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Radiofrequency Ablation for Lower Limb Pain

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ABSTRACT: Radiofrequency Ablation (RFA) can be used to remove or change unwanted elements. Radiofrequency (RF) has been treating various pain-producing components for over 50 years. However, not all pain syndromes have been treated with it because of understanding or technical limitations. This review paper will focus on how RFA is used to treat lower limb pain for new indications.

Lower Extremity PainPost- surgery pain: herniorrhaphy, cesarean section, appendectomy, Pudendal neuralgia, Recalcitrant neuropathic pelvic pain, Meralgia paresthetica.

Knee Pain Syndromes: Subchondral insufficiency fractures of the knee, Knee osteoarthritis

Ankle Pain Syndromes: Achilles tendinosis, Insertional Achilles tendinosis.

KEYWORDS: Neurology, Pain, Radiofrequency.

1. MAIN TEXT

INTRODUCTION

Radiofrequency Ablation (RFA) has been utilized to eliminate or modify noxious sources. For more than 50 years, RF has been used to treat a range of pain-producing components, although not all pain syndromes have been treated with it due to knowledge or technical limitations. There are different ways to diagnose the skeletal and muscular syndromes, from traditional methods such as X-ray and CT (1), to novel MRI and PET scans. PET/CT can detect a variety of primary and metastatic lesions as well as incidental abnormalities (2). Recently, of direct magnetic resonance arthrography (MRA) was used for joint and glenoid labral lesions (3). Also, there are several treatment modalities for MSK disease, from drug therapy to neuromodulation, such RFA. This review paper will focus at how RFA is used to treat lower limb pain, for new indications. (4).

Knee pain: The complex nerve architecture of RF in the treatment of knee pain is an important point in its growth. As a result, conventional CRFA methods for knee pain may fail to address all relevant and accessible sensory afferents of the anterior knee joint capsule. RFA in the knee traditionally targets the superior lateral genicular nerve (SLGN), superior medial genicular nerve (SMGN), and inferior medial genicular nerve (IMGN).(5). However, current cadaver investigations reveal that additional articular nerves are involved in sensory innervation of the anterior knee joint capsule. (6). In addition to the previous nerves, these studies included sensory inputs from the nerves' terminal articular branches to the vastus intermedius (NVI), vastus lateralis (NVL), vastus medialis (NVM), common fibular nerve, and recurrent fibular nerve.

Tran also exhibited more heterogeneity in the SLGN, SMGN, and IMGN courses.

Also in 2020, a three-tined RFA cannula was used on patients with persistent knee pain, showing a substantial improvement in pain relief after 6 months compared to traditional and genicular nerve techniques. Depending on the magnitude of the lesion, different cannulae (conventional, cooled, and three-tined) cause varied neuronal capture and clinical consequences. In both cases, the size of the lesion depends on the needle gauge, the active tip length, and the temperature of the lesion. (7)..

The three-tined cannula forms the pyramidal lesion, which is the biggest lesion diameter closest to the cannula's tips, which increases the likelihood that nerves will be captured. (8). This issue was also addressed in the Finalyson study, which looked at the several types of multitined RFA cannulas available. Using a three-tinned cannula with a distal deployment mechanism, this study demonstrated that it is possible to establish a stable lesion size up to an angle of 90 degrees with respect to the periosteal surface. (9).

Subchondral insufficiency fractures of the knee: This is a painful and refractory fracture. In a patient suffering from excruciating pain as a result of this fracture, a cooled RFA method of the genicular nerves for knee discomfort and a bisphosphonate injection for inadequate bone mineralization/density were used. After 4.5 months, there was an improvement in the patient's pain, function,

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and range of motion. (10).

In a trial, patients with severe knee osteoarthritis who had previously undergone knee arthroplasty were subjected to ultrasound-guided pulsed RF of the superior medial, superior lateral, and inferior medial genicular nerves. The pain reduction rate was greater than 80% in the 3-week and 3-month follow-ups. (11). We can experiment with changing the number of needles to see if we can enhance efficacy. In a 2020 study, the Safety and efficacy comparison of three- vs four-needle technique in the treatment of severe knee osteoarthritis using cooled radiofrequency ablation, was examined. After 6 months, 79 percent of patients treated with 4 needles and 45 percent of patients treated with 3 needles had a reduced need for opioids in 77 treated knees. As a result, the four-needle treatment technique was found to be more effective in the treatment of knee osteoarthritis. (12).

Monopolar cooled RFA (CRFA) produces spherical lesions of 0.5-1.0 cm3 volume that extend 4 mm beyond the active tip. So the sensory afferent targets described by Tran would be missed by the current RFA procedure. The SLGN, SMGN, NVL, NVI, and NVM can be missed. A novel approach targeting NVL and NVM was tested in 2020, as well as more CRFA electrode placements needed to cover both branches of NVI. The pes anserine tendon/tendon footprint can be compromised in genicular CRFA. An inferior and posterior approach reduces the likelihood of pes anserine tendon injury. (13).

Phantom pain can be debilitating and limit functional progress after amputation. Many treatments have failed, including physical therapy, medicines, and interventions. Because it inhibits evoked synaptic activity, Pulsed radiofrequency ablation (PRFA) has shown promise in treating neuropathic pain. West et al. presented four amputees who received PRFA after failing conservative RLP and PLP management. All 4 patients had PRFA and had at least 80% RLP alleviation for 6 months. One patient experienced complete phantom feeling resolution, while another reported decreased spontaneous PLP frequency and evoked PLP resolution. Patients reported increased prosthesis tolerance and decreased oral pain medication use. This case series demonstrates PRFA is a potential therapeutic option for intractable RLP and/or PLP (14).

