Case Report

Water-cooled radiofrequency neuroablation for sacroiliac joint dysfunctional pain

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Abstract

Sacroiliac (SI) joint dysfunction is a common source of chronic low-back pain. Recent evidences from different parts of the world suggest that cooled radiofrequency (RF) neuroablation of sacral nerves supplying SI joints has superior pain alleviating properties than available existing treatment options for SI joint dysfunctional pain. A 35-year-old male had intractable bilateral SI joint pain (numeric rating scale [NRS] - 9/10) with poor treatment response to intra-articular steroid therapy. Bilateral water cooled = RF was applied for neuroablation of nerves supplying both SI joints. Postprocedure pain intensity was 5/10 and after 7 days it was 2/10. On 18th-month follow-up, he is pain free except for mild pain (NRS 2/10) on occasional extreme twisting of the back. This case attempts to highlight that sacral neuroablation based on cooled RF technique can be a long lasting remedial option for chronic SI joint pain unresponsive to conventional treatment.

Key words: Cool radiofrequency neuroablation, low back pain, sacroiliac joint

Introduction

The sacroiliac (SI) joint is a common source of chronic low-back pain (LBP) with reported prevalence ranging from 18% to 30%.[1] Treatment options mostly have an either short duration of pain relief or have limited evidence of efficacy.[2] Sacral neuroablation by various form of radiofrequency (RF) techniques may provide better relief of SI joint pain.[3,4] More recently, neuroablation of nerves supplying SI joint using cooled RF technique has shown promising outcome with long-term benefit.[5-7]

Case Report

A 35-year-old male presented to our pain clinic with intractable LBP (numeric rating scale [NRS]: NRS-9/10). He had similar episodes of pain on multiple occasions in last 5 years with a persistent presence of LBP (NRS 5-7/10). Clinical examination showed straight rigid spine with limited mobility, tender bilateral SI joint areas, positive Patrick's and Gaenslen's test. Blood sugar and serum uric levels were within normal range; magnetic resonance imaging, X-ray of the lumbosacral spine and human leukocyte antigen typing ruled out Ankylosing spondylitis. He was diagnosed to have bilateral SI joint dysfunction — right side being worse than left. Diagnosis was confirmed by fluoroscopic guided bilateral SI joint injection of local anesthetic which reduced the pain intensity to NRS-4/10. Along with oral analgesics (diclofenac sodium 50 mg 8 hourly), methyl prednisolone acetate (40 mg in each joint) was injected in each SI joint under fluoroscopic guidance for long-term relief of pain. Pain intensity became 4/10 after 3 weeks with improved mobility. Later on, pain recurred after 2 months with similar intensity. Based on duration and severity of pain as well as frequency of its recurrence, we considered him as a poor responder to intra-articular steroid therapy and decided to apply sacral WC-RF neuroablation for pain relief.

Technique

Cooled RF aided denervation of nerves supplying both SI joints with the aid of Pain Management SInergy® System (Baylis Medical Company, Montreal, Canada) was used

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to complete the intervention procedure. Patient was placed in the prone position, and skin overlying each SI joint area was infiltrated with 1% lidocaine after sterile preparation of the site. C-arm fluoroscopy was used to visualize areas adjoining bilateral SI joints and sacral neuronal foramina. Three 27-gauge 3.5-inch Quincke needles were placed into S1 through S3 posterior sacral foramina (PSFA) to establish internal reference points for RF probe placement. Distance between the place for probe introducer and the aperture of PSFA was decided to use epsilon ruler (Baylis Medical Incorporation, Montreal, Canada) which had been aligned with the medial border of each sacral foramen. Beginning at S1 level, an RF probe introducer with stylet was inserted on the bone of posterior sacrum, lying at a safe distance from sacral foramina as guided by internal reference points and epsilon marker. A depth marker was fixed to the level of the skin, and the stylet was removed. SInergy® RF probe was subsequently inserted through the same introducer. Correct probe placement was confirmed in lateral view. Tissue impedance was verified and adjusted to keep below 500 Ω. Motor and sensory testing were done to avoid somatic nerve injury and to verify correct probe placement. Following instillation of 0.25% bupivacaine 1ml for each lesion area, WC-RF energy was delivered for 150 s with 60°C as the target electrode temperature. Two or three lesions were created at each sacral level about 1 cm apart from one another using epsilon ruler [Figure 1], creating a strip of lesioned tissue lateral to each sacral foramen starting from S1 to S3 on both sides as recommended by the manufacturer of the equipment [Figure 2]. Postprocedure NRS was 5/10. Patient was discharged on 3rd day with an advice to take oral diclofenac 75 mg 8 hourly for 5 days. He had pain intensity of 2/10 after 2 weeks, and it continued to be mild in nature over the next 1-year. On 18th-month follow-up, he was found to be a pain free except for mild pain (NRS-2/10) on extreme twisting of the back.

