

Alcohol neurolysis of genicular nerve for chronic knee pain

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Radiofrequency neurolysis (RFN) of the genicular nerves has recently become accepted as an effective technique to alleviate knee pain particularly in patients with knee osteoarthritis (OA) or postoperative pain. However, genicular nerve RFN can produce high procedure and equipment costs, longer procedural times, procedure-related pain, and failure rate of over 25%. We are presenting two cases of alcohol neurolysis of the genicular nerve using fluoroscopy and ultrasonography in patients with knee OA or persistent postsurgical pain of the knee. Alcohol neurolysis of the genicular nerve with dual imaging modality can be a cheap, safe and effective method in patients with chronic knee pain. (Korean J Pain 2019; 32: 223-7)

Key Words: Ethanol; Fluoroscopy; Knee; Nerve Block; Osteoarthritis; Pain, Postoperative; Radiofrequency Therapy; Ultrasonography.

Chronic knee pain is one of the most common causes for visiting the doctor, especially in the elderly [1]. Many patients with knee pain have osteoarthritis (OA) or persistent postsurgical pain after knee arthroplasty or arthroscopic surgeries [2,3]. Radiofrequency neurolysis (RFN) of the genicular nerves, which are the branches of the tibial, common peroneal, and obturator nerves, and these nerves provides innervation to the capsule of the knee joint, as well as to the intra-articular and extra-articular ligaments, have recently been of considerable interest as an effective technique to alleviate knee pain, particularly in patients with knee OA [4-7]. However, genicular nerve

RFN has several disadvantages, including high procedure and equipment costs, longer procedural time, procedure-related pain, and a nonresponse rate over 25% [8]. Therefore, we have attempted alcohol neurolysis of the genicular nerve using a dual imaging modality (fluoroscopy and ultrasonography) in patients with chronic knee pain with or without knee OA.

CASE REPORT

This case report was approved by the Pusan National University Hospital Institutional Review Board (IRB No.

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H-1812-001-073), and informed consent was obtained from patients.

1. Case 1

A 51-year-old female presented with a history of left knee pain which had worsened after surgery. She had a history of suffering a medial meniscus anterior horn tear two years previous, and had undergone three arthroscopic surgeries. She visited our clinic for persistent knee pain, which was described as an electric shock sensation and lancinating-like pain. Her pain intensity (numerical rating scale, NRS) score was 8/10 and was usually aggravated after walking more than 100 m and relieved by rest. She reported several disturbances in her daily activities, and particularly with sleep. The score on her DN4 (Douleur Neuropathique en 4) questionnaire was reported to be 6/10, which supported a possible neuropathic or mixed neuropathic and nociceptive type of pain. A knee X-ray did not show any significant osteoarthritic changes. Therefore, we concluded that her pain was predominantly neuropathic, from persistent postsurgical pain of the knee. She was started on medication and treated conservatively with anticonvulsants (gabapentin), nonsteroidal antiinflammatory drugs, and exercises. However, she did not respond to conservative treatment, and after 1 month, a diagnostic block on the superomedial genicular nerve (SMGN), inferomedial genicular nerve (IMGN), and superolateral genicular nerve (SLGN) was performed under ultrasonographic guidance with 2 mL of 1% lidocaine. She reported greater than 50% reduction in pain in the 24 hours following injection. Genicular nerve neurolysis with alcohol was then performed one week later. Post procedure and at six weeks follow-up, the patient reported good pain relief with an NRS score of 0/10. She has also improved significantly functionally and is able to sleep well.

2. Case 2

A 60-years-old female presented with a history of bilateral knee OA which had worsened over 10 years. She had had a recent history of right knee arthroscopy and cartilage graft which worsened her right knee pain. She complained of pain in the anterior and lateral areas of her right knee, which was described as a pricking sensation along with a dull aching sensation. No neuropathic-like

symptoms were described. The pain worsened upon activity and was relieved by rest. She gave a pain score of 3/10 when resting and 8/10 with activity. There was limitation of activity with the pain, but no sleep disturbances were noted. During physical examination, noted that she had right knee effusion but no limitation in movements. Bilateral knee X-ray was reported as Kellgren-Lawrence grade 3, and osteoarthritic changes were evident in both patellofemoral joints. Her pain was predominantly nociceptive, most likely due to knee OA, considering the changes in the X-ray of the knee, instead of persistent postsurgical pain. A diagnostic nerve block on three genicular nerves of her right knee was done under ultrasonographic guidance with 2 mL of 1% lidocaine which also produced more than a 50% reduction of pain. Genicular nerve neurolysis was performed one week later. Post procedure and at six weeks follow-up, the patient reported excellent pain relief with an NRS score of 0/10. She also had significant functional improvement.

