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Cooled Radiofrequency Ablation for Lumbar Facet Pain in Context of Lumbar Instrumentation and Cardiac Pacemaker: A Case Report

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Background: Many patients with severe axial lumbar pain due to the facet joints (i.e., facet arthropathy) have pain refractory to lumbar surgical instrumentation. Patients who have facet-mediated pain refractory to surgical management may benefit from radiofrequency ablation (RFA) of any remaining medial branch nerves, but RFAs in proximity to spinal instrumentation can cause thermal damage. In addition, many of these patients are older and potentially have cardiac implantable electrical devices (CIEDs). RFAs generate electromagnetic interference, which may damage or interrupt the function of CIEDs. Pain physicians may have safety concerns regarding performing RFAs for patients with lumbar instrumentation and CIEDs.

Case Report: We describe a case in which we safely performed 2 lumbar cooled RFAs in a staged fashion in a patient who had previous lumbar instrumentation, as well as a cardiac pacemaker. The patient reported near-complete bilateral pain relief without periprocedural pain, and no changes on electrocardiography or complications were observed.

Conclusion: RFAs may be safely performed in patients with CIEDs and pre-existing instrumentation if society-based practice guidelines are followed.

Key words: Case report, chronic pain, facet arthropathy, lumbar surgery, pacemaker, radiofrequency ablation

BACKGROUND

Radiofrequency ablation (RFA) of the medial branch nerves is a common procedure in interventional pain management. The prevalence of low back pain secondary to lumbar facet disease increases with age, and lumbar fusion with instrumentation may be performed. Despite surgical management, patients may continue to have facetogenic pain, possibly from adjacent-segment disease or pseudoarthrosis formation. These patients may benefit from RFA, but there is a concern that RFA in proximity to spinal instrumentation can lead to thermal damage (1).

Other comorbidities also rise in prevalence with age, including cardiac disease and arrhythmias that may require a cardiac implantable electrical device (CIED). This results in an increased likelihood of encountering a patient with a CIED who may be a candidate for RFA. However, RFAs generate electromagnetic interference (EMI), which may damage or interrupt the function of CIEDs (2).

Pain physicians may have safety concerns regarding performing RFAs for patients with lumbar instrumentation and CIEDs. We describe a case in which we safely performed 2 lumbar cooled RFAs in a patient who had lumbar instrumentation, as well as a cardiac pacemaker.

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CASE PRESENTATION

We obtained written informed consent for this case report. The patient was a 77-year-old woman who had a cardiac pacemaker implanted in 2018 for sick sinus syndrome. She presented to our clinic with axial lumbar pain refractory to multimodal analgesic medications, physical therapy, and a previous L4-S1 fusion with pedicle screws in 2018. Her pain was in the lower back, which she described as "sore" and "locked in." She rated the pain as 8 of 10 in intensity on the numeric rating scale (NRS). Symptoms were exacerbated when moving from a sitting to standing position and improved with rest and ice packs. She denied any numbness, tingling, or radicular symptoms. Magnetic resonance imaging of the lumbar spine demonstrated an L4-S1 posterior decompression and fusion, mild spinal canal narrowing at L3-L4, and bilateral neural foraminal narrowing at L3-L4, without significant progression since surgery.

The patient was considering a revision surgery due to the severity of her axial pain. However, because of significant osteoporosis, there was a concern for increased postoperative complications and whether the osseointegration of new instrumentation would be successful.

Two diagnostic blocks of the bilateral L3, L4 medial branch nerves, and L5 dorsal rami provided near-complete but transient analgesia, demonstrating that the patient was a candidate for RFA. We obtained a recent pacemaker interrogation report and communicated with her cardiologist, confirming that the patient was not pacemaker-dependent.

