

ORIGINAL ARTICLE

Radiofrequency Ablation for Chronic Knee Pain: Local Experience at Tertiary Care

Ali Sarfraz Siddiqui¹, Aiman Arif², Gauhar Afshan³DOI: <https://doi.org/10.62848/bjpain.v1i1.9978>

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Abstract

Background: Osteoarthritis (OA) is one of the most common chronic type of arthritis affecting the adult population. Symptomatic knee OA affects 6% of the adult population and occurs in 10% of adult of 65 years and older. Radiofrequency ablation (RFA) has been used for the variety of chronic pain when conservative therapies failed. Genicular nerve RFA is a treatment modality for OA knee patients, especially when surgery is contraindicated due to advanced medical problems or when the patient is not willing to undergo surgery.

Methods: This retrospective observational study was conducted in the Pain Management Section, Department of Anaesthesiology, Aga Khan University Hospital, Karachi. We included all patients who underwent diagnostic genicular nerve block for chronic knee pain between 1 June 2017 and 30 December 2018. Patients who underwent radiofrequency ablation of genicular nerves for chronic knee pain were recruited for this study. All enrolled patients were then followed for the next six months.

Results: Twenty-eight patients with chronic knee pain were selected to undergo radiofrequency ablation (RFA) of genicular nerves. Seventy-five percent of the patients were female, the average age of the patients were 62.89 (± 10.96) years, and the mean body mass index was 30.29 (± 4.88) kg/m². The mean numerical rating pain (NRS) score was 7.4 (± 1.03) before pain intervention and 2.8 (± 1.07) after RFA of genicular nerves, which was statistically significant ($p=0.0005$). In our patient cohort, knee RFA was found to be effective in 23 patients (82.14%).

Conclusion: This study reports 60-70% pain relief for six months in 82% of patients who underwent RFA of genicular nerves for severe osteoarthritis of knee joints.

Keywords: Osteoarthritis knee, Knee pain, Radiofrequency ablation (RFA), Genicular nerves

1 Assistant Professor & Pain Consultant, Department of Anaesthesiology, Aga Khan University, Karachi Pakistan

2 Medical student, Aga Khan University, Karachi, Pakistan

3 Professor & Pain Consultant, Department of Anaesthesiology, Aga Khan University Karachi, Pakistan

Correspondence

Ali Sarfraz
Siddiquisarfraz.siddiqui@aku.edu

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Introduction

Osteoarthritis (OA) is one of the most common chronic type of arthritis affecting the adult population. It affects the patient's quality of life due to multiple suffering, such as pain, fatigue and functional limitations. The knee joint is the most common joint affected by OA and is evident symptomatically and radiographically¹. Symptomatic knee OA affects 6% of the adult population and occurs in 10% of adults (65 years and older). The incidence of OA is 1.7 times higher in women than in men, and progressive disease occurs slightly more often in women². Several modalities for pain management are available, including physical therapy and analgesics such as nonsteroidal anti-inflammatory drugs (NSAIDs) and intra-articular steroids³. Total knee replacement is the treatment of last resort in advanced disease. Radiofrequency ablation (RFA) has been used for the variety of chronic pain when conservative therapies fail⁴. It acts by disrupting the transmission of pain signals by thermal lesion production to interrupt nociceptive signals⁵. Genicular nerve RFA is a recently introduced treatment modality for OA knee patients, especially when surgery is contraindicated due to advanced medical problems or when patients not willing to undergo surgery. The knee joint is innervated by multiple nerves, including the common peroneal, saphenous, tibial, femoral, and obturator nerves, which are known as genicular nerves^{6,7}. Any of these nerves can be approached percutaneously under fluoroscopic guidance, and ablation of the three genicular nerves, i.e., lateral superior, medial superior, and medial inferior nerves can alleviate chronic knee pain⁸. Considering the encouraging results in the literature, the RFA genicular nerve was also introduced in our tertiary care centre. After comprehensive evaluation at the pain clinic, this option was offered to all those who fail to respond to conservative therapy for knee pain. After informed consent was obtained from the patients, a diagnostic genicular nerve block was performed with local anesthesia under fluoroscopy. If the patient reported a 50% reduction in pain and improvement in routine physical activities at the first follow-up visit, then genicular nerve RFA was performed under fluoroscopy. This study was designed to evaluate the efficacy of the RFA of genicular nerves for the management of chronic knee pain at our tertiary care hospital.

