [14,16,17]. The location of these nerves, their anatomical relationship with surrounding tissues, and their origin and termination become better understood through cadaveric studies; therefore, it is possible to perform GNB without imaging [18,19].

Genicular nerve radiofrequency ablation (GNRFA), including conventional, cooled, and pulsed techniques, has been used in the management of symptomatic knee osteoarthritis (OA). This new and innovative treatment option has the capacity to decrease pain and improve function and quality of life in certain patients. GNRFA is reserved for patients with symptomatic knee OA who have had failure of conservative treatment and have had failure of or are poor candidates for surgery. GNRFA has been shown to consistently provide short-term (3 to 6-month), and sometimes longer, pain relief in patients. GNRFA has been demonstrated to be safe to administer repeatedly in patients who respond well to this minimally invasive procedure [20].

Hence through this study, we intend to critically analyse the comparison of Ultrasound Guided Versus Anatomical Landmark Guided Medial Geniculate Nerve Block In Chronic Osteoarthritis Of Knee Joint

MATERIAL AND METHODS

This study was conducted in the Department of Orthopaedics People tree hospitals, Yeshwanthpur from April 2023 to February 2025. Approval from the Institutional Ethical committee for the study was obtained. In this study, adult patients with chronic knee pain, who are going to be treated with medial genicular nerve block (anatomical vs ultrasound guided) were selected after obtaining their informed valid written consent.Total number of 79 participant was achieved as final sample size among which 50 participants were given anatomical landmark guided medial geniculate nerve block and 29 participants were given USG guided medial geniculate nerve block.

Inclusion criteria: 1.Varus deformity of knee 2.Chronic knee pain > 3 months which not relived by medication alone 3.All grade of Kellgren Lawrence classification 4.Age group > 40 years

Exclusion criteria: 1.Valgus deformity 2.Recent infection (within 3 months) 3.Bleeding disorder 4. Malignancy

Statistical analysis : Data entry was done using Microsoft excel worksheet.Data was coded and analyzed using statistical package for social sciences (SPSS) version 23.Mean and SD values were calculated for continuous variables. (VAS and WOMAC score).Proportions or frequencies were calculated for qualitative variables (sex, side, comorbidities, etc.).Independent t test, Chi square test and ANOVA test were used appropriately as test of significance.

Follow Up: Done 1 hour post injection, then at 1 month, 3 months and 6 months.Evaluation of pain

by VISUAL ANALOUGE SCORE (VAS) and evaluation of function by WOMAC & KSS (Knee Society Score).

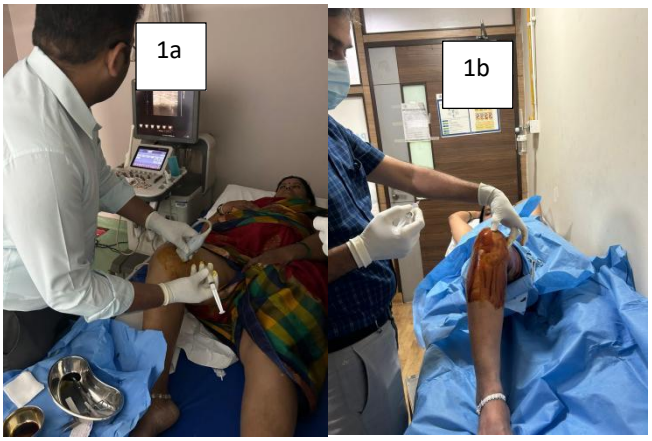

Fig 1 A Anatomical Landmark Guided MGNB &Fig 1 B Ultrasound Guided MGNB

Procedure:

1. **Anatomical landmark guided -**Injection was given at Midpoint of superior pole of patella and medial epicondyle of femur for superior medial genicular nerve block.At convergence point of medial tibial condyle and tibial shaft for inferior medial genicular nerve block.
2. **Ultrasound guided** - Injection was given using USG after visualizing the exact location of superior and inferior medial geniculate nerves.

