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Comparison of intraarticular injection versus radiofrequency neurotomy in knee osteoarthritis

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Abstract

Background: Multiple modalities are existing for pain management in knee osteoarthritis cases. This study was conducted to compare between the efficacy of genicular nerves radiofrequency ablation versus intraarticular steroid injection in pain management in knee osteoarthritis.

Patients and methods: A total of 58 cases with knee osteoarthritis were included and they were divided into 2 equal groups; the RF group who underwent radiofrequency for the genicular nerves, and the IA group who underwent intraarticular steroid injection. Follow up visits were scheduled after 1week, 2 weeks, 1,2, 3, and 6 months. Both visual analog score and The Western Ontario and McMaster Universities Osteoarthritis Index (**WOMAC**) scores were assessed in each visit. Furthermore, patient satisfaction was also recorded.

Results: Patient characteristics did not differ significantly between the two groups ($p > 0.05$). Both VAS and total WOMAC scores were improved in both groups. However, the RF showed better scores at 2-, 3-, and 6- month visits. Satisfaction grades did not differ between the two groups.

Conclusion: Both genicular nerve RF and intraarticular steroid injection are safe and efficacious in pain management in knee osteoarthritis cases. Nevertheless, the effect is more prolonged after RF.

Keywords: intra-articular, osteoarthritis, radiofrequency

Introduction

Knee osteoarthritis is one of the commonest joint diseases that is characterized by progressive joint cartilage degeneration. Pain is the most annoying symptom as reported by such cases (1).

Therefore, the main goal of osteoarthritis medications is to relieve pain. Other goals include an increase range of motion, decreasing disability, and protecting the joint from further damage (2).

Multiple treatment modalities are present for knee osteoarthritis including weight loss, non-steroidal anti-inflammatory drugs, glucosamine, intraarticular injections, arthroscopy, and surgical intervention (3).

Intraarticular injection techniques are usually recommended before surgical interventions. Multiple studies have reported that intraarticular steroid injection can improve knee pain, function, and range of motion. Steroid injections have been also beneficial in cases with exacerbation of joint swelling or inflammation as they are potent anti- inflamatory drugs (4).

Radiofrequency neurotomy has been successfully used in the management of many painful conditions like trige-minal neuralgia and spinal pain (5). Furthermore, one study has reported

that radiofrequency genicular nerve ablation may provide adequate and prolonged pain relief in patients of chronic osteoarthritis (6).

Genicular nerves supplying the knee joint arise from obturator, femoral, saphenous, common peroneal, and tibial nerves. Application of RF causes destruction of pain signals leading to interruption of pain signaling pathw-ays (7) This study was conducted aim-ing to compare between the efficacy of genicular nerve radiofrequency ablation and intraarticular steroid injection in knee osteoarthritis.

Patients and methods*:*

Study design: This is a prospective comparative single-blinded study, that was conducted at Sohag University Hospitals during the period between January and July 2019.

Study cases: A total of 58 cases who presented to the outpatient pain clinic complaining of knee osteoarthritis were enrolled in the study. They were divided into 2 equal groups; the RF group included 29 cases who underwent genicular nerve radiofrequency ablation, and the IA group included the remaining 29 cases who underwent intraarticular steroid injection.

Randomization: was done through a computer program.

Ethical considerations: approval of ethics committee at Sohag University then a written consistent from each patient after full illustration of the procedure.

Inclusion criteria: Patients who were diagnosed with knee osteoarthritis according to the American College of Rheumatology (8), and failed to respond to conventional treatment techniques incl-udeing medications and physiotherapy. Patients with Kallgren-Lawrence (K/L) rating scale (9) lower than 4 were included in our study.

Exclusion criteria: Patients with acute knee pain, previous knee surgeries, bleeding diathesis, connective tissue disorders, or neurological disabilities were excluded from our study. Furthermore, patients with a Kallgren-Lawrence (K/L) rating scale of 4 were also rolled out.

Patient consent:

Informed written consent was obtained before the procedure from all cases after explaining the advantages and drawbacks of each approach.

Pre-procedure preparation:

All cases were subjected to complete history taking, physical examination, and routine laboratory investigations. Additionally, plain X-ray films were ordered for all cases. Both visual analog score (VAS) and Western Ontario and McMaster's Universities Osteoarthritis (WOMAC) (10) scores were assessed before the procedure in all cases.

