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Original Article

Comparison of The Analgesic Efficacy of Genicular Nerve Phenol Neurolysis In Patients with Knee Osteoarthritis Versus Radiofrequency Ablation

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ABSTRACT

Objective: To compare the analgesic efficacy of genicular nerve phenol neurolysis compared to radiofrequency ablation in patients with knee osteoarthritis.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Pain Management, Combined Military Hospital (CMH), Rawalpindi, Pakistan, from Feb to Jul 2025.

Methodology: A total of 154 patients were recruited into the study and divided into two groups: Group PN using phenol neurolysis (n=77) and Group RA using radiofrequency ablation (n=77). Patients with Grade III or IV osteoarthritis, moderate to severe knee pain, persistent pain >6 months or failure of conservative treatment were included. Pain score on Numerical Rating Scale (NRS) and Western Ontario and McMaster Universities Arthritis Index (WOMAC) scale at baseline, 2, 4 and 12 weeks were recorded.

Results: Participants had a median age of 60 (58.00-63.00) years and a Body Mass Index (BMI) of 28 (27.00-30.00) kg/m2. Intragroup median pain score and WOMAC score interpretation revealed significant improvement from baseline in both groups (p <0.001). At 12 weeks median pain score was 3.33 (3.23-3.60) in Group PN as compared to 3.13 (2.00-3.33) in Group RA (p <0.001). Functional status assessment on WOMAC scale at 12 weeks revealed a higher median score of 37.40 (36.35-39.80) in Group PN as compared to 37.20 (34.75-38.30) in Group RA, with a p-value of 0.026.

Conclusion: Radiofrequency ablation appears to be superior at 12 weeks as compared to genicular nerve phenol neurolysis in providing pain relief and improvement of functional status in patients with knee osteoarthritis.

Keywords: Analgesia; Osteoarthritis; Radiofrequency ablation.

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INTRODUCTION

Osteoarthritis is common musculoskeletal pathology with a rapidly increasing occurrence around the globe with middle and older age group having the highest reported incidence.[1] Among Pakistani population, 57% of patients were middle-aged females.[2] Sedentary lifestyle, decreased calcium intake, genetic predisposition and obesity lead to disruption of articular cartilage and remodeling of the knee joint resulting in knee osteoarthritis.[3] Due to the increasing burden of osteoarthritis on the health care system and advances in the field of pain management, various treatment options for osteoarthritis are in practice, including non-pharmacological, pharmacological, interventional or surgical approaches, however, none of the treatments are considered gold standard.[4] Selection of appropriate treatment and expertise of the treating physician play a vital role in patients' outcome, however most of the patients do not respond to conservative treatment and usually require interventional approach such as intraarticular injections, genicular nerve block and neurolysis, or a combination of both. Due to the limited number of previous comparative studies on interventional techniques and the uncertain comparative duration of pain relief, a gap in available research exists which needs to be addressed. The aim of this study is to compare the analgesic efficacy of genicular nerve phenol neurolysis and radiofrequency ablation in patients with knee osteoarthritis as this will help clinicians to optimize their treatment as per the patient's requirement, leading to reduced pain, improved quality of life and greater patient satisfaction.

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METHODOLOGY

This quasi-experimental trial was conducted after gaining the approval of Ethics Review Committee of the hospital (ERC No. 789, dated 12 February 2025). Duration of study was from February to July 2025.

Minimum sample size was calculated using World Health Organization (WHO) calculator, keeping the confidence interval at 95%, power of test at 80%, with anticipated reduction in pain being more than 50%, assessed at 3 months, being 51% versus 28% between the radiofrequency ablation versus phenol neurolysis group.[5] Minimum sample size came out to be 67 patients but 77 patients were included in each group, making the total study sample of 154 patients, which was enrolled using simple random sampling through computer generated slips.

Inclusion Criteria: Patients were included if there were diagnoses with Grade III or IV osteoarthritis, moderate to severe knee pain, having pain score of 6 or more on Numerical Rating Scale (NRS), persistent pain for more than 6 months or failure of conservative treatment.

Exclusion Criteria: Patients were excluded if diagnosed with coagulopathy, taking anticoagulants, history of receiving intraarticular injection in the past 3 months, diagnosed with psychiatric illness, presence of pacemaker or with a history of renal or hepatic disorder.

