Original Article

Intra-Articular Hyaluronic Acid Injection versus RF Ablation of Genicular Nerve for Knee Osteoarthritis Pain: A Randomized, Open-Label, Clinical Study

ESI Institute of Pain Management, Sealdah, ‘KPC Medical College & Hospital, Kolkata, India

Abstract

Background: Chronic knee osteoarthritis (OA) is one of the most common diseases of advanced age. Available therapies have insufficient evidence and adverse effects. Hyaluronic acid (HA) injection reduces knee pain in certain patients only for short duration. Radiofrequency (RF) neurotomy of genicular nerve branches has been tried recently. Comparison of these two modalities is lacking. The aim of this study was to compare pain relief and daily activities by visual analog scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores between intra-articular HA injection and RF neurotomy of genicular nerves.

Materials and Methods: Patients were treated with intra-articular HA injection and RF neurotomy of genicular nerves in each group (n = 12). Pain relief and day-to-day activity were compared. Results: There was statistically significant difference and lower VAS and WOMAC scores in the RF group compared to HA group after treatment.

Conclusion: As compared to intra-articular HA injection, RF neurotomy of genicular nerves appears to be a promising and more effective therapeutic procedure for patients with chronic knee OA.

Keywords: Genicular nerve, knee pain, radiofrequency

INTRODUCTION

Chronic knee osteoarthritis (OA) is one of the most common diseases of advanced age. The women have higher prevalence than men (11.4% vs. 6.8%). The gender difference in prevalence has recently been emphasized in a meta-analysis, which provides evidence for a greater risk of knee OA in women. Globally, OA is the eighth leading cause of disability with the joint, most frequently associated with disability being the knee. In the Asia-Pacific region, the prevalence of knee OA was 7.50% in China, 5.78% in rural India, 22.00%–28.00% in urban and 25.00% in the rural population of north Pakistan, and 10.20% in Bangladesh. The total societal cost of the treatment of OA has been estimated to increase worldwide because of its dramatic growth in morbidity.

The current treatment for knee OA consists of conservative treatment, such as exercise, physical therapy, pharmacological agents, and in some cases, surgical treatment. Although many of the commonly used conservative treatments have been recognized to be effective, still evidences are insufficient.

Intra-articular hyaluronic acid (IA-HA) injections for the treatment of knee OA have been shown to reduce the pain and improve joint function. Use of RF ablation will also reduce the adverse effects related to nonsteroidal anti-inflammatory drugs.

Address for correspondence: Dr. Subrata Ray, Department of Anesthesia and Pain, KPC Medical College & Hospital, Kolkata, India. E-mail: raysubrata82@gmail.com

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Ray D, Goswami S, Dasgupta SR, Ray S, Basu S. Intra-Articular hyaluronic acid injection versus RF ablation of genicular nerve for knee osteoarthritis pain: A randomized, open-label, clinical study. Indian J Pain 2018;32:36-9.
(NSAIDs) and other pharmacological agents. Study comparing the role of IA-HA injection and RF ablation of genicular nerve is lacking.

1. The aim of our study was to compare the efficacy and outcome of IA-HA injection with the RF ablation of genicular nerve in grade 1–grade 3 OA of knee.
2. Objectives were to measure visual analog scale (VAS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores for outcome of the procedures.

**Subjects and Methods**

After obtaining the approval of the institutional ethics committee, this clinical study was carried out in a pain management institute in Kolkata, West Bengal, India, between December 2015 and June 2016.

The inclusion criteria for this study were the subjects who were able to walk with painful knee OA (VAS more than 4/10) and fulfilled the criteria for knee OA of the medial femorotibial joint as defined by the American College of Rheumatology, the age of the subjects above 40 of either sex and all subjects had radiographic knee OA with Kellgren–Lawrence (K/L) grade 1–3 evaluated by the weight-bearing anteroposterior X-rays of the tibiofemoral joint using the bilateral standing extended view. And the exclusion criteria were patients on an oral, topical, or intra-articular steroid during the 4 weeks before the study; patients with an oral, topical, or suppository NSAID within 2 weeks before the study; patients having secondary knee OA; patients with severe OA (K/L grade >3) in a location other than the knee joint; patients with rheumatoid arthritis; patients with joint replacement surgery in either knee and/or a hip; patients with hematological, cardiac, hepatic, or renal disorders; and patients with meniscal tear, ligament injury, bursitis, and popliteal cyst and blood investigations suggestive of any infection.

