

Editorial Commentary: Radiofrequency Ablation for Patients With Osteoarthritis of the Knee Could Be Indicated for Patients Failing Conventional Nonoperative Treatment and Wishing to Avoid Total Knee Arthroplasty



Sheryl Lipnick, D.O., F.A.A.O.S.

Abstract: Patients with knee osteoarthritis are constantly looking for ways to combat their pain and improve their quality of life. As newer treatments present themselves, it is up to the orthopaedic specialists to provide the best treatment possible. Radiofrequency ablation, usually administered by a pain management specialist, has shown to be an acceptable alternative treatment and should be considered in the management of osteoarthritis. It should be considered for patients who have failed nonoperative treatments and are not interested in pursuing total knee arthroplasty, and possibly for patients who have persistent pain after total knee arthroplasty.

See related article on page 2287

Patients with knee osteoarthritis are constantly looking for ways to combat their pain and improve their quality of life. If you walk into any supermarket or drug store, you will see the obvious role nonoperative modalities play. Patients can choose anything from braces to supplements to a whole shelf full of oral and topical pain relievers, including anti-inflammatory medications and acetaminophen. As newer treatments present themselves, it is up to the orthopaedic providers to assist these patients in choosing the best treatment possible. Updated clinical practice guidelines per the American Academy of Orthopaedic Surgeons for the treatment of knee osteoarthritis recommend acetaminophen, intra-articular corticosteroids, and oral anti-inflammatory drugs (NSAIDs).¹ Per the guidelines, there is strong evidence to support oral and topical NSAIDs, exercise (supervised, unsupervised, and/or

aquatic), self-management programs, patient education programs, and oral acetaminophen. There is strong evidence against lateral wedge insoles and oral narcotics, including Tramadol.

According to Moseley et al. from their article in the *New England Journal of Medicine* in 2002, arthroscopy is the most commonly performed type of orthopaedic surgery, and the knee is by far the most common joint on which it is performed.² They conducted a randomized, placebo-controlled trial to evaluate the efficacy of arthroscopy for osteoarthritis of the knee and concluded that arthroscopic lavage with or without debridement is not better than a placebo procedure in improving knee pain and function. Surprisingly, overall rates of knee arthroscopy still increased after the Moseley article, but there was a decrease in rates of knee arthroscopy for osteoarthritis alone with increased rates of knee arthroscopy for osteoarthritis with meniscal tear.³

I became familiar with radiofrequency ablation of the genicular nerves as a treatment for knee pain due to osteoarthritis after a discussion with a pain management specialist on recommendations to treat my patients who have failed nonoperative treatment, but didn't want a knee arthroplasty. I was very excited to see the article by Wu, Li, Si, Zeng, Li, Liu, and Shen entitled "Radiofrequency Ablation in Cooled

Hoffman Estates, Illinois

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Monopolar or Conventional Bipolar Modality Yields More Beneficial Short-Term Clinical Outcomes Versus Other Treatments for Knee Osteoarthritis: A Systematic Review and Network Meta-Analysis of Randomized Controlled Trials.⁴ This article not only evaluated the various types of radiofrequency commonly used, but also compared these radiofrequency treatments to other well-known treatments for osteoarthritis, specifically corticosteroid injections, hyaluronic acid injections, platelet-rich plasma, NSAIDs, and exercise. Ozone, erythropoietin, and dextrose were also included in the analysis. The article includes 10 years of literature involving 21 studies from 10 countries.⁵⁻²⁵ Two of these studies were performed in the United States in 2019 and 2020, reflecting increased global acceptance of this procedure.^{5,18} The orthopaedic literature on this topic is scarce, most likely because these procedures are mostly done by pain management physicians. This article is an important link to expose a newer technique to manage knee pain due to osteoarthritis.

Radiofrequency ablation (RFA) is the targeted delivery of radiofrequency energy to lesions through a probe that causes the thermal degradation of nerve structures via ionic heating. Traditional radiofrequency ablation probes operate at a set temperature of 80°C. In cooled radiofrequency ablation, the internally cooled probes operate at a set temperature of 60°C, while temperatures in tissues beyond the probe tip reach 80°C. This allows more energy to be delivered to surrounding tissues, creating larger lesions which can help overcome physiological variability of nerve location and increase the likelihood of treatment success.⁵ According to Lima et al., the main indications of the use of radiofrequency ablation for the treatment of knee osteoarthritis are Kellgren-Lawrence grades 3 and 4 with moderate to severe pain and failure of conservative treatment; persistence of pain even after total knee arthroplasty; and patients with an indication for total knee arthroplasty who refuse to undergo surgical treatment.²⁶

Hong et al. reported that radiofrequency ablation can reduce pain, but will not likely improve joint function.²⁷ This finding contrasts the more recent meta-analyses by Wu et al., Liu et al., and Zhang et al.^{4,28,29} According to Liu et al., the systematic review by Hong et al. only considered outcomes measured by the Oxford Knee Score, while the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score was not considered.²⁸ Hong et al. also speculated that pulsed radiofrequency performed at the lower temperature of 42°C may better avoid nerve destruction with neuropathic pain and Charcot joint with less neuritis-like reactions and motor deficits.