Methods

This retrospective observational study was conducted in the Pain Management Section, Department of Anaesthesiology, Aga Khan University Hospital Karachi between July and September 2019, after approval from the Institutional Ethical Review Committee. Data were retrieved from our pain management software program of the hospital, i.e., Pain Management Clinic System (PMCS) and the patient's medical record. In the PMCS, the medical records of all patients visiting the pain clinic, undergoing pain procedures and follow-up after the procedure are available. For the study purpose, we included all patients who underwent diagnostic genicular nerve block for chronic knee pain between 1 June 2017 and 30 December 2018. Patients who underwent radiofrequency ablation of genicular nerves for chronic knee pain after positive diagnostic block (defined as a 50% decrease in numerical rating pain score from baseline post procedure) were finally recruited in this study. Variables were defined for the study, and a special data collection form was designed. All enrolled patients were then followed up for the next six months. Follow-up information was also retrieved from the software program. For any missing data, patient medical records were reviewed to determine the pain status and whether they had undergone knee surgery. All statistical analyses were performed using Statistical Packages for Social Sciences version 19 (SPSS Inc., Chicago, IL). Mean and standard deviation were computed for age, weight, height, BMI and NRS (Numerical Rating Scale). Frequency and percentage were computed for qualitative observations such as sex, comorbidity, diagnosis, site of pain and overall efficacy of RFA. Independent sample t-tests were used to compare quantitative point estimate differences in patients with and without effective RFA, while chi-square tests and Fisher's exact tests were used to compare qualitative point estimates in patients with and without effective RFA. $P \leq 0.05$ was considered significant.

Results

A total of 28 patients with chronic knee pain were selected to undergo radiofrequency ablation

(RFA) of the genicular nerve with moderate to severe knee pain due to osteoarthritis. The majority of patients were female (75%), the average age of the patients was 62.89±10.96 years, and the mean body mass index was 30.29±4.88 kg/m² (Table I).

Table I: Demographic characteristics of patients (n=28)

Variables	Point estimates
Age (years)	62.89±10.96
Weight (kg)	77.45±11.19
Height (cm)	160.27±7.18
BMI (kg/m ²)	30.29±4.88
Gender	
Male	7 (25%)
Female	21 (75%)

All patients who presented with knee pain were known to have osteoarthritis except for one diagnosed case of rheumatoid arthritis. On presentation in the pain clinic, 22 out of 28 (78.6%) patients had NRS pain scores ≥ 7. Three patients presented with severe pain after knee replacement surgery in the past. The mean numerical rating pain (NRS) pain score was 7.4 (±1.03) before pain intervention and 2.8 (±1.07) after RFA of genicular nerves, which was statistically significant (p=0.0005) (Figure 1).

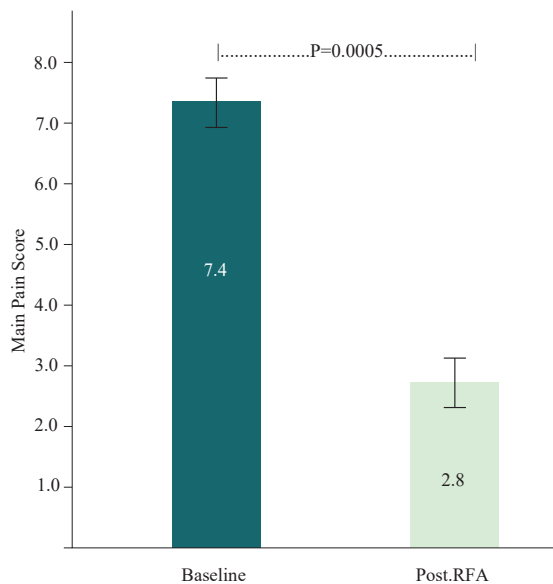


Fig. 1: Comparison of the mean pain score at baseline and after the RFA procedure (n=28)

The need for supplementary analgesia was also reduced related to the treated knee joint during the 6-month follow-up period. The effectiveness of RFA of genicular nerves was defined as a 60-70% decrease in numerical rating pain score from baseline up to six months. In our patient cohort, knee RFA was found to be effective in 23 patients (82.14%) with the resumption of their routine daily activities (Figure 2).

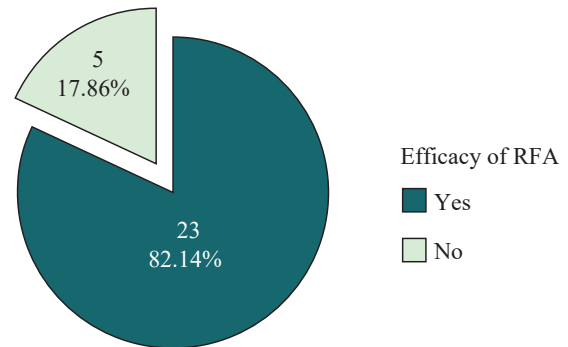


Fig. 2: Effectiveness of the radiofrequencyablation procedure after six months.