Intraarticular injection:

The medial approach was the preferred method of injection when the patient was in the supine position. Methylprednisolone (MP) was administered via intraarticular injection at a dose of 8mg/mL×5mL.

Radiofrequency genicular nerve ablation:

The patient was placed in the supine position and the possible locations of the genicular nerves were identified under fluoroscopic guidance on the medial and lateral aspects of the lower femur in addition to the medial aspect of the upper tibia. After skin sterilization and draping, it was infiltrated with lidocaine (2% concentration),5 ml volume at first. After that, a 10 cm RF cannula with a 22-gauge size was placed for each nerve. Multiple images in different planes were obtained to confirm the needle tip position. The electrode tip temperature was raised up to 80º C for 1.5 minutes.

Follow-up: Scheduled follow-up visits were arranged after 1, and 2 weeks away

from the procedure. Patients were examined for potential complications like infection or hematoma. Additional 4 visits were scheduled at 1,2,3 and 6 months after the intervention. Both VAS and WOMAC scores were assessed during these visits. Moreover, patient satisfaction was also recorded.

Sample size calculation: Sample size was calculated using Power Analysis and Sample Size software program (PASS) version 15.0.5 for windows (2017) using the results published by S. Sari et al (August 2016) with the WOMAC score difference during a three-month follow-up period between both groups after the injection as the primary outcome. Patients were allocated into two groups: Group RF: patients received an intra-articular radiofrequency neurotomy ablation and Group IA: patients received an intra-articular steroid injection. The null hypothesis was considered as the absence of difference between treatment modalities regarding the WOMAC score difference during a three-month follow-up period of the injection. A sample size of 23 patients in each group is needed to achieve 90% power (1-β or the probability of rejecting the null hypothesis when it is false) in the proposed study using a Repeated Measures Analysis with a significance level (α or the probability of rejecting the null hypothesis when it is true) of 5%. The expected drop-outs are 6 so a total of 29 will be enrolled in each group.

***Statistical analysis*:** Statistical analysis was performed using the SPSS software program. Data were presented as mean ± standard deviation, or number (%). The comparison between both groups was performed by an independent t-test or chi-squared test as appropriate. Changes were evaluated using the repeated measures general linear model. A p-value of less than 0.05 was considered statistically significant.

Results

The mean age of the included cases was 45.31 and 44.76 years for RF and IA groups respectively. We included 19 females (65%) and 10 males (35%) in the RF group, while the IA group included 16 females (55%) in addition to 13 males (45%). The rest of the patient characteristics are shown in table (1). Neither of these variables was significantly different between the two groups.

		RF Group (n = 29)	*IA Group (n = 29)*	*95%*	*p*
Age (years)		**45.31 ± 8.85**	**44.76 ± 9.88**	**- 4.38, 5.49**	**0.82**
Gender	**Male**	**35% (10)**	**45% (13)**	**-0.15, 0.35**	**0.59**
	Female	**65% (19)**	**55% (16)**		
BMI		**27 ± 5.86**	**24.86 ± 7.07**	**-1.28, 5.56**	**0.22**
ASA	**I**	**86% (25)**	**93% (27)**	**-0.09, 0.23**	**0.67**
	II	**14% (4)**	**7% (2)**		
	II	**38% (11)**	**45% (13)**	**-0.18, 0.32**	**0.79**
	III	**62% (18)**	**55% (16)**		
Osteoarthritis Side	**Right**	**59% (17)**	**59% (17)**	**-**	**1**
	Left	**41% (12)**	**41% (12)**		
Duration (years)		**4.48 ± 1.18**	**4.1 ± 0.9**	**-0.17, 0.93**	**0.18**

Table (1): Demographic characteristics of the patients.

In both groups, the total WOMAC score was decreased compared to the baseline score. Nevertheless, the RF group showed significantly better scores at 2-,3-, and 6- month visits compared to the steroid group, indicating that RF may have a prolonged duration of pain relief compared to steroids ($p < 0.001$). These data are illustrated in table (2).