3. Alcohol neurolysis procedure

In both cases, chemical neurolysis with alcohol was performed 1 week after a successful diagnostic block with lignocaine 1% using dual image modalities (ultrasonography and fluoroscopy). Neurolysis is done on the SMGN, IMGN, and SLGN. An explanation of the procedure was given and a written consent was obtained from both these patients prior to the procedure. During the procedure, the patients are in a supine position. The affected knee was slightly flexed with a towel roll tucked under it. After an initial survey scan using ultrasonography and fluoroscopy, the point of injection was marked. A mixture of 2% lidocaine and contrast dye (total 1 mL) was then injected under ultrasonographic guidance. The spread of dye was further confirmed with fluoroscopy before 1 mL of 99% alcohol was injected for each nerve (**Fig. 1**).

The NRS score and Knee Osteoarthritis and Outcome Score (KOOS) were collected before and six weeks after the procedure. The results of the KOOS are represented in **Fig. 2**.

DISCUSSION

In this case report, alcohol neurolysis of the genicular nerves, including the SMGN, IMGN, and SLGN, resulted in significant improvement in pain intensity and quality of life

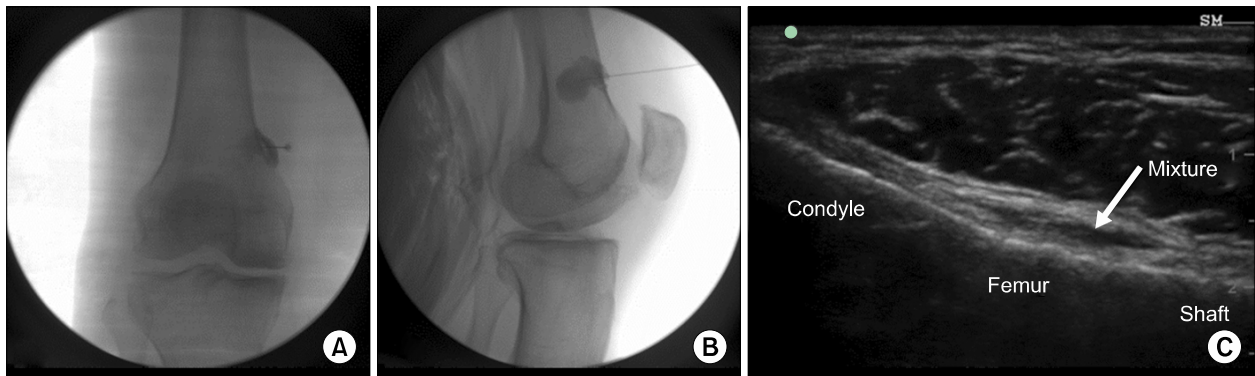


Fig. 1. Anteroposterior (A) and lateral (B) fluoroscopies view of contrast and lidocaine mixture spread. Ultrasound view (C) during injection of contrast and lidocaine mixture in superomedial genicular nerve.

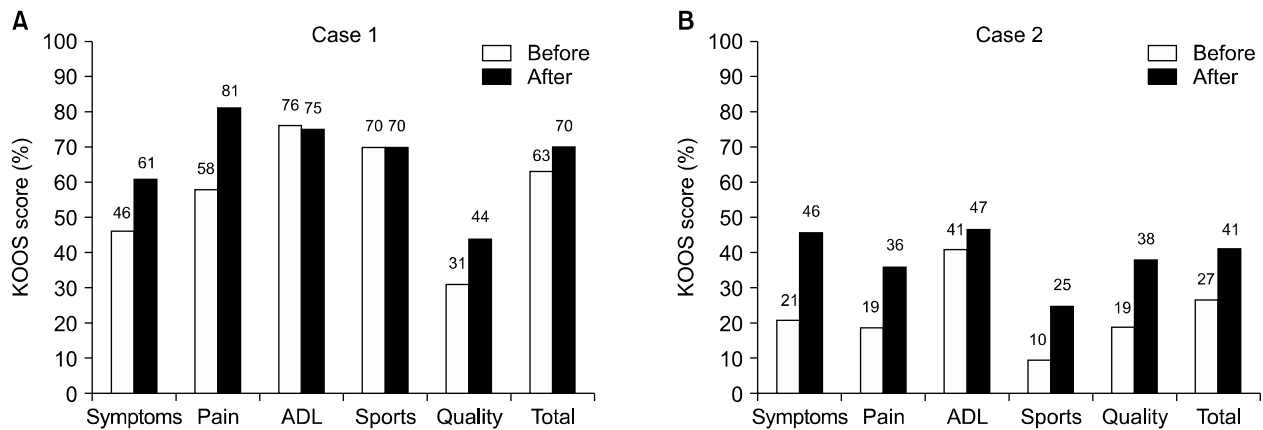


Fig. 2. Knee Osteoarthritis and Outcome Score (KOOS) for case 1 (A). Note that significant improvement in symptoms, pain and quality of life. KOOS for case 2 (B). Note that significant improvement in all categories and total score. ADL: activities of daily living.

in both patients with chronic knee pain for six weeks.

