

Case Report

Ultrasound-guided Radiofrequency Lesioning of the Articular Branches of the Femoral Nerve for the Treatment of Chronic Post-arthroplasty Hip Pain

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Background: Total hip arthroplasty (THA) is a common surgical treatment for several conditions of the hip. While the majority of patients obtain satisfactory results, many develop chronic post-arthroplasty hip pain that can be difficult to treat.

Objective: We evaluate the effectiveness of cooled (60°C) radiofrequency lesioning of the articular branches of the femoral nerve (ABFN) as a minimally invasive treatment for patients suffering from chronic post-arthroplasty hip pain. This treatment has never been described previously in this population.

Study Design: Case report.

Setting: Center for Pain Medicine, Massachusetts General Hospital, Harvard Medical School.

Method: A 59-year-old woman with long-standing osteoarthritis of the right hip who underwent primary total hip arthroplasty and presented with chronic post-arthroplasty hip pain.

Intervention: Cooled (60°C) radiofrequency lesioning of the ABFN under ultrasound guidance.

Outcome Measure: Functional ability and numeric rating scale (NRS) scores at rest and with activity.

Results: Prior to intervention, the patient reported severe disruption in daily activities, sleep, and relationships; NRS scores at rest and with activity were 4/10 and 10/10, respectively. At 4 weeks following intervention, the patient reported significant improvement in functional ability and NRS scores decreased to 1/10 and 2/10, respectively. At 6 months, the patient's NRS scores at rest and with activity were 0/10 and 1/10, respectively. At 24-month follow-up, the patient continued to endorse significant pain relief with NRS scores at rest and with activity of 0 – 1/10 and 1 – 2/10, respectively. There were no side effects or complications including motor weakness, sensory loss, and neuralgias.

Limitations: Although the patient obtained good results from the intervention, the description of the study is from a single case report. Further study is necessary to investigate the widespread use of this technique and its outcomes.

Conclusion: Cooled (60°C) radiofrequency lesioning of the ABFN under ultrasound guidance is both an effective and minimally invasive intervention for chronic post-arthroplasty hip pain.

Key words: Radiofrequency lesioning, articular branches, femoral nerve, post-arthroplasty, total hip arthroplasty, hip pain, chronic pain

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Total hip arthroplasty (THA) continues to be a common surgical treatment for chronic hip pain resulting from various etiologies such

as osteoarthritis, joint pain, functional limitation, dysplasia, and joint degeneration (1). It is associated with improved function and quality of life, and

the majority of patients who undergo THA attain significant long-term reduction in their pain (2). With the aging population, THA has become an increasingly common treatment option for hip pain throughout the world (3). However, the increased incidence of THA has given rise to a growing post-surgical population that is encountering postoperative complications. Among these complications is the presence of chronic, postoperative pain after THA. The incidence of post-arthroplasty chronic hip pain is reported as high as 28% (4).

Sensory innervation of the hip joint is attributed to the articular branches of the obturator, femoral, sciatic, and gluteal nerves (5). Percutaneous radiofrequency lesioning (RFL) of the articular branches of the femoral nerve (ABFN) for hip pain was first introduced in 1981 (6). However there has since been a scarcity of reports on the topic. The majority of reports discuss RFL of articular branches of both the femoral and obturator nerves for patients who have contraindication to THA due to their comorbidities. Furthermore, these cases have utilized RFL of the nerves at higher temperatures (75 – 90°C). This case report describes the novel and effective use of cooled (60°C) RFL of the ABFN under ultrasound guidance, specifically for the treatment of chronic post-arthroplasty hip pain.

CASE REPORT

After thorough discussion with the patient, consent was obtained for the presentation of this case.

A 59-year-old, 85 kg woman with a past medical history significant for hypertension, asthma, osteoarthritis, migraines, and fibromyalgia presented with 7 months of right hip pain after revision of a primary right THA. The patient's hip pain began several years prior and was attributed to osteoarthritis. The patient underwent primary THA and experienced substantial pain relief lasting 2 years. She then developed progressive recurrence of the hip pain. Magnetic resonance imaging of the hip 4 years after THA was inconclusive and showed only moderate metal artifact. Further workup revealed serum cobalt and chromium toxicity secondary to degeneration of the metal-on-metal hip implant. The decision was made to undergo THA revision. The revision was performed without immediate complication, but her hip pain again gradually returned over the course of 6 months despite physical therapy, acupuncture, and medical pharmacotherapy, including hydrocodone/acetaminophen 5 mg/325 mg (3 – 5 tablets daily), cyclobenzaprine 10 mg nightly, topical diclofenac daily,

and duloxetine 30 mg twice daily. She was not on systemic non-steroidal anti-inflammatory drugs (NSAIDs) due to a prior gastric bypass procedure.