RESULTS AND ANALYSIS

A total of 79 participants, with 55 females (69.6%) and 24 males (30.4%) were included in the study.F**emales formed a larger proportion** of the participants overall .The **51-60 years age group** constituted the largest proportion of participants across both ALG & USG groups and in the overall total.Mean age in AL guided MGNB group is **56.6 (SD=8.38)** and in USG guided MGNB group is **57.8 (SD=7.3).** Mean BMI in AL guided MGNB group is **28.3 (SD=3.2)** and in USG guided MGNB group is 28.4 **(SD=3.4).**On the Left side (knee) , 23 participants (46.0%) underwent the AL-guided MGNB procedure, while 13 participants (44.8%) had the USG-guided MGNB, totalling 36 participants (45.6%).On the Right side (knee), 27 participants (54.0%) were in the AL-guided MGNB group, and 16 participants (55.2%) were in the USG-guided MGNB group, making a total of 43 participants (54.4%).There was slightly higher proportion of nerve blocks performed on the **Right side** overall. The severity of OA was graded as per KL grading system. **Grade 3 - Moderate** category had the highest proportion of participants across both groups and in the overall total.The varus deformity among the patients were classified into Mild, moderate and severe deformity.Most cases fell into mild category (55.2%).With regard to swelling after the block procedure, in the ALG-guided group, 92.0% of participants (46 out of 50) reported no swelling, while 8.0% (4 participants) experienced swelling. In the USG-guided group, 82.8% (24 out of 29) reported no swelling, and 17.2% (5 participants) experienced swelling. The p-value is 0.276, indicating no statistically significant difference between the two groups regarding swelling complications. No study participants had complication as infection after the medial geniculate nerve block in any of two compared methods.

Medial geniculate nerve block effectively reduces pain severity (VAS scores) in OA patients, with immediate and significant relief observed after 1 hour. Pain levels remain low after 1 month but gradually increase over 3 and 6 months, although they stay below baseline levels. ALG shows slightly better initial pain relief than USG, but the differences diminish over time (Table 2 & Fig 2). Overall, the block provides temporary relief, with diminishing efficacy as months pass. ANOVA was performed to compare the effect of ALG or USG guided Medial geniculate nerve block on VAS score at different interval (Table 3). There was not a statistically significant difference in VAS score between ALG or USG guided Medial geniculate nerve [p-value=0.192].

Table 1: Demographics of of patients undergoing ALG and USG guided Medial geniculate nerve block in chronic OA.

Characteristics	Overall N =79	Anatomical Landmark Guided	Ultrasound Guided

	N(%)	(N=50)	(N=29)
Sex Male Female	 24 (30.4) 55 (69.6)	 16 (32) 34 (68)	 8 (27.6) 21 (72.4)
Age , mean (SD), years		56.6 (SD=8.38)	57.8 (SD=7.3).
BMI, mean (SD) , kg/m2		28.3 (SD=3.2	28.4 (SD=3.4)
Side of block Right Left	 43(54.4%) 36(45.6%)	 27 (54.0%) 23 (46.0%)	 16 (55.2%) 13 (44.8%)
KL Grade Grade1 Grade 2 Grade 3 Grade 4	 17 (21.5) 23 (29.1) 27 (34.2) 12 (15.2)	 7 (14.0) 18 (36.0) 19 (38.0) 6 (12.0)	 10 (34.5) 5 (17.2) 8 (27.6) 6 (20.7)
Varus Deformity Mild Moderate Severe	 43 (54.4) 32 (40.5) 4 (5.1)	 27 (54.0) 19 (38.0) 4 (8.0)	 16 (55.2) 13 (44.8) 0 (0.0)
Complication such as swelling after MGNB No Yes		 46 (92.0) 4 (8.0)	 24 (82.8) 5 (17.2)

Table 2: Comparison of VAS Score at Different Time Interval among ALG and USG Guided Medial Geniculate Nerve Block in Chronic OA Patients

