CURRENT CONCEPTS REVIEW

Radiofrequency Ablation for the Management of Pain of Spinal Origin in Orthopedics

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Received: 21 March 2023 *Accepted: 28 August 2023*

Abstract

Radiofrequency (RF) is a minimally invasive procedure for interrupting or modifying nociceptive pathways to manage musculoskeletal neuropathic and nociplastic pain. RF has been used to manage cervical and lumbar facet joint syndromes. The benefits of RF are the following: it is safer than surgery; it doesn´t need general anesthesia, by that means diminishing the complications; it causes pain alleviation for a minimum of 3-4 months; it can be repeated if needed; it improves joint function; and it minimises the necessity for oral pain treatment. RF must not be used in pregnant women; unstable joints, uncontrolled diabetes mellitus; and presence of an implanted defibrillator. Even though complications from RF are rare, possible adverse events are infection, hemorrhage, numbness or dysesthesia, greater pain in the procedure area, and deafferentation impact. Even though there is a peril of injuring non-targeted neural tissue and other tissues, this can be lessened by carrying out the procedure with the help of fluoroscopy, ultrasonography or computed tomography. RF seems to be a helpful procedure for relieving chronic pain syndromes; despite this, definite proof of the procedure's effectiveness is still needed. RF is an encouraging procedure for treating chronic spinal pain, especially when other procedures are pointless or not feasible.

Level of evidence: III

Keywords: Chronic pain, Management, Radiofrequency, Spine

Introduction

Radiofrequency (RF) waves destroy the neural tissue that sends pain impulses to the brain. An RF circuit includes an RF generator creating the energy, a needle that is introduced into the individual, and a ground pad that is connected to dispel the energy as long as it is attached to the RF generator. RF energy is applied and sent to the individual, which makes the ions in the transmitting tissues to swing, liberating heat energy at the tip of the needle but without making the needle hot. The oscillations of the ions make the encircling tissue of the tip of the needle hot.[1,2]

The utilization of RF (also known as rhizotomy or neurotomy) for treating chronic pain was first published in 1931.[3] In 1950s, the first commercial RF generator was created.[4] Publications of other RF methods appeared in 1998, when pulsed RF was developed to cause a less "aggressive" technique.[5] the way by which pulsed RF alleviates pain endures unsure. A third category of RF ("cooled" RF) started utilization in the mid-1990s. It puts cold saline solution to the tip of the RF probe, which produces extensive, controlled injuries;[6-10] nonetheless, it was not until 2008 that the first publications mentioning the utilization of cooled RF were reported.[11-14] Since then, cooled RF has been demonstrated to be valuable for many indications.[15-24]

The objective of this paper is to perform a narrative review of current publications on the capacity of RF in managing spinal pain. For this aim, a quest was carried in PubMed on July 15, 2023, utilizing "radiofrequency facet joint" as key words. We encountered 464 publications, 46 of which were chosen because, in our belief, they were the most relevant and were absolutely connected to the title of this paper. Therefore, 418 were excluded. Besides, 3 chapters from a relevant book published on the topic were analyzed,

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amounting to a total of 49 references. Consequently, this paper is not a systematic review of the literature but rather a narrative review.

Indications, contraindications and advantages of RF

RF is advised for treating pain emerging from various musculoskeletal origins only if conservative management [pain killers, nonsteroidal anti-inflammatory drugs (NSAIDs), weight loss, Physical and Rehabilitation Medicine] has failed to render pain relief and the individual is not a candidate for surgical treatment.[25-27] RF must not be used in pregnant women, individuals with uncontrolled diabetes mellitus, and in those who wear an internal defibrillator. RF is safer than surgery, does not need general anaesthesia (therefore reducing complications), renders pain alleviation for a minimum of 3-4 months, can be done again if required; ameliorates joint function, and minimises the necessity of oral pain treatment.[15-24]

RF in cervical facet joint syndrome

History, physical exam, and radiographic evaluation might help detect an individual's candidacy for diagnostic cervical medial branch nerve blocks as a reasonable step in the confirmation of cervical facet joint pain, as well as to evaluate their candidateship for subsequent RF. The confirmation of cervical facet-mediated pain typically should be made by means of local anaesthetic blocks, either an intraarticular injection of the facet joint or a block of the nerves innervating the facet joint (i.e., the dorsal primary rami or medial branches). Before performing RF of the cervical facet, we should perform "double blocks" to confirm that the cervical facet joint is the primary pain generator.[28-35]

In a systematic review, successful pain alleviation ranged from 30% to 50%.[36] [Figure 1] shows fluoroscopically guided conventional RF for cervical medial branch denervation.