When the patient presented to our pain center, she was approximately 7 months status-post THA revision. She endorsed non-radiating right hip pain that was located in her right lateral hip and buttock. The pain was characterized as throbbing, stabbing, burning, and sharp in character, was exacerbated by sitting, lifting, walking, and bending, and worsened as the day progressed. Partially alleviating factors included heat and pain medication including hydrocodone/acetaminophen. Patient reported that the pain significantly interfered with daily activities, sleep, and relationships. She reported feeling depressed and frustrated. On numeric rating scale (NRS), the patient expressed a range of 4 – 10 out of 10. She stated that her pain level varied depending on activity and time of day but that on average, she was at a 10/10 level.

On exam, patient had mild tenderness to palpation on the lateral aspect of her right hip. Flexion, extension, rotation, and lateral bending at her back did not consistently reproduce the pain. She denied tenderness over the spinous processes and paravertebral lumbar regions. Straight leg test was negative bilaterally. Strength was 5/5 throughout the bilateral upper and lower extremities and deep tendon reflexes were 2+ at the patella and Achilles. Plantar reflex was downgoing and both gait and balance were within normal limits. There were no hyperesthesias, dysesthesias, allodynia, or hyperalgesia noted. By the time she had presented to us, she had already tried physical therapy, joint injections, acupuncture, aquatherapy, and the multiple surgeries outlined above without significant long-term benefit.

Initially, the patient was prescribed a long-acting opioid (morphine sulfate controlled-release 15 mg twice daily) to help with pain and aid in physical therapy. Upon follow-up, the patient denied improvement of pain and reported an increase in the dosage frequency of her pain medication. After a thorough discussion of the risks, benefits, and alternatives, the patient was agreeable to a diagnostic block of the ABFN and subsequent RFL following a successful diagnostic block. Following diagnostic block of the ABFN with 3 mL of 0.5% bupivacaine under ultrasound guidance, the patient reported > 50% decrease in hip pain and a NRS of 5/10 from 10/10. The patient was monitored and evaluated for meaningful improvement in function and pain. She endorsed significant relief in pain both at rest