We then performed a left-sided cooled RFA, targeting the anatomic location of the medial branch nerves and L5 dorsal ramus while avoiding contact with the lumbar instrumentation (Fig. 1). Under fluoroscopic guidance in the anterior-posterior view, the left L5 dorsal ramus was located at the junction of the sacral ala and articular process of the sacrum, and the left L4 medial branch nerve and left L3 medial branch nerve were located at the superior junction of the transverse and superior articular processes of L5 and L4, respectively. A 20-gauge cooled radiofrequency lesioning needle with a 4-mm active tip (Coolief Cooled Radiofrequency System, Avanos, Alpharetta, Georgia) was then guided into position over each of these points after local subcutaneous anesthesia was administered with 1% preservative-free lidocaine. A fluoroscopic image in the lateral position was then obtained to ensure that all 3 needle tips were well outside of the neuraxial space. Sensory stimulation was then performed at each level at 50 Hz, with concordant symptoms noted at < 1.5 volts per level, with no radicular symptoms. Motor stimulation at 2 Hz was performed at 3 times the sensory threshold with no evidence of distal muscle contraction and no radicular symptoms. Following this, 1 mL of preservative-free lidocaine 2% was injected at each level through the needles after these reassuring sensory and motor test results. Approximately one minute afterward, allowing the preservative-free 2% lidocaine to take effect, the patient then received a 150-second (2 minutes, 30 seconds) lesioning cycle at 60 degrees Centigrade. After lesioning, a 3 mL solution containing 1 mL of 40 mg/mL methylprednisolone and 2 mL of preservative-free lidocaine 2% was injected through the needles prior to restyletting and withdrawing, 1 mL of the mixture per site.

Out of consideration of the patient's comfort, we did not place an additional RFA probe to directly measure temperatures (3), and the patient's small habitus would have made adjacent probe placement challenging. Throughout the procedure, we monitored the patient's vital signs and continuous electrocardiography (EKG), placed the electrosurgical grounding pad below the level of the umbilicus (such that the pacemaker was not between the path of the grounding pad and radiofrequency generator), and avoided sedation so that the patient could verbalize any pain or sensation of excessive warmth. The patient noted no symptoms of warmth or pain during her RFA and had no appreciable changes in her vital signs or EKG readings. She reported near-complete relief from her left-sided RFA at a 2-week follow-up. A right-sided RFA was then performed with the identical technique and precautions, with near-complete pain relief and no intra-procedural sensations or warmth, pain, or EKG changes.

DISCUSSION

Cardiac Implantable Electrical Devices

Cardiac implantable electrical devices (CIEDs) are a term that includes permanent pacemakers, implantable cardioverter-defibrillators (ICDs), and cardiac resynchronization therapy devices. Pacemaker-ICDs detect ventricular tachyarrhythmias and deliver high-energy shocks to prevent sudden death or syncope. They may interpret the signal from EMI as a tachyarrhythmia and deliver an inappropriate shock or interpret EMI as intrinsic cardiac activity and inhibit pacing in a pacemaker-dependent patient.