After obtaining history and examination findings, laboratory and radiological investigations were done, while procedure was explained to each participant and detailed written informed consent was taken. Patients were prepared for the procedure as per the hospital protocol. Demographic characteristics, baseline pain score on NRS and baseline functional status using WOMAC Index was recorded. Using noninvasive monitors (electrocardiography, blood pressure and oxygen saturation probe), a baseline record of vitals was obtained. Each patient was placed in supine position with knee roll placed under the affected knee joined. Using sterile technique, linear ultrasound probe was used for assessing the structures of knee joint. In Group PN, under ultrasound guidance, spinal needle 25 gauge and 6% phenol 4ml was injected at three points: medial and lateral metaphysis of femur and medial metaphysis of tibia, targeting superomedial, superolateral and inferomedial genicular nerve branches, respectively. In Group RA Universal RF system (URF)-3AP was used and a 10 cm RFA needle with 10mm active was placed at the 3 points described above, under ultrasound guidance. After confirming correct placement using sensory and motor stimulus, radiofrequency ablation was done at 81° Celsius for 90 seconds. After the procedure, patients were shifted to post-procedure ward, and any complications were recorded on a predesigned data collection tool. Patients were assessed on follow-up visits at 2 weeks, 4 weeks and 12 weeks and at each follow-up visit, pain score on NRS and functional status on WOMAC were recorded. Data was analyzed for 154 patients using Statistical Package for Social Sciences (SPSS) 23.00, where age, BMI, duration of symptoms, NRS and WOMAC scores at specified intervals were expressed as medians with interquartile ranges and compared using the Mann Whitney-U test. Data such as gender and grade of osteoarthritis were expressed as frequency with percentage and compared using Chi-square or Fisher-exact test as appropriate where a *p*-value of ≤0.05 was taken as statistically significant.

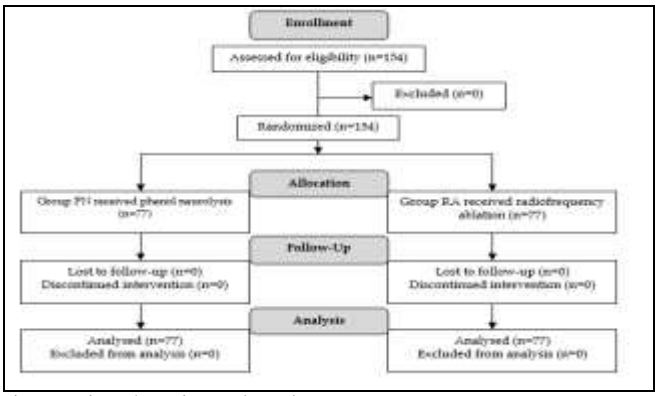

Figure: Patient Flow Diagram (n=154)

RESULTS

We included 154 patients in our study with a median age of 60.00 (58.00-63.00) years and a BMI of 28.00 (27.00-30.00) kg/m2. Among our participants a female predominance was observed with a female to male ratio of 1.2:1. Osteoarthritis (OA) of Grade III was observed in 87(56.50%) patients while 67(43.50%) patients has Grade IV OA. Demographic characteristics of both groups are shown in Table-I.

Pain score before treatment, at 2 weeks and at 4 weeks, was comparable between the two groups, while at 12 weeks, it was observed that the median pain score was 3.33 (3.23-3.60) in Group PN as compared to 3.13 (2.00-3.33) in Group RA with a *p*-value of <0.001. NRS score at different intervals among both groups is shown in Table-II.

Functional status assessment on WOMAC scale at 12 weeks of treatment revealed a higher median score of 37.40 (36.35-39.80) in Group PN as compared to Group RA 37.20 (34.75-38.30) with a *p*-value of

0.026. Functional status score at different intervals among both groups is shown in Table-III.

The intragroup analysis revealed that compared to baseline median pain scores and baseline functional status score, there was significant improvement of both the parameters at the subsequent reassessments, with a *p*-value of <0.001.

Table–I: Demographic Characteristics of Both Groups (n=154)

Variables Median (IQR)		Group PN (n = 77)	Group RA (n = 77)	*p*-value
Age (years)		60 (57.00 -62.50)	61 (58.00-63.00)	0.077
Body Mass Index (kg/m2)		28 (27.00-30.00)	28 (27.00-30.00)	0.741
Duration of Symptoms (months)		7.00(5.50-9.00)	7(6.00-9.50)	0.477
Gender n(%)	Males	32 (41.60%)	38 (49.40%)	0.332
	Females	45 (58.40%)	39 (50.60%)	
Grade of Osteoarthritis	Grade III	47(61.00%)	40(51.90%)	0.225
	Grade IV	30(39.00%)	37(48.10%)	