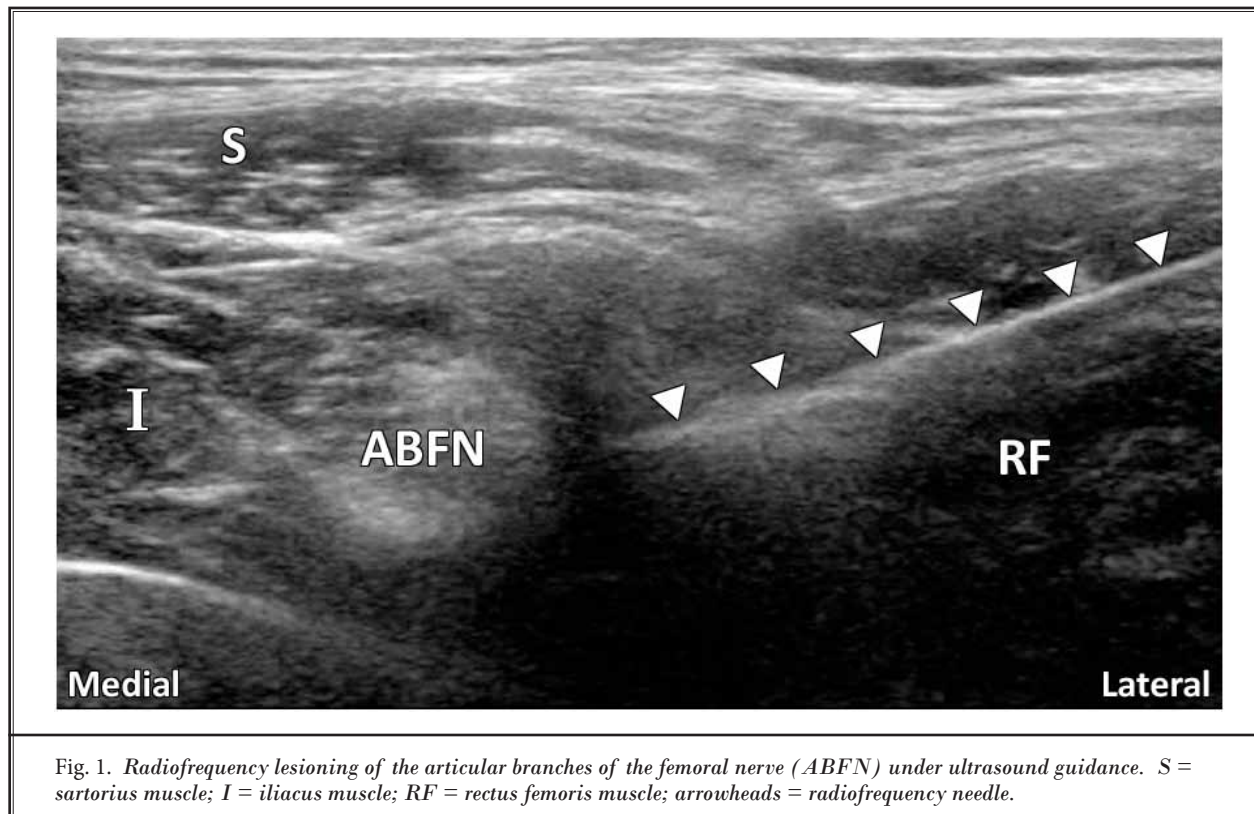


Fig. 1. Radiofrequency lesioning of the articular branches of the femoral nerve (ABFN) under ultrasound guidance. S = sartorius muscle; I = iliacus muscle; RF = rectus femoris muscle; arrowheads = radiofrequency needle.

and activity for several days. RFL was then subsequently performed.

The ABFN were identified with a linear ultrasound probe (12 MHz), at a 3 centimeter depth, at the junction of the sartorius, iliacus, and rectus femoris muscles. After the skin was anesthetized with 1% lidocaine, a Kimberly-Clark (Roswell, Georgia) 17 gauge cooled radiofrequency cannula was advanced in plane with the ultrasound probe (Figs. 1, 2). Sensory and motor stimulation were both performed and no quadriceps muscle stimulation was elicited at 3V. Approximately 3 mL of 2% lidocaine was injected. The radiofrequency needle was inserted and RFL was completed at 60°C for 150 seconds.

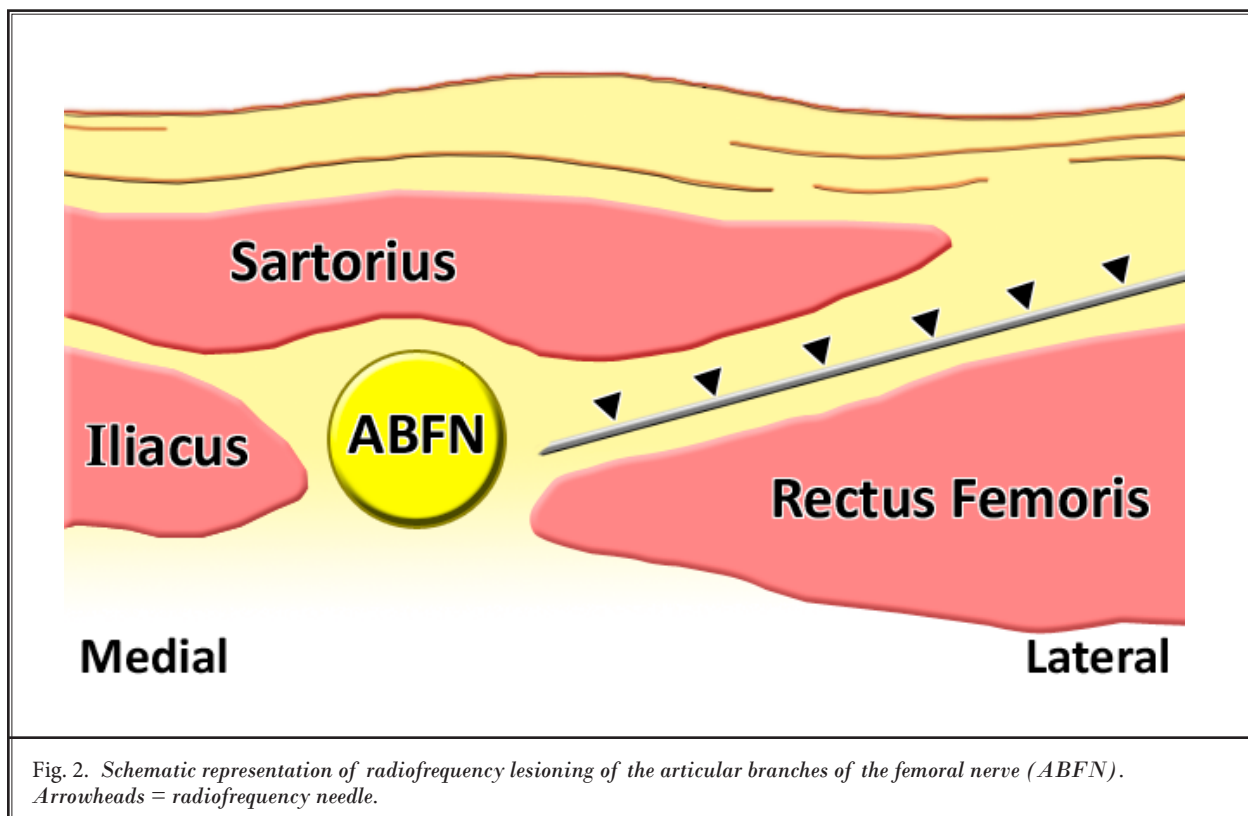
During follow-up at 2 weeks, the patient reported > 90% pain relief of hip pain and a drastic improvement in functionality and daily life activities. At 4 weeks, her NRS score had decreased from 10/10 to 1 – 2/10 and she reported that no pain was present the majority of the time. At 6 months, her NRS was 0/10 and she reported pain only with extensive activity with a maximal score of 1/10. At 24 months, her NRS was 0 – 1/10 at rest and 1 – 2/10 with extensive activity. She described improvements particularly with walking, climbing stairs, bend-