WOMAC score		*RF Group (n = 29)*	*IA Group (n = 29)*	*95% CI*	*p*
WOMAC PAIN	**Basal**	**11.72 ± 1.907**	**11.34 ± 2.159**	**- 0.69, 1.45**	**0.444**
	Two weeks	**7.48 ± 1.617**	**7.52 ± 1.214**	**-0.79, 0.72**	**0.927**
	One month	**5.90 ± 1.012**	**7.00 ± 1.512**	**- 1.78, - 0.43**	**0.003**
	Two months	**5.83 ± 1.560**	**7.17 ± 1.713**	**-2.21, -0.48**	**0.003**
	Three months	**7.00 ± 1.982**	**8.07 ± 2.329**	**-2.21, 0.07**	**0.114**
	Six months	**7.86 ± 2.295**	**8.90 ± 2.396**	**-2.27, 0.20**	**0.080**
WOMAC Stiffness	**Basal**	**2.62 ± 0.942**	**2.55 ± 1.152**	**-0.48, 0.62**	**0.840**
	Two weeks	**0.41 ± 0.628**	**0.69 ± 0.930**	**-0.69, 0.14**	**0.305**
	One month	**0.28 ± 0.455**	**0.45 ± 0.632**	**-0.46, 0.12**	**0.328**
	Two months	**0.14 ± 0.351**	**0.41 ± 0.628**	**-0.54, -0.01**	**0.057**
	Three months	**0.55 ± 0.632**	**0.72 ± 0.797**	**-0.55, 0.21**	**0.470**
	Six months	**1.03 ± 0.680**	**1.07 ± 0.961**	**-0.47, 0.40**	**0.980**
WOMAC Function	**Basal**	**40.76 ± 6.004**	**40.21 ± 3.144**	**-1.97, 3.07**	**0.488**
	Two weeks	**33.97 ± 4.395**	**34.52 ± 3.612**	**-2.67, 1.56**	**0.601**
	One month	**26.90 ± 4.135**	**27.38 ± 3.590**	**-2.52, 1.55**	**0.637**
	Two months	**23.28 ± 3.217**	**25.31 ± 2.316**	**-3.51, -0.56**	**0.002**
	Three months	**28.28 ± 3.239**	**32.48 ± 3.562**	**-6.00, -2.42**	**< 0.001**
	Six months	**32.59 ± 4.005**	**35.31 ± 4.630**	**-5.00, -0.45**	**0.008**
WOMAC Total	**Basal**	**54.72 ± 5.812**	**53.86 ± 5.242**	**-2.05, 3.77**	**0.350**
	Two weeks	**42.24 ± 5.356**	**42.72 ± 4.008**	**-2.97, 2.01**	**0.699**
	One month	**33.83 ± 4.310**	**34.83 ± 4.132**	**-3.22, 1.22**	**0.371**
	Two months	**28.14 ± 4.397**	**33.93 ± 4.464**	**-8.12, -3.46**	**< 0.001**
	Three months	**35.17 ± 4.833**	**40.48 ± 6.801**	**-8.41, -2.21**	**< 0.001**
	Six months	**41.07 ± 4.114**	**46.17 ± 5.478**	**-7.65, -2.56**	**< 0.001**

Table (2): WOMAC score of the patients.

Although VAS scores were decreased compared to the baseline in both groups, the RF group showed significantly lower VAS scores in the last 3 follow up visits ($p < 0.05$). Based on VAS and WOMAC score findings, it was expected to see better patient satisfaction during the last 3 follow up visits. However, patient satisfaction did not differ between the two groups. This may be attributed to having better scores compare to the baseline which may have a positive impact in the patient daily life.

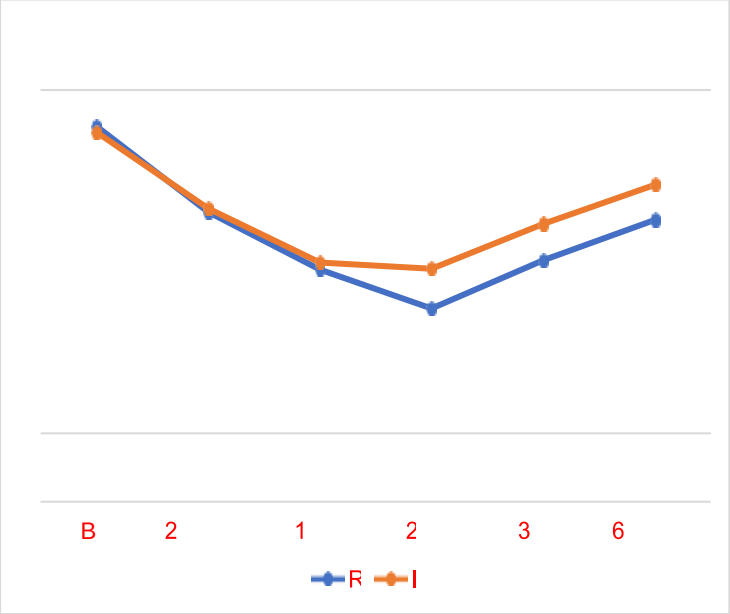

Figure (1): Total WOMAC score changes through the study period.