**Study period:** approximately 7 months.

**Sample size:** twelve patients in each group. Group HA received IA-HA injection and group RF received RF of genicular nerve.

**Parameters:** Pain was evaluated by VAS score (0–10), and combination of pain and daily activity was assessed by WOMAC before the procedure and 1, 4, and 12 weeks after the procedure.

**Study technique**

Patients were randomly assigned to receive percutaneous RF genicular neurotomy (RF group, n = 12) or IA-HA injection (HA group, n = 12) using a computer-generated randomization schedule.

Patients of HA group were given with injection HA. Each 10-mL, prefilled syringe of injection HA contains hylan polymers (hylan A + hylan B) 48 mg, sodium chloride 51 mg, disodium hydrogen phosphate 0.96 mg, sodium dihydrogen phosphate monohydrate 0.24 mg, and water for injection up to 6.0 mL. Patients were put on operation table; after proper antiseptic dressing and draping, the needle with prefilled medicine of HA injection was injected. Needle was introduced with landmark method, and needle position was confirmed by fluoroscopy. Patients were advised to take oral medication as before. They were also asked for follow-up after 1, 4, and 12 weeks consecutively.

Under aseptic conditions, the patients of group RF were placed in a supine position on a fluoroscopy table with a pillow under the popliteal fossa to alleviate discomfort. The true anteroposterior (AP) fluoroscopic view of the tibiofemoral joint was obtained. Skin and soft tissues were anesthetized with 1 mL 1% preservative free lignocaine. On first visit, diagnostic block was performed with 0.25% of injection bupivacaine hydrochloride in three branches of genicular nerve, namely superomedial, superolateral, and inferomedial [Figure 1]. Patients were observed for 24 h in ward. Pain relief of more than 50% for at least more than 2 h was considered to be a suitable candidate for RF neurotomy.

RF neurotomy was performed on the next day. A 10-cm, 22-gauge RF cannula with a 10-mm active tip was used for the technique. Under proper fluoroscopic guidance, sensory stimulation at 50 Hz was performed to identify the nerve position. The sensory stimulation threshold required was less than 0.6 V. Motor stimulation tested for the absence of fasciculation in the corresponding area of the lower extremity on stimulation of up to 2.0 V at 2 Hz. Lignocaine (2 mL of 1%) was injected before activation of the RF generator. Two RF lesions were made for each genicular nerve at 80°C for 90 s by rotating the needle tip 180°. These patients were also asked for follow-up after 1, 4, and 12 weeks consecutively in our institute.

**Statistical analysis**

For statistical analysis, raw data were entered into an MS Excel spreadsheet and analyzed by MEDCALC [statistical software, version 16.2.1.0 (MedCalc Software, Ostend, Belgium)]. Categorical data were analyzed by chi-square test and numerical data were analyzed by unpaired t-test. All analysis were two-tailed and P-value <0.05 was taken.
to be statistically significant. The power of study was 90% and type-I error was less than 5%.

RESULTS AND ANALYSIS
Among the total study group 34% were men (13% in group HA, 21% in RF) and 66% were women. There was no significant difference in age and sex distribution between the group HA and group RF as shown in analysis of Table 2. Parameters were recorded as shown in Table 1.

There was no significant difference in VAS-0 between group HA and group RF as mean VAS-0 was 8.16 (SD ± 0.717) and 8.25 (SD ± 0.621), respectively; P-value = 0.745 [Table 3]. There was gradual improvement in VAS score following the procedures, and differences in VAS-1 between group HA and group RF were 4.66 (SD ± 1.55) and 1.91 (SD ± 1.64), respectively, P-value being 0.0004. Further reduction in VAS score noted at 4 weeks follow-up with significant difference in group HA and group RF as mean VAS-4 were 5.16 (SD ± 1.8) and 1.75 (SD ± 1.28), respectively; P-value <0.0001.

VAS-12 scores were significantly lower[Table 3] in group RF than group HA, 1.83 ± 1.52 and 1.83 ± 1.52, respectively; P-value being statistically significant (<0.0001).

