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Case Report Open Access

Prolonged Pulsed Radiofrequency Ablation of Genicular Nerves of Knee for Intractable Pain from Knee Osteoarthritis: A Case Report

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Abstract

The literature on application of prolonged PRF of genicular nerves of knee for osteoarthritis of knee is nil. This study will provide level IV evidence that prolonged PRF is a safe and effective in treating knee pain from osteoarthritis of knee joint not responding to conservative modalities of treatment and who wants to avoid surgery.

Keywords: Pulsed radiofrequency ablation; Genicular nerves; Knee osteoarthritis

Introduction

Chronic osteoarthritis of knee joint is a common disability with increasing age and leads to pain, joint stiffness, functional limitations and disturbance in sleep [1,2]. The pharmacotherapy provides limited relief in pain from knee osteoarthritis and also associated with severe adverse effects like gastro-intestinal bleeding, ulcerations, etc with Non-steroidal anti-inflammatory drugs [3]. The other non-surgical modalities, such as intra-articular injection with steroids or hyaluronic acids, acupuncture, periosteal stimulation therapy; but these modalities are not effective in relieving pain and function in all patients [4-8]. For advanced stage of osteo-arthritis of knee surgery is the preferable option; but this may not be possible in many patients with multiple co-morbities [9]. In these patients who cannot or not willing to undergo surgery, the radiofrequency ablation of genicular nerves is a good option.

The pulsed radiofrequency is a type of radiofrequency which has a neuromodulatory role and may be useful in neuropathic pain conditions. We are describing the first case of application of prolonged pulsed radiofrequency to the genicular nerve of the knee for knee osteoarthritis. There is another previous study where they have applied normal PRF to saphenous, tibial and common peroneal nerves along with subsartorial, peripatellar and popliteal plexuses [10].

Case Report

The patient was 42 year old male with intractable pain from severe osteoarthritis of right knee. His pain intensity in numerical rating scale was 5 on lying down, 8 on standing and 10 on walking. The patients Oxford Knee Score and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was 7 and 81.25% respectively. The DN4 (Douleur Neuropathique 4) questionnaire score is 5, which suggested the neuropathic nature of the knee pain. He was on multiple medications, e.g., paracetamol 3 gm/day, etoricoxib 60 mg, tramadol 300 mg, fenatanyl patch 100 mcg/ hour, pregabalin 150 mg, with only 20-30 % relief. There was also allodynia and hyperalgesia on the medial aspect of the knee joint. He had also received two intra-articular injection of Synvisc-One (hylan G-F 20) and two intra-articular injections of methylprednisolone 40 mg, with relief of only up to 30-40% for 1-2 weeks only. He was offered the option of knee replacement surgery, but he had refused it. The role of radiofrequency ablation of the knee genicular nerves was discussed with him, and he had refused for the conventional radiofrequency owing to potential risks of motor damage and risks of increasing the pain. He had later agreed for the pulsed radiofrequency of the genicular a nerve which has a positive neuro modulatory role on the knee pain as there was evidence from the DN4 score that pain may be neuropathic nature.

The patient was given diagnostic genicular nerve block with 2% lignocaine under fluoroscopic guidance. The superior lateral genicular nerve, superior medial genicular nerve and inferior medial genicular nerve was blocked. The diagnostic block was considered successful as the patient had nearly 70-80% relief in pain at rest and 60% relief on standing and walking for at least 2 hours.

The therapeutic radiofrequency ablation of the knee performed in the operating theatre in a sterile environment. The patient is placed supine and the monitoring was done as per ASA requirement. A pillow was placed under the knee to open up the knee joint and decrease the discomfort. The affected knee was cleaned with sterile solution and draped. The fluoroscope (Siremobil Compact L, Siemens Healthcare GmbH, Henkestr Erlangen, Germany) was positioned to give an antero-posterior view of the knee joint (Figure 1). After anesthetizing the skin and subcutaneous space using 2% lignocaine, a 10 cm long RF needle with 10 mm active tip is directed under the fluoroscopic guidance to towards the junction of shaft of the bone and epicondyle. The final position of the needle was determined by the elicitation of the sensation in the concordant area of the knee with sensory stimulation at 50 Hz at below 0.5 V and absence of fasciculation at motor stimulation at 2 Hz at 2 V. The pulsed radiofrequency was done 600 seconds on both sides at pulses of 20 min/sec at 2 Hz frequency at 45V with a temperature cut off at 42 degrees by using Cosman RFG-1B RF generator (Cosman Medical, Inc, Burlington, Massachusetts). Also intra-articular injection of methylprednisolone 40 mg was given. There was no immediate complication.

After the procedure, there was improvement in pain intensity (NRS at rest and standing from 4 and 9 at before the procedure to 2.5 and 2.4 at 2 weeks and 6 months), Oxford knee score (from 7 at before the procedure and 28 and 30 at 2 weeks and 6 months) and WOMAC index (from 81.25% at before the procedure to 40.62% and 43.75% at 2 weeks and 6 months). There was also improvement in neuropathic features,

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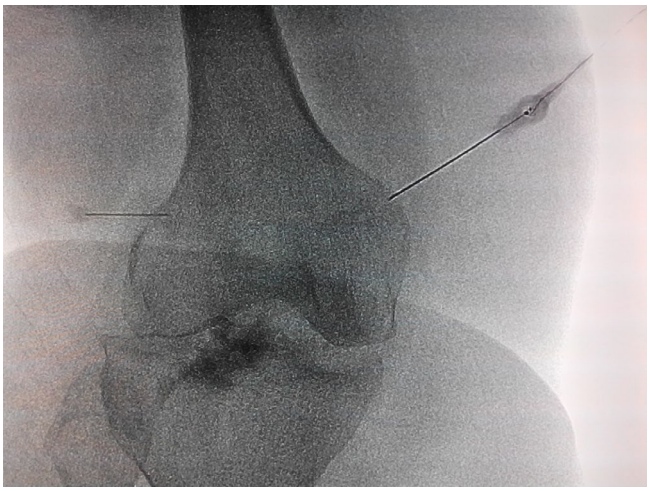

Figure 1: Image showing the antero-posterior view of the knee joint with RF needles in position for superior lateral genicular nerve, superior medial genicular nerve of knee.