VAS score at	Method of block	Mean	Std. Deviation	N
Baseline	ALG	6.08	1.200	48
	USG	5.81	1.241	27
	Total	5.99	1.214	75
After 1 hour	ALG	2.71	1.166	48
	USG	2.89	1.121	27
	Total	2.77	1.146	75
After 1 month	ALG	2.65	1.229	48
	USG	3.48	1.578	27
	Total	2.95	1.413	75
After 3 months	ALG	4.15	1.429	48
	USG	4.74	1.953	27
	Total	4.36	1.649	75
After 6 months	ALG	5.25	1.605	48
	USG	5.81	1.711	27
	Total	5.45	1.655	75
Source	Sum of Squares	df	F value	P value
Within the VAS at different interval	1312.381	1	905.227	0.001*
Between the VAS & Method of block (ALG/ USG)	2.515	1	1.735	0.192

Error	105.834	73		

(* p value <0.05 is taken as significant, CI=95%)

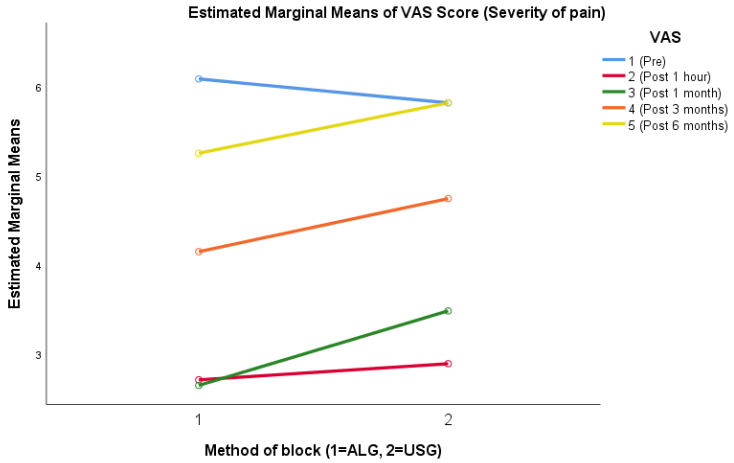

Fig 2. Estimated Marginal Means of VAS Score at Different Time Intervals

Table 3. ANOVA Was Performed To Compare the Effect of ALG or USG Guided Medial Geniculate Nerve Block on VAS Score at Different Interval

WOMAC score at	Method of block	Mean	Std. Deviation	N
Baseline	ALG	35.735	10.3997	50
	USG	34.315	9.8739	29
	Total	35.214	10.1693	79
After 1 month	ALG	30.238	10.5529	50
	USG	28.353	9.5874	29
	Total	29.546	10.1878	79
After 3 months	ALG	32.244	10.3529	50
	USG	30.286	10.6187	29
	Total	31.526	10.4265	79
After 6 months	ALG	35.524	10.3045	50
	USG	34.454	10.2214	29
	Total	35.131	10.2214	79

With regard to WOMAC scores, both groups showed similar baseline scores and experienced improvement after one month, with the USG group performing slightly better (Table 4 & Fig 3). However, the scores began to rise after three months, reflecting a decline in knee functionality, and by six months, they nearly returned to baseline levels, indicating that the treatment effects were short-lived for both groups.Anova revelaed no statistically significant difference in WOMAC score between ALG or USG guided Medial geniculate nerve block [p-value=0.509].(Table 5)

Table 4. ANOVA Was Performed To Compare the Effect of ALG or USG Guided Medial Geniculate Nerve Block on WOMAC Score at Different Interval

Source	Sum Of Squares	Df	F Value	P Value
Within the WOMAC at different interval	78234.977	1	749.40	0.001
Between the WOMAC & Method of block (ALG/ USG)	46.007	1	.441	0.509
Error	8038.486	77		