**IQR: Interquartile Range, PN: Phenol Neurolysis, RA: Radiofrequency Ablation*

Table–II: NRS Score at Different Intervals Among Groups (n=154)

NRS score Median (IQR)	Group PN (n = 77)	Group RA (n = 77)	*p*-value
Pretreatment	7.50 (6.90-8.10)	7.40 (7.00 -8.00)	0.618
2 weeks	4.30 (4.10-4.80)	4.40 (4.10-4.75)	0.883
4 weeks	3.50 (3.40-3.80)	3.60 (3.40-3.80)	0.852
12 weeks	3.33 (3.23-3.60)	3.13 (2.00-3.33)	<0.001

**IQR: Interquartile Range, NRS: Numerical Rating Scale, PN: Phenol Neurolysis, RA: Radiofrequency Ablation*

Table–III: Functional status at different intervals among groups (n=154)

WOMAC score Median (IQR)	Group PN (n = 77)	Group RA (n = 77)	*p*-value
Pretreatment	69.50 (63.85-75.35)	69.30 (64.65-74.15)	0.862
2 weeks	43.30 (41.35-46.25)	43.30 (41.45-46.25)	0.840
4 weeks	38.20 (36.40-40.35)	38.40 (36.50-40.40)	0.782
12 weeks	37.40 (36.35-39.80)	37.20 (34.75-38.30)	0.026

** WOMAC: Western Ontario and McMaster Universities Arthritis Index scale, PN: Phenol Neurolysis, RA: Radiofrequency Ablation*

DISCUSSION

Our comparison of genicular nerve phenol neurolysis (PN) and radiofrequency ablation (RA) revealed equal effectiveness of both modalities when pain assessment was done, however, 12 weeks after treatment, RA significantly reduced the median pain score as compared to PN (3.33 vs 3.13) with a *p*-value of <0.01, revealing a superior long term analgesic effect. Intragroup analysis of pain scores and functional status in our study revealed significant improvement from the baseline scores with a *p*-value of <0.001. As there were limited comparative studies available, individual studies comparison was carried out. A previous meta-analysis comparing three techniques of RA revealed no significant differences among the groups.[6] Another study which assessed the pain score and functional status using WOMAC scoring system in patients who received RA reported similar results as our study.[7] Another study assessed the efficacy of PN in patients with osteoarthritis of knee joint and concluded that mean pain score was reduced to after 6 months of treatment while functional assessment on WOMAC scale revealed an improvement from baseline score of 48.7 to 20.7, reporting effective analgesia by PN.[8] A similar case series revealed that up to 75-100% pain relief was observed in patients who receive PN.[9] One study noted that the maximum effect of phenol was observed in 1 week time and was responsible for 60% of the maximum effect.[10] For a similar reason, PN has been used effectively in patients with muscles spasticity, giving early relief and better outcomes.[11,12] Our results were also favored by similar studies which showed that 95% of the patients receiving RA had significant pain relief signifying long-term effects.[13,14] In our study, the median age of patients with knee osteoarthritis was 60 but a similar study from Pakistan reported mean age to be 50 years.[15] Similarly, we observed that our patients included 54.50% males as compared to 45.50% but a similar study from Pakistan revealed a male predominance with 58.10% males and 41.90% females15 while median BMI of patients in our study was 28 kg/m^2, while another study conducted in Pakistan, revealed a mean BMI of 30 kg/m^2.[16] Similar to our study, another local study revealed a significant decrease in median pain score assessed on a visual analog scale (VAS) and improvement of functional assessment on WOMAC scale after RA in patients (p <0.05).[17] Current advances have found mesenchymal stem cell therapy as a new treatment for osteoarthritis,[17] similar to platelet rich plasma (PRP), however, there is still no gold standard treatment.[18]

LIMITATIONS OF THE STUDY

We used NRS for pain assessment in our study, however addition of another pain score might have provided a better insight of pain assessment. Follow-up of our patients was done for a short period of 12 weeks which may limit our conclusions on a long-term comparison between the two treatment modalities.

CONCLUSION

Radiofrequency ablation and genicular nerve phenol neurolysis are effective in terms of analgesia and improving functional status in patients with knee osteoarthritis, however, radiofrequency ablation appears to be superior at 12 weeks compared to genicular nerve phenol neurolysis in providing pain relief and improvement of functional status in patients.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MUH & MI: Data acquisition, data analysis, critical review, approval of the final version to be published.

SMW & US: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

KT & MHAQ: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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