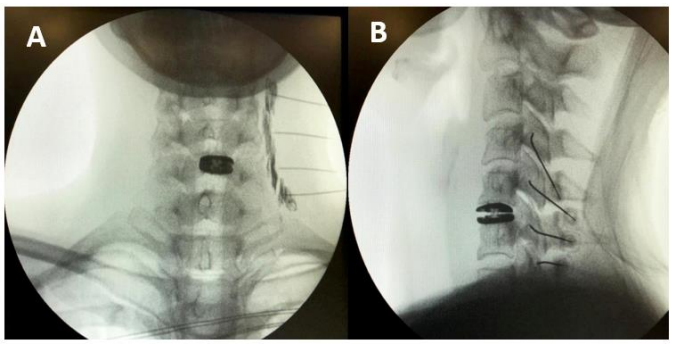

Figure 1. Fluoroscopically guided conventional radiofrequency (RF) for cervical medial branch denervation: (A) anteroposterior fluoroscopic view; (B) lateral fluoroscopic image

RF in lumbar zygapophyseal (facet) joint syndrome

Lumbar facet joints are the most frequent cause of chronic low back pain (compared with discs and sacroiliac joints), with an incidence of 21%-41%, and are to a greate degree the most frequent cause of chronic low back pain in individuals older than 65 years. The diagnosis of lumbar fact joint syndrome in individuals with low back pain must be confirmed by means of diagnostics blocks.[37-41]

Afifi et al compared the RF of lumbar facet joints with chemical neurolysis using ethyl alcohol 95% (EA-95) or glycerol 20% (Gly-20).[42] Ninety-five individuals with a mean age of 68 years were analyzed, of whom 30 experienced RF, 30 were managed with EA-95, and 35 were managed with Gly-20. After 6 weeks, the RF individuals had substantially lower VAS scores compared with the EA-95 cohort. After 6 months, the VAS was substantially inferior in the RF individuals than in the Gly-20 cohort. One year after the procedure, the VAS scores were substantially inferior in the RF cohort compared with the Gly-20 cohort. This study demonstrated that RF was associated with improved pain alleviation and quality of life (QoL) compared with chemical neurolysis. RF should therefore be deemed as the management of choice for individuals with chronic low back pain due to lumbar facet joint syndrome.[42]

Li et al published a systematic review to assess and compare the efficacy of various RF methods for treating facet joint-derived chronic low back pain.[43] Procedures included typical RF denervation, pulsed RF (PRF) denervation, PRF treatment of the dorsal root ganglia (PRF-DRG), RF facet capsule denervation (RF-FC), and RF ablation under endoscopic guidance (ERFA). The outcome was the modification in VAS average score from baseline at ≤6 months) and 12 months. Moderate evidence showed that conventional RF denervation had a bigger impact on pain alleviation than the sham control in the short-run and long term. Fair evidence demonstrated that PRF denervation was more efficacious than the sham control for pain over the long run. ERFA denervation was more efficacious for pain alleviation than the sham control in the short run and the long term. Fair evidence demonstrated that RF-FC denervation was more efficacious for pain alleviation than the sham control in the long term. PRF-DRG denervation was more efficacious for pain alleviation than the sham control in the short run. RF was an efficacious alternative for individuals with facet joint-derived chronic low back pain.[41] Turtle et al reported that instrumented lumbar spinal fusion can produce facet-mediated pain at levels adjacent to the surgical site due to disruption of lumbar medial branch nerve(s) and that RF could be useful in these cases.[44]

Even though complications from cervical and lumbar RF are rare, possible adverse events can include infection, hemorrhage, numbness or dysesthesias, greater pain in the area of the procedure, and deafferentation effects. Dysesthesia (a "sunburn"- type sensation) can occur after cervical RF, which has been encountered to be self-solving. Even though the peril for cervical nerve root injury exists, it can be lessened by performing the procedure with the help of fluoroscopy, and sensory and motor testing prior to lesioning.[45] [Figure 2] displays fluoroscopically guided conventional RF for lumbar medial branch denervation.

According to Lo Bianco et al, lumbar facet joint syndrome is one of the main causes of chronic low back pain. RF ablation utilizing a V-shaped active tip needle might produce a greater injury in the medial branch nerves, ameliorating clinical result. They assessed the effectiveness and the possibility of

RF ablation utilizing V-shaped active tip needles. The inclusion criteria were the following: adult individuals (>18 years), diagnosis of chronic lumbar facet joint pain and unsuccessful attempt of conservative management. The exclusion criteria were the following: lumbar pain unrelated to facet joints and prior spinal/lumbar surgical procedures. The primary outcome of the analysis was a modification in pain intensity at follow-up. The secondary parameters were quality of life, the occurrence of complications and the influence on postprocedural analgesic consumption. For these objectives, the following parameters were evaluated: pre- and posttreatment numeric rating scale (NRS), neuropathic pain 4 questions (DN4), EuroQoL - EQ-5D-3L, EQ-VAS, EQ-index and North American Spine Society (NASS) index. Sixty-four individuals were included. 7.8% of individuals at 1-month, 37.5% at 3-month, 40.6% at 6-month and 35.9% at 9-month follow-up reported a decrease of more than 80% in NRS, DN4, EQ-index and EQ-5D-VAS at the different time-points. This study demonstrated that RFA utilizing a V-shaped active tip needle may be a possible and efficacious management for chronic lumbar facet joint syndrome.[46]