Meta-analysis studies can be quite complex. Wu et al. did a nice job of identifying areas of concern or high bias. They also described the differences between the

three different modalities (cooled, conventional, and pulsed) of radiofrequency in an understandable way in section 4.1 of the article.⁴ The authors also sought to compare targets (genicular nerves vs articular cavity), number of electrodes (bipolar vs monopolar), and image guidance (ultrasound vs fluoroscopy). Twenty-one articles were used for the meta-analysis; however, the majority of these studies did not compare the same things. For instance, one study out of Egypt by El-Tamboly et al. looked at pulsed radiofrequency ablation of the genicular nerves versus intra-articular pulsed radiofrequency ablation plus intra-articular platelet-rich plasma injection.¹² The pulsed radiofrequency ablation of the genicular nerves was found to be inferior. This is contrasted by Elawamy et al., who found pulsed radiofrequency ablation of the genicular nerves to be superior to intra-articular platelet-rich plasma injection alone.¹³ Can we conclude that intra-articular pulsed radiofrequency ablation is the key ingredient? We cannot without more studies and information.

There were only two articles in the meta-analysis that directly evaluated bipolar versus monopolar. Bipolar radiofrequency ablation involves inserting two electrodes to target the genicular nerves without sensory localization, which can decrease the procedural pain with equal analgesic efficacy in treating knee pain.²² They recommended performing a diagnostic genicular nerve block prior to radiofrequency ablation. Patients who have greater than 50% pain relief are a candidate to receive radiofrequency ablation. The article by Jadon et al. used conventional radiofrequency ablation of the genicular nerves. They found that both bipolar and monopolar groups had good pain relief. There was no difference in pain relief or duration of pain relief between the two groups. There were no significant differences in procedure time and no complications in either group. They found less procedural pain in the bipolar radiofrequency ablation versus the monopolar and recommended bipolar radiofrequency ablation as an effective alternative for ablation of genicular nerves in patients with knee pain due to osteoarthritis. The article by Gulec et al. evaluated bipolar and monopolar pulsed intra-articular radiofrequency ablation.⁸ They evaluated visual analog scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores up to 3 months. They concluded that bipolar intra-articular pulsed radiofrequency ablation is more advantageous in reducing chronic knee pain and functional recovery compared with monopolar intra-articular pulsed radiofrequency ablation. Wu et al. concludes that bipolar radiofrequency ablation of the genicular nerves is more effective than monopolar ablation for improving pain and function in conventional and pulsed modalities.⁴ There was, however, no direct comparison of pulsed bipolar versus monopolar

radiofrequency ablation of the genicular nerves, only intra-articular radiofrequency ablation. This will need to be an area of further future study. I also agree with Wu et al. that the bipolar versus monopolar comparison was not fully assessed in the cooled modality.

A recent meta-analysis by Zhang et al. discussed the efficacy and safety of radiofrequency ablation for treatment of knee osteoarthritis. Seven out of nine of the articles cited in their article were also cited in the meta-analysis by Wu et al. They observed improved Western Ontario and McMaster Universities Arthritis Index (WOMAC) outcomes at 4, 12, and 24 weeks with the use of radiofrequency ablation. No serious adverse events were observed.²⁹

Another recent meta-analysis by Liu et al. similarly reviewed the efficacy and safety of radiofrequency treatment for improving knee pain and function in knee osteoarthritis.²⁸ That study evaluated 15 randomized controlled trials with 1,009 total patients. Seven out of 15 of those studies were used in the meta-analysis by Wu et al. They demonstrated that radiofrequency treatment correlated with improvements in pain relief and knee function (WOMAC) at 1–2, 4, 12, and 24 weeks after treatment. The Oxford Knee Score did not differ significantly between the two groups, and treatment with radiofrequency did not significantly increase adverse effects. Subgroup analysis showed that radiofrequency treatment targeting the genicular nerve was significantly better than intra-articular radiofrequency at 12 weeks after treatment.

Clinical studies have demonstrated 12 months of pain relief in the majority of patients with radiofrequency ablation.^{18,30} Hunter et al. further evaluated a subset of these subjects in a randomized controlled trial showing that cooled radiofrequency ablation provided sustained pain relief, improved function, and perceived positive effect through 24 months for subjects with osteoarthritis knee pain with no safety concerns identified.³¹

Wu et al. stated that the three genicular nerves could be chosen as the targets in the three modalities, and the articular cavity can also be chosen as the target in the pulsed modality.⁴ Conventional bipolar genicular nerve radiofrequency ablation had the greatest net benefit on the VAS at 6 months and cooled monopolar genicular nerve radiofrequency ablation had the greatest net benefit on the WOMAC at 6 months. They conclude that patients respond better to the cooled modality compared to the conventional and pulsed modalities. The effectiveness of radiofrequency in cooled modality in combination with various intra-articular injections remains to be compared. Fluoroscopy and ultrasound guidance showed no differences in improving pain and function.

For further understanding of the technique for genicular radiofrequency ablation, I recommend the brief article by Greco et al., which summarizes anterior

joint innervation and appropriate electrode placement.³²

The article by Wu et al. opens the door for further discussion of the various types of delivery for radiofrequency ablation. More studies are needed to fully conclude the best combination of modalities (cooled, pulsed, and conventional), targets (genicular nerves versus articular cavity), and number of electrodes (monopolar versus bipolar). Once this determination is made, the effective length of pain relief and improved function will then need to be determined. As orthopaedic surgeons, we need to collaborate with our pain management colleagues to meet the needs of our patients. There may be a role for orthopaedic surgeons to perform a diagnostic genicular nerve block to evaluate which patients may be appropriate for further ablation. Radiofrequency ablation, usually administered by a pain management specialist, has shown to be an acceptable alternative treatment for osteoarthritis of the knee. It should be considered for patients who have failed nonoperative treatments and are not interested in pursuing total knee arthroplasty, and possibly for patients who have persistent pain after total knee arthroplasty.

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