The difference of WOMAC was notably significant between the groups [Table 4]. Maximum improvement of WOMAC noted after 12 weeks in group RF compared to group HA, as mean WOMAC-12 were 12.06 ± 4.033 and 59.93 ± 15.986, respectively; P-value being statistically significant (<0.0001).

DISCUSSION
Knee OA is a common but often difficult problem to manage in primary care. Traditional nonsurgical management, consisting of lifestyle modification, physical therapy, and pharmacologic therapy, is often ineffective or leaves residual symptoms such as chronic pain. All perception of knee pain must be mediated via the nervous system. Yet the conventional approach to knee pain is traditionally and universally musculoskeletal. Although the musculoskeletal system is the natural starting point for the evaluation of knee pain, once musculoskeletal etiologies have been eliminated or treated, persistent knee pain should then be considered of neural origin.

In this study, we have compared between IA-HA injection and genicular RF neurotomy. We have selected two groups having grade 1–grade 3 knee OA in 40 years or more age group population. The difference of mean age in years was not statistically significant between the groups. VAS-0 difference was not statistically significant between the groups. After 1 week of both the procedures, patients were assessed and there was significant difference of VAS-1 between the groups with the P-value of 0.0004. There was further decrease in the VAS score after 4 and 12 weeks of assessment in RF group compared to HA group. This difference was very much statistically significant as the P-value of all analysis were <0.0001 as shown in Table 3.

The activity index as expressed by WOMAC score has remarkably improved in RF group in comparison to HA group. Though the initial score (WOMAC-0) had no difference but WOMAC taken after 1 week (WOMAC-1) had statistically significant difference between the groups, with more improvement of the activity in RF group [Table 4]. It was gradually improving after 4 and 12 weeks in RF group than HA group as evident by the P-value of <0.0005.

The efficacy of IA-HA for knee OA has been debated for more than a decade. Although it has been systematically evaluated in meta-analyses, most previous studies have focused on comparing the findings with either placebo or intra-articular corticosteroids.[16-18] Inconsistent conclusions among the meta-analyses and conflicting results regarding IA-HA’s safety influenced the use of this injection.

The use of RF for chronic knee OA pain requires the identification of anatomic landmarks for nerves innervating the knee joint. Choi et al.[19] conducted a study performing genicular nerve RF in 19 patients and achieved a very good pain relief without adverse effect. Our study is also corroborating with the aforementioned study. Our study additionally reveals improvement in

<table>
<thead>
<tr>
<th>Table 1: Parameters observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before intervention</td>
</tr>
<tr>
<td>Group HA</td>
</tr>
<tr>
<td>Group RF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Comparison of demographic factors between HA and RF groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Age, years (mean ± SD)</td>
</tr>
<tr>
<td>Male (%)</td>
</tr>
<tr>
<td>Female (%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Difference of VAS between the groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>VAS-0 (mean ± SD)</td>
</tr>
<tr>
<td>VAS-1 (mean ± SD)</td>
</tr>
<tr>
<td>VAS-4 (mean ± SD)</td>
</tr>
<tr>
<td>VAS-12 (mean ± SD)</td>
</tr>
</tbody>
</table>
day-to-day activity as evident by WOMAC index, which was not evaluated earlier. There was no adverse effect with any of the procedures.

Limitations of this study include small study population, lack of blinding, and short follow-up period.

**Conclusion**

In conclusion, RF neurotomy of genicular nerves appears to be a promising and more effective therapeutic procedure for patients with grade 1–grade 3 chronic knee OA compared to IA-HA injection in terms of pain relief and improvement in day-to-day activity.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**References**


**Table 4: Difference of WOMAC between the groups**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Group HA (mean ± SD)</th>
<th>Group RF (mean ± SD)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WOMAC-0</td>
<td>80.46 ± 3.556</td>
<td>81.15 ± 4.40</td>
<td>0.676</td>
</tr>
<tr>
<td>WOMAC-1</td>
<td>44.35 ± 11.83</td>
<td>11.45 ± 4.679</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>WOMAC-4</td>
<td>52.17 ± 17.85</td>
<td>12.24 ± 4.307</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>WOMAC-12</td>
<td>59.93 ± 15.986</td>
<td>12.06 ± 4.033</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>