ing, and standing from a sitting position. There were no side effects or complications following the procedure including motor weakness, sensory loss, and neuralgias.

DISCUSSION

THA is a reliable surgical treatment option for patients with chronic hip pain. In recent years, the proportion of patients choosing THA for alleviation of hip pain is increasing. A study reviewing the National Hospital Discharge Survey was notable for a 50% increase in primary THA rates and a 60% increase in revision THA from 1990 to 2002 (7). The incidence of persistent hip pain after THA is not an uncommon finding and clinicians must be prepared to deal with this growing cohort of patients. A 2006 study surveying 1,048 patients who had undergone THA in the previous 12 – 18 months showed a 28.1% rate of chronic ipsilateral hip pain postoperatively. They also reported a 12.1% rate of pain that limited daily activities to a moderate, severe, or very severe degree (4). Another study of 662 post-THA patients showed a 27% rate of persistent post-surgical pain after 3 – 4 years (8).

The mechanism underlying RFL in the treatment



of chronic pain involves thermocoagulation of nerve fibers and the denaturing of proteins that ultimately disrupt nociception (9). Recent studies on radiofrequency ablation in animal myocardium models suggest that using radiofrequency ablation with tips at colder temperatures can be associated with increased radiofrequency power delivery and lesion size (10). The application of cooled radiofrequency technology was utilized in this patient instead of conventional radiofrequency to theoretically maximize the size of the lesioning field, although the clinical relevance of this technique continues to be studied. In large tissue volumes, the water-cooled radiofrequency electrode will produce a much larger lesioning zone and will produce a significantly larger lesion over the tip relative to the conventional RF electrode (11).

Although RFL of the nerves that innervate the hip joint was first described in 1981, there have since been only a few reports on the technique. Okada presented 15 cases in 1993 using RFL of the obturator, femoral, and sciatic nerves at 80°C for 120 seconds with good results (12). Kawaguchi (6) described 14 cases of RFL to articular branches of both the obturator and femoral nerves in patients mostly contraindicated to THA. Four

of the patients were described as postoperative but only non-THA surgeries were included. RFL in these patients was conducted at 75 – 80°C for 90 seconds with significant reduction in VAS scores in 12 of the 14 patients with a duration of relief from 1 – 11 months (mean 4.2 months) without adverse effects (6). Fukui (13) and Malik (14) further described RFL of articular branches of both the obturator and femoral nerves in patients with contraindications to THA with good results. However none of these studies focused on the treatment of postoperative hip pain after THA. The decision for diagnostic neural blockade and subsequent RFL of the ABFN without inclusion of the obturator branches was based on the patient's anatomic location of pain, which was limited to the lateral hip without reports of groin or medial thigh pain.

The successful use of cooled RFL of the ABFN for chronic persistent hip pain status-post THA has not been reported to our knowledge. Secondly, the number of patients undergoing primary THA and revision THA is increasing worldwide; consequently, the incidence of chronic, postoperative hip pain will also likely increase. Clinicians have traditionally been ill-equipped to handle this population of patients who have essentially failed

medical and surgical treatment of hip pain. Although further study is needed to investigate the widespread use of this technique and its outcomes, the novel appli-

cation of this intervention presented here adds to the clinician's arsenal of possible modalities in treating this difficult and increasing problem.

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