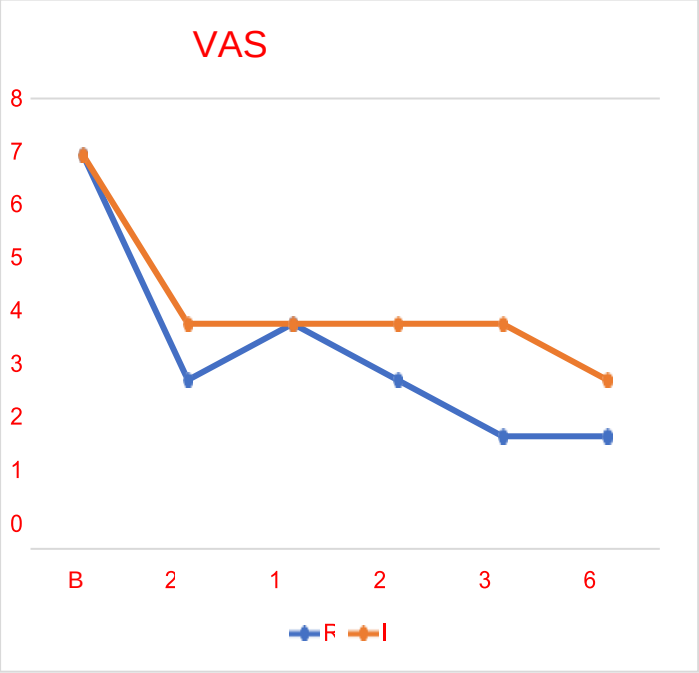

Figure (2): VAS score changes through the study period.

Discussion

Osteoarthritis is the most common chronic joint disease with worldwide prevalence. Its manifestations include pain, joint dysfunction, and muscle atrophy. The knee joint, as it is a weight-bearing joint, is the commonest joint affected by that disease (11). As the main pathophysiological process of OA cannot be reversed, the existing treatment modalities including lifestyle changes, physical therapy, medications, and surgery are used for symptom con-

trol (12).RF can be applied for knee osteoarthritis in two ways; either extraarticular ablation of genicular nerves, or intraarticular pulsed radiofrequency (6, 13).This study was conducted at Suhag University hospitals aiming to evaluate the safety and efficacy of genicular nerve radiofrequency ablation versus intraarticular steroid injection in knee osteoarthritis patients.Unluckily, there is a paucity of studies comparing RF neurotomy and intraarticular injection.We included a total of 58 cases, and they were divided into 2 equal groups; the RF group who underwent genicular nerve RF, and the IA group who underwent steroid injection. No statistically significant difference was detected between the two groups regarding patient demographics (age, sex, BMI, and OA grade) ($p > 0.05$).

Another study handling the same perspective did not report any statistically significant difference between patient characteristics before intervention (4). This comes in line with our study results. Our study revealed that both groups experienced a decrease in both VAS and WOMAC scores after both procedures. However, the radiofrequency group had better scores compared to steroids especially after 2, 3, and 6 months ($p < 0.05$).Another study has also compared RF with steroid injection in managing knee pain. Authors reported results that are consistent with ours. The RF group reported a significant reduction regarding both VAS and WOMAC scores at the first month and the third month ($p < 0.001$) (4).Conversely, another study reported no difference between the two approaches regarding pain and function improvement at 3 and 6 months after knee arthroplasty (15), In another study, Our study has some drawbacks, first of all, is relatively small sample size, and short duration follow up. In addition, the analgesic requirement of the patients was not assessed as well. These points must be kept in consideration on performing further studies.

Conclusion:

Both genicular nerve RF and intraarticular steroid injection are safe and efficacious in pain management in knee osteoarthritis cases. Nevertheless, the effect is more prolonged after RF.

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