RFN of the genicular nerves is presently the popular choice for neurolysis, and many studies have been done to support its use [5–9]. It is a reliable, safe, and effective technique with relatively good outcomes [8]. However, we believe chemical neurolysis has an added value when compared to RFN, despite the lack of studies related to this technique, and its significance should be investigated further. Chemical neurolysis can be performed with alcohol or phenol and it is cost-effective, easily performed, and has an early clinical outcome [10,11]. Furthermore, it is possible to use this technique as a rescue method in the event RFN fails.

A recent cadaveric study indicated the regional anatomy of the nerve supply to the anterior capsule of the knee could be categorized into 4 quadrants and supplied by 11

different nerves which vary in position in relation to their bony landmarks. This further elaborates the variation of these nerves with a frequency map of the innervation of the anterior knee joint [12].

A genicular nerve block (GNB) is usually done on the SMGN, IMGN, and SLGN. The inferolateral genicular nerve is not usually blocked due to concerns with injury to the common peroneal nerve [6]. The SLGN, SMGN, and IMGN are the most appropriate branches to conduct neurotomy by applying radio frequency thermocoagulation current, as these branches are easily accessible percutaneously [13]. Early studies identified bony landmarks to locate needle placement *via* fluoroscopy [7]; and recently with the use of ultrasonography, the genicular arteries are identified near the periosteal areas at the junctions of the epicondyle and the shafts of the femur and tibia, and the needle tar-

get is next to each genicular artery because the SLGN, SMGN, and IMGN are located next to the arteries [4,14]. However, considering the variation in the course of these nerves, placement of a single small-tip RFN needle would not capture all the nerves innervating the anterior knee joint. This could be the reason for the 25% non-responder rates with this technique.

The use of chemical neurolysis techniques can be an effective method to accomplish a larger, thorough lesioning when compared to an RFN needle. Using live fluoroscopy during injection can ensure proper spread and pattern of the neurolytics. This technique is able to cover the anatomical variability of genicular nerve location [8]. Hence, this method will ensure a better success rate and outcome.

The use of ultrasonography is gaining popularity when performing procedures pertaining to the genicular nerves. Several studies have reported the successful performance of a GNB or genicular nerve RFN under ultrasound guidance [4]. These are based on anatomical studies demonstrating that the genicular nerves are accompanied by genicular arteries or are located near the adductor tubercle and medial collateral ligament [15,16]. In the fluoroscopy technique, probable sites of the genicular nerves were identified in the medial and lateral regions of the lower end of the femur and the medial region of the upper end of the tibia. In the ultrasound technique, the genicular arteries are identified about 1.0–1.5 cm from the edge of the patella, the nerves are located next to the arteries, and the needle is placed next to the artery [13]. Most of the time, the nerves are not easily identified.

In our experience, we noticed there were variations in the position of the arteries along the junction of the femoral and tibial condyle. Studies have shown that when comparing both techniques, there were no differences in success rates and NRS scores between the two types of imaging modalities. But most studies recently lean towards the use of ultrasound because it is safe to both medical practitioners and patient in terms of radiation risk [13]. In the cases above, two different imaging modalities were used when performing the procedure in order to increase the accuracy and the success of the block. Dual modality is also used to prevent complications of the unwanted spread of alcohol causing damage to other tissues.

The ideal volume of neurolytics used is debatable, as there are no major studies comparing the volumes of neurolytics used for the genicular nerves. In some case re-

ports, 0.5–2.0 mL were used simply based on the volumes of local anaesthetics used for diagnostic blocks. These volumes include mixing alcohol with local anaesthetics [5,10]. However, in our cases, we used 1 mL of 99% alcohol, without mixing it with local anaesthetics. We used a mixture of local anaesthetic (lidocaine) and contrast dye during placement of the needle. The common concentration of ethyl alcohol used for chemical neurolysis ranges from 30% to 100% solution [14]. Thus, the intention of using 1 mL of 99% alcohol in our case was that we wanted to maintain about a 50% concentration of alcohol in the tissues, and we found that the volume of 1 mL of alcohol (a total of 1 mL of contrast medium and local anaesthetic had already been injected prior to alcohol injection) was sufficient in our cases.

We used KOOS to assess the patient's response to treatment. It holds five separately scored subscales, and is a valid, reliable, and a responsive self-administered instrument that can be used for short-term and long-term follow-up for several types of knee injury [17]. The score is a percentage score from 0 to 100, 0 representing extreme problems and 100 representing no problems. Both the patients had good outcomes after alcohol neurolysis with more than 50% improvement in their NRS scores. However, the second patient had significant improvement in her total score in the KOOS assessment. She had improvement in all aspects assessed in the KOOS, while the first patient had improvement in three out of five aspects of the KOOS. This may indicate that genicular nerve neurolysis may be applicable in cases which predominantly have nociceptive pain, such as knee OA, instead cases with neuropathic pain.

In conclusion, alcohol neurolysis of the genicular nerve is cheaper and has an early clinical outcome when compared with RFN, and can also be used as a rescue method in the event RFN fails. Even though its safety and efficacy is well seen in many case reports, larger randomized controlled trials are needed to substantiate its use.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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