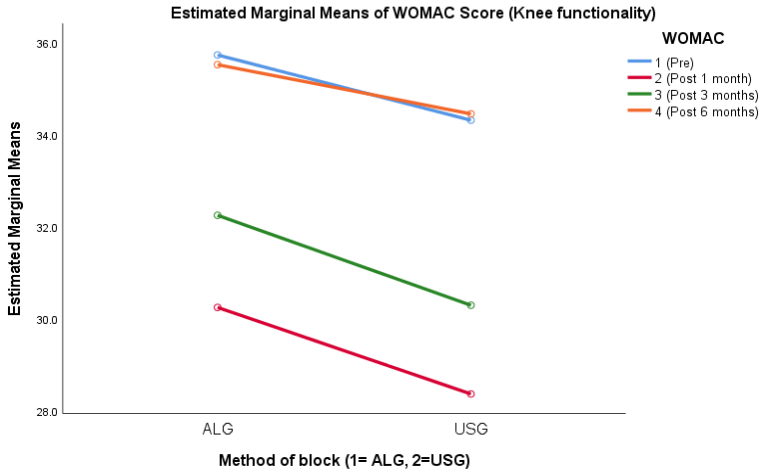

Fig 3. Estimated Marginal Means of WOMAC Score at Different Time.

Both ALG & USG groups showed initial improvement in Knee Society Scores (KSS) post-treatment, as evidenced by the increase in "excellent" scores and decrease in "poor" scores at one month. However, by six months, these gains diminished, and a similar decline was observed in both groups. Statistical analysis confirms there was no significant difference between ALG and USG guided methods of medial geniculate nerve block at any time point.(Table 6)

Table 5: Comparison of KSS Score at Different Time Interval among ALG and USG Guided Medial Geniculate Nerve Block in Chronic OA Patients

	KSS Score Category	AL Guided MGNB N (%)	USG Guided MGNB N (%)	X^2 Value	P Value
Baseline	Poor	21 (42.0)	9 (31.0)	1.896[a]	0.595
	Fair	8 (16.0)	8 (27.6)		
	Good	17 (34.0)	10 (34.5)		
	Excellent	4 (8.0)	2 (6.9)		
	Total	50 (100)	29 (100)		
Post 1 month	Poor	9 (18.0)	3 (10.3)	1.357[a]	0.734
	Fair	13 (26.0)	8 (27.6)		
	Good	11 (22.0)	9 (31.0)		
	Excellent	17 (34.0)	9 (31.0)		
	Total	50 (100)	29 (100)		
Post 3 months	Poor	12 (24.0)	6 (20.7)	0.224	0.988
	Fair	12 (24.0)	8 (27.6)		
	Good	13 (26.0)	8 (27.6)		
	Excellent	13 (26.0)	7 (24.1)		
	Total	50 (100)	29 (100)		
Post 6 months	Poor	18 (36.0)	11 (37.9)	1.061[a]	0.822
	Fair	11 (22.0)	6 (20.7)		
	Good	14 (28.0)	10 (34.5)		
	Excellent	7 (14.0)	2 (6.9)		
	Total	50 (100)	29 (100)		

([a]Fisher's exact test applied as there was expected count < 5 in one or more cells, CI=95%)

Table 6. Comorbidity Profile of Study Participant in Both the Groups (Table Includes Multiple Responses)

Comorbidity	N	ALG	USG	χ^2 Value	p Value
Diabetes	34	21 (35.0)	13 (34.2)		
Hypertension	27	16 (26.7)	11 (28.9)		
Hypothyroid	21	14 (23.3)	7 (18.4)		