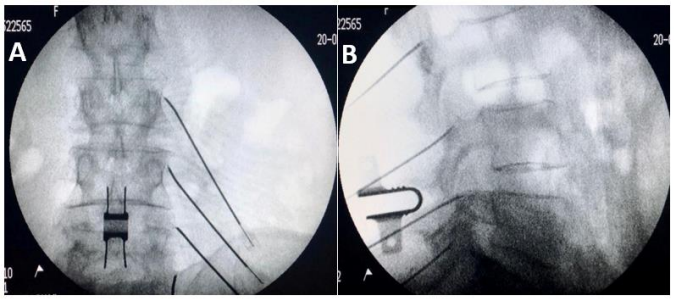

Figure 2. Fluoroscopically guided conventional radiofrequency (RF) for lumbar medial branch denervation: (a) anteroposterior fluoroscopic view; (b) lateral fluoroscopic image

RF in sacroiliac joint pain

In a systematic review, Maccagnano et al compared conventional RF and cooled RF to treat sacroiliac joint pain. Nine studies were identified, with 276 individuals suffering sacroiliac joint pain that were managed with RF. The two techniques showed no major adverse events, and no statistical difference between the two procedures studied was found. The authors stated that bibliography on the subject is currently missing, and well-constructed RCTs are required to assess this deficiency.[47] [Figure 3] shows fluoroscopically guided conventional RF for sacroiliac joint denervation.

Maalouly and Rao have recently analyzed 81 individuals (59 women, 22 men) who experienced cooled radiofrequency ablation. Their average age was 55 years. Twenty-two of the individuals had experienced fusions of the lumbar spine in previous years. Follow-up period ranged from 6 months to 1.5 years. After RF ablation, seven individuals progressed to fusions, and 6 individuals had to have the surgical technique repeated to alleviate their pain. This study concluded that sacroiliac joint RF ablation was a good alternative in the management of sacroiliac joint pain demonstrating good outcomes in the short-run follow-up period. It is an easy technique that can be performed in less than 30 minutes and is able of rendering substantial pain alleviation for individuals with sacroiliac joint pain.[48]

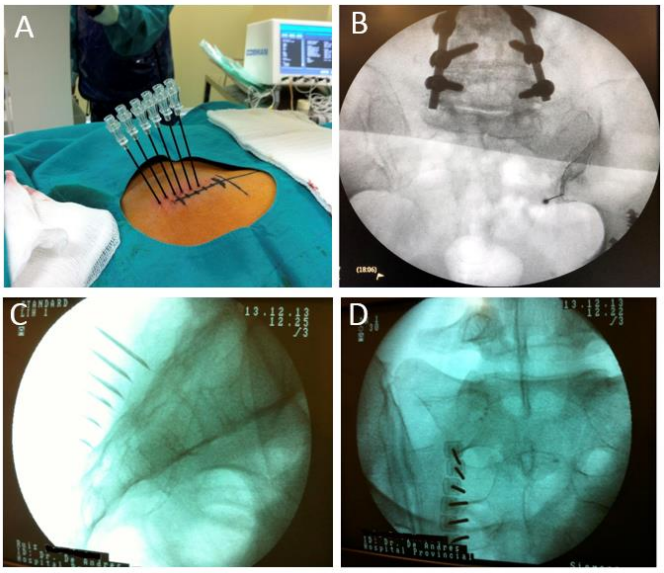

Figure 3. Fluoroscopically guided conventional radiofrequency (RF) for sacroiliac joint denervation: (A) clinical view; (B) anteroposterior fluoroscopic view; (C) lateral fluoroscopic image; (D) oblique fluoroscopic view

RF in coccydynia

Through a 2022 systematic review, Andersen et al evaluated the effectiveness of accessible management alternatives for patients with chronic coccydynia.[45] The greatest reduction in pain was experienced by the individuals who experienced RF treatment. An equivalent amelioration was experienced with extracorporeal shockwave therapy, coccygectomy, and injection. Although pain improved in all the studied alternatives, the average pain improvement was less for those who underwent ganglion block, stretching/manipulation and conservative/usual care. This report emphasised that treatment of coccydynia must begin with non-invasive approaches prior to considering coccygectomy. Nonsurgical treatment provided pain relief for many of the patients. Coccygectomy might be helpful for refractory patients.[49]

Conclusion

RF is a minimally invasive procedure utilized to destroy or modify nociceptive pathways for managing spinal pain. Satisfactory outcomes have been observed in sacroiliac joint pain utilizing RF of the lateral branches of the L4-S3 dorsal rami. In cervical and lumbar facet joint syndromes, RF of the respective branch nerves has yielded promising results. RF seems to be a helpful procedure for relieving chronic spinal syndromes, even if, until now, solid proof is still needed on

the effectiveness of this procedure. RF is a hopeful procedure for treating chronic spinal pain, especially when other procedures are ineffective or not feasible.

Acknowledgement

Not applicable

Conflict of interest: None

Funding: None

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