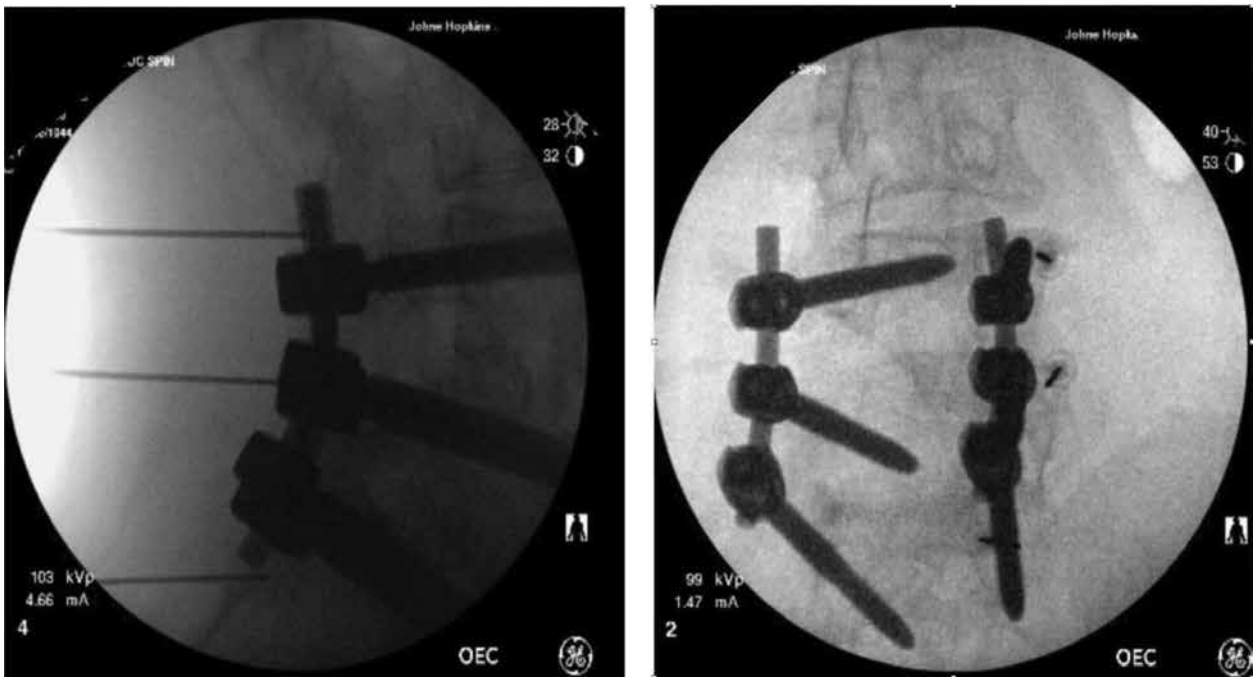

Fig. 1. Fluoroscopic images demonstrating the placement of radiofrequency probes for a medial branch nerve RFA in a patient with lumbar pedicle screws.

In a survey of 197 pain clinicians, only 20% indicated that they were aware of guidelines regarding periprocedural CIED management (4), despite published recommendations from the American Society of Anesthesiologists (ASA) practice advisory (2) and Spine Intervention Society (SIS) (5).

ASA and SIS recommend gathering the following information: 1) device type, manufacturer, and primary indication for placement; 2) whether a patient is pacemaker-dependent; and 3) current settings and confirmation of proper device function (obtaining a recent interrogation report of the CIED). The Anesthesia Patient Safety Foundation states that the risk to CIEDs from EMI from procedures below the level of the umbilicus (e.g., T10) is low (6), but the risk can be further mitigated by ensuring that the CIED is not between the path of the electrosurgical generator and grounding pad (e.g., placing the pad on the patient's calf).

The detection of EMI may lead to inappropriate shocks by an ICD. This may be prevented by turning off the anti-tachyarrhythmic functions of the ICD via placement of a magnet, however, the effect of magnets on ICDs varies by manufacturer. For pacemaker-dependent patients, inadvertent inhibition of pacing due to EMI can be prevented by placing the device in an asynchronous mode, in which continuous pacing is delivered regardless of cardiac activity sensed.

There are no reports in the literature regarding adverse events resulting from spine RFAs and EMI on CIEDs, and in one retrospective case review of 10 patients with CIEDs who collectively underwent 32 lumbar or sacroiliac RFAs, no adverse events were observed (7).

Lumbar Instrumentation

Lumbar RFAs in the presence of instrumentation may pose a challenge for pain physicians. The anatomical target of the RFA probes lies immediately adjacent to posterior instrumentation. The heat generated from the radiofrequency waves may theoretically transfer to the instrumentation if there is sufficient contact (3). This risks injury to the patient if a screw has eroded through bone and is in contact with a nerve root or blood vessel. The SIS guidelines recommend avoiding direct placement of the probe onto instrumentation, reviewing the imaging to identify migrated instrumentation, and monitoring for rapid temperature increases if possible (8).

In a study of 6 patients who had undergone lumbar fusion, close proximity of the RFA probes to the pedicle screws led to temperature increases. Two procedures

were aborted because the temperature of the pedicle screws reached 42°C (3). Similar findings have been demonstrated in a cadaver study, in which temperature increases were evident along the entire length of the screws (1). However, when probes are placed such that direct contact with lumbar instrumentation is avoided, any potential heat increase is probably minor and does not impact outcomes (9).

There have been no reports in the literature regarding complications arising from RFAs in patients with spine instrumentation. In a retrospective chart review by Ellwood et al (10) of 36 patients who collectively underwent a total of 56 cervical and thoracic RFAs, no complications occurred. Abd-Elsayed et al (9) performed a retrospective case-control review of 52 patients with genicular, lumbar, and cervical instrumentation at the site of cooled RFA, versus 170 patients without instrumentation. There was no difference in outcomes, with an average pain reduction of 50% lasting 90 days, and no reported complications. Although the data is limited, the lack of safety signals in these studies provides a degree of reassurance that RFA is a reasonable treatment to consider for the 7-16% of patients who might have facetogenic pain at the levels of previous lumbar surgery (11).

CONCLUSION

As the average age of the U.S. population increases, pain physicians are likely to encounter patients with refractory facetogenic pain who also have lumbar instrumentation and CIEDs. Although the available literature is limited, our clinical case demonstrates how lumbar RFAs may be safely performed without interference with CIEDs or pre-existing instrumentation if practice guidelines are followed.

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