Pain management becomes more critical when the population is vulnerable, such as pregnant patient; or, when the disease is prevalent, such as carpal tunnel syndrome (15).

ANKLE PAIN SYNDROMES

In the case of acute Achilles tendon damage, direct radiofrequency (RF) therapy has been proven to heal the tendon injury, improve gain, and decrease the associated pain. (16).

Achilles tendinosis is a persistent degenerative disease in the Achilles tendon resulting in pain and swelling. The defective micro-architecture of the damaged tendon can be restored using a novel technology known as Topaz micro-debridement, which is being developed. This procedure has been employed in treating upper limb tendinopathies for some time, but its application in treating tendinopathies of the foot and ankle is rather new. The VISA-A scores improved from 18/100 to 63/100 after the topaz radiofrequency micro-debridement for Achilles tendinosis was performed, and all patients experienced objective improvement in functional outcome. When treating Achilles tendinosis, it has been suggested that topaz micro-debridement may be employed. (17).

When it comes to treating arthritis, RFA is routinely used, and RF ablation devices are commonly used in arthroscopic joint procedures to remove soft tissue. RFA technology has been used in a variety of other arthroscopic procedures in the past, including chondroplasties, partial meniscectomies, meniscal tears and repairs, and ligament reconstructions. (18).

With arthroscopic ankle joint application, recent advances have been documented. The effects of RF ablation of dendritic synovitis and ankle arthroscopy on persistent ankle pain were studied. The RF microanatomy wand was used to remove the joint's hypertrophic synovitis, or synovial buildup.

When conservative treatment has failed, bipolar RF-based arthroscopic micro debridement may help relieve persistent ankle joint discomfort. Obese patients experienced more pain relief with this treatment. The concern with RF ablation in arthroscopic surgery is that it raises tissue temperature, potentially damaging capsular tissue and chondrocytes. A 2018 study, suggested that a high irrigation flow should be established, during the use of RF in arthroscopic surgeries of the ankle joint, to prevent the temperature from rising to 50 ° C / 122 ° F. To avoid tissue damage, the ankle joint's pressure difference should be increased. (19). Some rheumatological illnesses, such as Ankylosing spondylitis, can manifest themselves in various ways depending on the stage of the disease. (20).

Complex regional pain syndrome (CRPS): There have been a number of different forms of sympathetic chain neurolysis (sympathectomy) that have shown promise as effective treatments for complex regional pain syndrome at various times (CRPS).

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The advent of new pain syndromes and complications such as increasing pain have prevented sympathectomy from becoming a conventional treatment. It has been claimed that pulsed radiofrequency (PRF) therapy may be used to treat a variety of chronic neuropathic pain conditions, including some kinds of CRPS, to avoid the negative effects associated with neurolysis (21).

RF for Pelvic and Hip Pain: PRF lowers VAS and reduces the need for analgesics when used to treat chronic pelvic pain.. A new anterior approach of cooled RF hip denervation was introduced for chronic pelvic pain. This approach avoided the neurovascular femoral bundle and ensured that the right landmarks were achieved. The needle access to the lateral articular branches of the femoral nerve was easy in these individuals, but placing the second trocar in the incisura acetabuli was more difficult. These findings support an anterior needle approach to the lateral articular branches of the femoral and obturator nerves, followed by RF denervation using a US-guide and fluoroscopy landmarks. (22).

A new anterior approach of cooled RF hip denervation was introduced for chronic pelvic pain. This approach avoided the neurovascular femoral bundle and ensured that the right landmarks were achieved. The needle access to the lateral articular branches of the femoral nerve was easy in these individuals, but placing the second trocar in the incisura acetabuli was more difficult. These findings support an anterior needle approach to the femoral and obturator nerves' lateral articular branches, followed by RF denervation using a US guide and fluoroscopy landmarks. In chronic pelvic pain patients, the effect of PRF on femoral articular branches and obturator nerves was investigated. 57 percent of patients reported decreased pain and impairment ratings fell after a 6-month follow-up. (23). Chronic Post-arthroplasty Hip Pain: This condition can develop following a total hip replacement. At 6-month and 24-month follow-up, cooled (60 ° C) RF lesioning of the articular branches of the femoral nerve successfully reduced chronic post-arthroplasty hip pain. (24).

PRF can be used to treat chronic pelvic pain in patients who aren't surgical candidates. A 10 cm neurotherm needle at 42°C for 480 seconds, for example, relieved his pain in bilateral coxarthrosis. (25). Lumbosacral facet joint discomfort can be treated with both medial branch and IA stimulation. Pain impulses from the facet joint to the brain can be blocked by stimulating the posterior primary ramus medial branch.. (26).

CONCLUSION

This review paper will focus on how RFA is used to treat lower limb pain for new indications (27). They include:

- Lower Extremity PainPost- surgery pain: herniorrhaphy, cesarean section, appendectomy, Pudendal neuralgia, Recalcitrant neuropathic pelvic pain, Meralgia paresthetica
- Knee Pain Syndromes: Subchondral insufficiency fractures of the knee, Knee osteoarthritis
- Ankle Pain Syndromes: Achilles tendinosis, Insertional Achilles tendinosis

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