IHD	5	3 (5.0)	2 (5.3)	0.5199	0.971
Other	11	6 (10.0)	5 (13.2)		
Total	98	60	38		

With regard to comorbidity, no significant differences was observed between the groups for any condition. Overall, the data suggests that the participants in both groups had comparable health profiles in terms of comorbidities. As the KL grade increases (indicating more severe osteoarthritis), the mean VAS scores progressively rise. This demonstrates a clear trend where **higher KL grades are associated with greater pain severity**. The significant F value (19.742) and p-value (0.001*) confirm that this increase is statistically significant. (Table 8) Thus, pain severity worsens as the structural changes in osteoarthritis become more advanced.Similarly, the mean WOMAC scores show a steady increase as KL grade progresses. Higher WOMAC scores reflect **poorer knee functionality**. The significant F value (153.349) and p-value (0.001*) underscore the statistically significant deterioration in knee function as the severity of osteoarthritis (KL grade) increases (Table 9). This trend highlights the impact of disease progression on joint functionality and quality of life.The statistical association reflects that medial geniculate nerve block is effective by both the methods in patients with initial KL Grades as in mild to moderate form of disease but with increasing severity effect of nerve block is decreasing.

Table 7: KL grade vs VAS

KL Grading	N	ALG Mean (SD)	USG Mean (SD)	F value	P value
Grade 1	17	3.29 (1.113)	4.20 (1.229)		
Grade 2	20	5.06 (1.289)	5.25 (0.957)		
Grade 3	27	5.58 (1.427)	7.00 (0.756)		
Grade 4	11	7.0 (0.894)	7.60 (0.548)	19.742	0.001*

Table 8: KL vs WOMAC

KL Grade	N	ALG Mean (SD)	USG Mean (SD)	F value	P value
Grade 1	17	22.48 (3.296)	24.85 (1.955)		
Grade 2	23	29.15 (2.218)	28.55 (1.780)		
Grade 3	27	40.67 (5.882)	38.39 (4.881)	153.349	0.001*
Grade 4	12	53.55 (3.321)	50.14 (1.612)		

Table 9: Comparison of Study Participant Having Different KL Grade With Recurrence of Pain (In Days) After Medial Geniculate Nerve Block by Both Methods (N=79)

Method of block	KL Grade	N	Mean	(SD)	F test	P value
ALG	Grade 1	7	64.29	26.992		
	Grade 2	18	77.50	42.504		
	Grade 3	19	58.42	36.707	0.877	0.460
	Grade 4	6	58.33	39.707		
USG	Grade 1	10	78.50	46.071		
	Grade 2	5	84.00	65.038		
	Grade 3	8	90.00	50.709	0.078	0.971
	Grade 4	6	85.00	44.159		

As there are chances of recurrence of pain after MGNB ,we followed up for **recurrence of pain (measured in days)** .Across both ALG and USG methods, the recurrence of pain (in days) does not vary significantly across KL Grades, as demonstrated by the **insignificant p-values** for both groups (Table 10).

DISCUSSION

MGNB is new technique which can used for chronic knee pain which not alleviated by analgesics alone and acute knee pain after meniscus tear or post operative pain (knee surgery) .Our results provided a sugnificant for pain relief and also improved functional score by both method (Anatomical landmarks & USG guided) MGNB. With total 55