Five (17.85%) patients did not report a decrease in pain of more than 60-70% after the RFA procedure. These patients had a relatively higher BMI (31.69 kg/m²); among them, four were female patients. No patient developed any complications, such as infection, hemorrhage, thermal injury, or loss of sensory and motor control in the corresponding area of the genicular nerves. Only one female patient with average height and weight with bilateral knee osteoarthritis and a known case of breast cancer underwent knee replacement surgery four months after effective RFA of the bilateral genicular nerves. She presented to the pain clinic with severe bilateral knee pain (NRS = 8), and after bilateral genicular nerve RFA, the NRS score was reduced to 3. However, she had to undergo surgery because of pain recurrence. None of the other patients required surgery in the 6-month follow-up period.

Discussion

Osteoarthritis is a chronic degenerative disease that leads to damage to articular cartilage, osteophyte formation, and sclerotic changes in the subchondral bone. Since there is no curative treatment and a serious decline in quality of life, the main focus of management is to reduce functional disability, decrease pain and delay the progression of disease⁹. In many patients, however, conventional methods of treatment, such as NSAIDs, opioid use, intraarticular steroids, or surgical interventions, are not effective enough to provide significant pain relief. Conventional RFA is an appropriate alternative that can be used not only to reduce pain but also to optimise physical activity and minimise the use of medications. This retrospective study reinstates the potential of RFA of genicular nerves as an effective treatment modality for patients with knee osteoarthritis. It showed significant pain relief, approximately 82% after RFA, that persisted for at least six months after the procedure. Choi et al. was the first to establish the effectiveness of conventional RFA neurotomy in 2011. It was a double-blind randomised control trial that assessed the efficacy of RFA for 3 months postprocedure, and 50% pain relief was seen in 59% of the patients at the end of the 12 weeks as opposed to no pain relief in participants in the control group⁸. Additionally, there were no notable adverse effects reported with the procedure. Previous literature has shown minimal adverse effects, such as minor joint swelling and subcutaneous hematomas¹⁰⁻¹². A potential cause of concern in terms of adverse effects has been injury to the geniculate arteries that lie adjacent to the targeted nerves and the risk of third-degree burns due to high temperature associated with the procedure, but no such events have yet been reported¹³. Many other studies have been carried out to investigate different aspects related to the RFA procedure and its efficacy compared to other treatment modalities. One of these studies recently investigated the impact of conventional RFA on improving the functionality and requirements of analgesics such as NSAIDs and opioids. A significant decrease in VAS and WOMAC scores was seen, while 66.7% of opioid users and 56.3% of NSAID users discontinued their medication¹⁴. Davis et al even compared the results of cooled radiofrequency ablation (CRFA) with the use of intra-articular steroids (IAS) and concluded that more than 50% pain reduction was

seen in 74.1% of patients in the CRFA group versus 16.2% in the IAS group¹⁵. These studies prove that RFA is a better long-term treatment option and can provide more patient satisfaction while being less invasive than surgery. Apart from conventional RFA procedures, pulsed RFA and cooled RFA procedures have also been investigated. While cooled RFA produces a larger lesion, increasing the chances of denervation, pulsed RFA is nonablative and reduces heat exposure to the tissues. All three procedures have been reported to produce an effective analgesic effect, and there is a lack of high-quality comparative studies to conclude which procedure is most effective due to inconsistent procedures and assessment methods and limited study sizes^{13,16}. One of the limitations of this study is its duration for follow up, i.e., the six months only. There have been limited studies in which patients were followed up for more than six months after the RFA procedure. One such study showed that 64% of patients had more than 50% pain relief at six months and 32% at 12 months after RFA¹⁷. The study also demonstrated the use of ultrasound guided RFA as opposed to fluoroscopy¹⁷. Ultrasound is easier, there is no radiation involved and anatomic structures can be more easily visualised¹⁴. There is, however, no evidence regarding ultrasonography being a better modality as compared to fluoroscopic guided RFA. Moreover, an anatomic study also proved that the course of the nerves may be variable in the proximal area, but the contact between the femur and tibia is constant. Therefore, regardless of visualisation, RFA can be safely carried out using fluoroscopy with low chances of unsuccessful block¹⁸. Limitation is the design of the study, which is a retrospective small cohort without a control group. However, this is the first study reported in Pakistan. Considering its effectiveness compared to other treatment modalities, RFA is found to be a reasonable option for the management of chronic knee pain in patients with severe osteoarthritis.

Conclusion

This study reports a 60-70% pain relief for six months in 82% of patients who underwent RFA of genicular nerves for severe osteoarthritis of knee joints.

Declaration

Ethics approval:

Ethical approval was taken from institutional ethical review committee of Aga Khan University Hospital, Karachi.

Author Contributions:

Conception and development of the idea: ASS, GA

Data collection: ASS, AA

Data analysis: ASS

Writing - Original Draft Preparation: ASS, AAR-view & Editing: ASS, AA, GA

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Conflict of Interests: None

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