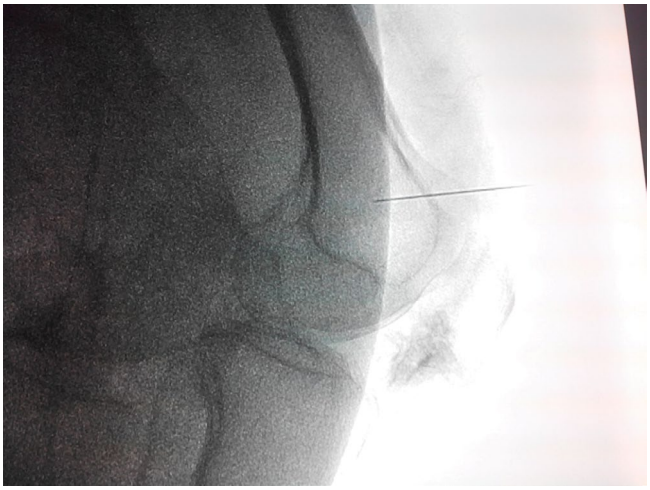

Figure 2: Lateral view of the knee joint showing the RF needle at femoral surface for superior lateral genicular nerve RF.

which decreased from 5 at DN4 to 2 at 2 weeks and 6 months. The medications also tapered slowly and at 6 months the patient was taking paracetamol 3 gm/ day, tramadol 100-200 mg/ day and etoricoxib 60 mg 1-2 times a week. At 6 months, the consent of the patient was taken for publication of his case report.

Discussion

The extended pulsed radiofrequency of the genicular nerves lead to decrease the pain in the knee joint and improvement in the function which was maintained for 6 months. This is the first study on the application of prolonged PRF on the knee genicular nerves. There was one previous study where the authors have applied the normal PRF to the saphenous, tibial and common peroneal nerves along with subsartorial, peripatellar and popliteal plexuses as compared to prolonged PRF to the superior lateral genicular, superior medial genicular and inferior medial genicular nerves in our study [10]. There were also significant improvement of pain and function in the previous study when the PRF was applied to the 3 nerve and plexuses. Our study also confirms that the need to apply PRF to so many nerves and plexuses can be avoided if good pain relief can be obtained by applying the prolonged PRF to the genicular nerves, which are only sensory nerves and supplies the knee joint only (Figure 2).

The knee joint is innervated by femoral, obturator, sapheneous and common peroneal and posterior tibial nerves [11]. The tibial nerve gives superior lateral genicular, superior medial genicular and inferior medial genicular nerves, which accompanies the genicular vessels and lies close to epicondyles of tibia and femur and their position is usually fixed [12]. So, the pain arising out of knee joint may not be completely relieved by radiofrequency ablation of the genicular nerves only. The diagnostic genicular nerve block prior to the radiofrequency ablation gives an impression about the possible relief the RF of the genicular nerves. The RF of other nerves was not performed as there may be motor involvement if RF was applied to other nerves and the patient also got 70-80% relief in pain at rest and 60 % relief on standing and walking after the diagnostic genicular nerve block.

Choi et al found that the conventional RF of the genicular nerves provided more than 50% relief in pain intensity in more than 50% of patients for 12 weeks and improvement in knee function [13]. In a recent study by Martina Bellini et al, the cooled radiofrequency (RF) of genicular nerves resulted in significant and long term improvement in pain and function [14]. In another recent study, Sinem Sari et al also found that RF of genicular nerves resulted in significant improvement in pain and function of the knee joint [15].

There has been no literature on the application of pulsed RF to the knee genicular nerves for knee osteoarthritis pain. The pulsed RF had been found to be effective in many painful conditions. Recently, the prolonged duration of pulsed RF has been found to more effective in some painful conditions, and also it is devoid of adverse neuropathic effects of conventional RF, which makes it more attractive when it is desired to avoid the adverse effects of conventional RF. Recent studies have found that by increasing the duration of pulsed RF to gasserian ganglion, it resulted in considerable amount of pain relief in trigeminal neuralgia without any adverse effects [16-18]. The mechanisms of pulsed RF and conventional radiofrequency are different. The PRF has a neuromodulatory role with c-Fos gene and activating transcription factor 3 (ATF3) [19,20]. As the mechanisms of two types of RF are different, the PRF can also be used in conditions where the conventional RF has failed. Also in a recent review, there were evidences that injury to the genicular arteries are possible while performing the conventional RF to the genicular nerves and it was suggested that these injuries can be avoided by doing PRF [21]. The limitations of this report were single patient, bias from intra-articular steroid injection, etc.

Conclusion

The prolonged PRF of genicular nerves of knee can be an effective treatment option for the patients who are suffering from intractable pain knee osteoarthritis and who want to avoid surgery. But to generalize the above statement, larger randomized sham controlled trial with large sample size and prolonged follow-up is needed.

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