females and 24 males , it illustrates that female formed larger proportion of participants in both group. In our data 51 – 60 years age group constituted largest population (44.3%). With respect to BMI , 46.8 % are overweight and 35.4 % are obese. Not a single participant was from underweight category. Total four grade for Osteoarthritis of knee as per Kellgren & Lawrence classification in our data out of them 21.5 % are in grade 1, 29.1% are in grade 2, 34.2% are in grade 3 and 15.2% are in grade 4.We included only Varus deformity in MGNB because that is the sensory branch(MGN) which supply medial compartment of knee. In our data 54.4 has mild deformity, 40.5% has moderate deformity, 5.1% has severe deformity.In our data baseline mean VAS score was 5.99 and after 1 hour mean VAS came down to 2.77 which indicate there is significant reduction in pain after MGNB and there is no statistically difference in VAS score between ALG and USG guided medial geniculate nerve block. Baseline WOMAC 35.214, at 1 month it was 29.514, at 3rd month 31.526, at 6th month 35.131 which indicates that WOMAC score is improving after MGNB and there is no significant difference in WOMAC score between ALG or USG guided MGNB (p-value = 0.509). Both groups showed initial improvement in Knee Society Scores (KSS) post-treatment, as evidenced by the increase in "excellent" scores and decrease in "poor" scores at one month. However, by six months, these gains diminished, and a similar decline was observed in both groups. Statistical analysis confirms there was no significant difference between ALG and USG guided methods of medial geniculate nerve block at any time point. In both ALG and USG-guided medial geniculate nerve block methods improved knee joint ROM from baseline to 1 month in all participants and in their respective groups ($p < 0.05$). At 3 months, the ALG group and all participants continued to show statistically significant improvements, while the USG group did not ($p = 0.118$). These results suggest that both methods are effective in the short term, but the ALG method demonstrates more sustained improvement at 3 months compared to the USG method. Comorbidity profiles of study participants in the ALG and USG groups, with no significant differences observed between the groups for any condition. Diabetes was the most common comorbidity, present in 35.0% of the ALG group and 34.2% of the USG group. Other conditions such as hypertension, hypothyroidism, ischemic heart disease (IHD), and Other (Like asthma) comorbidities showed similar distributions and no statistical difference ($p = 0.971$) across the two groups. Overall, the data suggests that the participants in both groups had comparable health profiles in terms of comorbidities. In the ALG-guided group, 92.0% of participants (46 out of 50) reported no swelling, while 8.0% (4 participants) experienced swelling. In the USG-guided group, 82.8% (24 out of 29) reported no swelling, and 17.2% (5 participants) experienced swelling. The chi-square (χ^2) value is 1.553, with a p-value of 0.276, indicating no statistically significant difference between the two groups regarding swelling complications. No study participants had complication as infection after the medial geniculate nerve block in any of two compared methods.

Doo-Hwan Kim et al [21] conducted study on A Prospective Randomized Comparison of the Efficacy of Ultrasound- vs Fluoroscopy Guided Genicular Nerve Block for Chronic Knee Osteoarthritis. On that study Two main findings in the present study were noted. First, post-intervention outcomes were similar for both imaging modalities used during GNB. Second, although GNB with a steroid was effective, its effects lasted for only one month after the procedure in patients with chronic knee OA. The use of imaging devices in the performance of nerve blocks can help increase procedural accuracy and reduce complications compared to a blind technique. Therefore, selecting the appropriate imaging device is imperative for increasing the success rate of a nerve block.

Damla Cankurtaran et al [22] conducted study on Comparing the effectiveness of ultrasound guided versus blind genicular nerve block on pain, muscle strength with isokinetic device, physical function and quality of life in chronic knee osteoarthritis. The results indicated that both techniques were effective in reducing the symptoms and improving physical function. Although there was not a significant difference in pain and muscle strength between the groups

Loïc Fonkoue et al [23] conducted study on a Comparison of Genicular Nerve Blockade With Corticosteroids Using Either Classical Anatomical Targets vs Revised Targets for Pain and Function in Knee Osteoarthritis. Patients in both groups demonstrated significant improvements in pain intensity, analgesic consumption, quality of life and knee function. Compared to the patients in the classical targets group, patients who benefited from GNB with the revised targets reported significantly less pain one hour after the procedure and better WOMAC score 4 weeks later. There were no significant difference in between both groups.

CONCLUSION

From this prospective study we suggest that Medial Geniculate Nerve block is very effective method of decreasing pain in osteoarthritis patients having mild to moderate grades of severity and less advantages in severe grades (KL Grade).Among the two techniques of (Anatomical guided and USG guided) of medial geniculate nerve block , we

conclude that there is no any major difference between both methods .MGNB whether anatomical landmark guided or USG guided provides temporary pain relief and functional improvement, with diminishing benefits over time, particularly in severe OA cases and patients with higher BMI it is having less advantage. Hence we recommend MGNB as treatment of choice for patients requiring immediate pain relief from chronic OA for a temporary period of time. The treatment is safe, and both methods are similarly effective, offering flexible choices for clinical application.

Limitations

1. Small sample size.
2. Limited previously conducted studies.

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