Discussion

In a retrospective data analysis, Kapural *et al.* first demonstrated the importance of cool RF based sacral lateral branch denervation for SI joint pain in 2008.[5] In the same year, Cohen *et al.* established its efficacy among 14 patients through a case-control study where >50% patients had >50% pain reduction after 6 months of the procedure.[3] Applying on 15 patients, Karaman *et al.* from Turkey in 2011 found similar pain relief in >80% of patients after 6 months of neurotomy.[8] In the subsequent year, Patel *et al.* conducted a randomized placebo-controlled trial among 51 patients (34 patients received cooled RF intervention) and observed significant pain relief and better quality of life for 9 months in those who had WC-RF based neuroablation.[9]

Stelzer *et al.* from Austria followed-up 105 numbers of patients for 20 months who had received WC-RF for SI joint dysfunctional pain.[6] Almost 50% of patients had significant pain relief till 20 months after the procedure. The longest follow-up has so far been done by Ho *et al.* involving 20 patients receiving WC-RF for SI joint pain.[7] About 80% patients had significant improvement of pain for 2 years.

In a retrospective study involving data from 88 patients, Cheng *et al.* has shown that comparative number of patients receiving either conventional RF or WC-RF had significant pain relief till 6 months of follow-up.[10] It may be emphasized that conventional and pulse RF intervention for SI joint pain usually produce pain relief for about 6 months.[2] Recent multiple studies reveal that WC-RF provides better quality of life and pain relief, for a longer duration of time.[6,7,10] Moreover, WC-RF intervention has even been found to be beneficial for control of SI joint pain because of metastatic tumor.[11]

During WC-RF application, the specialized electrode used is actively cooled by continuous internal flow of water at ambient

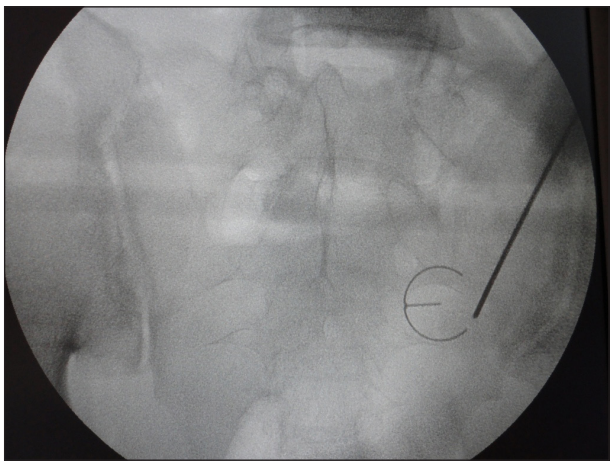

Figure 1: Anteroposterior fluoroscopic view showing placement of epsilon ruler over S3 sacral formanina and lesion of sacral dorsal nerve fibers at 3 O'clock position on the right side

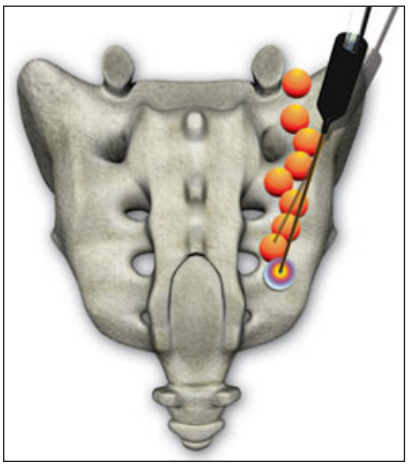

Figure 2: Sites for placement of specialized SInergy® radiofrequency (RF) probe during water cooled-RF neuroablation of dorsal sacral nerve fibers supplying sacroiliac joints

temperature. This active cooling prevents the electrode from acquiring high surrounding tissue temperatures and thus, allows continued flow of RF current with ensuing heating of larger tissue volume and the resultant larger thermal lesion without causing high impedance and tissue charring.[12]

While using 50°C isotherm as a criterion for lesion's edge, and if an 18-gauge electrode is used with its tip heated to 55°C-60°C for 150 s, the resulting WC-RF lesion is roughly 8-10 mm in diameter.[13] On the other hand, conventional and bipolar RF energy can generate a lesion of about 2 mm and 6 mm, respectively.[14] This allows tremendous benefit of ablating a neuronal structure, especially when the positions of such nerves are inconsistent.

Lateral branches of the S1-S3 dorsal roots are frequently implicated in SI joint pain and these lateral branches maintain an unpredictable distribution across the posterior sacrum before entering each SI joints.[1] This inconsistent location of the lateral branches over the sacral bone presents an inherent challenge when treating SI joint pain by RF neuroablation techniques — be it conventional or pulsed.[2] As mentioned before, WC-RF can treat a greater volume of the tissue lateral to sacral foramina indicating a greater likelihood towards adequate neuroablation of even erratically coursed sacral lateral branches supplying SI joints. This may the reason for better clinical outcomes when WC-RF has been used in managing SI joint pain.

Based on this mechanism, it can be stated that extended duration of pain relief in our patient was because of better denervation of even erratically coursed nerves by WC-RF through creation of larger thermal lesions. Another plausible mechanism of extended pain relief may be the ability of WC-RF to induce neuromodulation in nociceptive pain pathways resulting in to decreased sensation of pain arising from SI joints.[15] From initial studies and our case report, it is evident that WC-RF can effectively take care of SI joint pain and improves quality of life with reduced long-term medication.

References

1. Cohen SP. Sacroiliac joint pain: A comprehensive review of anatomy, diagnosis, and treatment. Anesth Analg 2005;101:1440-53.
2. Hansen H, Manchikanti L, Simopoulos TT, Christo PJ, Gupta S, Smith HS, *et al.* A systematic evaluation of the therapeutic effectiveness of sacroiliac joint interventions. Pain Physician 2012;15:E247-78.
3. Cohen SP, Hurley RW, Buckenmaier CC 3rd, Kurihara C, Morlando B, Dragovich A. Randomized placebo-controlled study evaluating lateral branch radiofrequency denervation for sacroiliac joint pain. Anesthesiology 2008;109:279-88.
4. Cohen SP, Abdi S. Lateral branch blocks as a treatment for sacroiliac joint pain: A pilot study. Reg Anesth Pain Med 2003;28:113-9.
5. Kapural L, Nageeb F, Kapural M, Cata JP, Narouze S, Mekhail N. Cooled radiofrequency system for the treatment of chronic pain from sacroiliitis: The first case-series. Pain Pract 2008;8:348-54.
6. Stelzer W, Aiglesberger M, Stelzer D, Stelzer V. Use of cooled radiofrequency lateral branch neurotomy for the treatment of sacroiliac joint-mediated low back pain: A large case series. Pain Med 2013;14:29-35.
7. Ho KY, Hadi MA, Pasutharnchat K, Tan KH. Cooled radiofrequency denervation for treatment of sacroiliac joint pain: Two-year results from 20 cases. J Pain Res 2013;6:505-11.
8. Karaman H, Kavak GO, Tüfek A, Çelik F, Yildirim ZB, Akdemir MS, *et al.* Cooled radiofrequency application for treatment of sacroiliac joint pain. Acta Neurochir (Wien) 2011;153:1461-8.
9. Patel N, Gross A, Brown L, Gekht G. A randomized, placebo-controlled study to assess the efficacy of lateral branch neurotomy for chronic sacroiliac joint pain. Pain Med 2012;13:383-98.
10. Cheng J, Pope JE, Dalton JE, Cheng O, Bensitel A. Comparative outcomes of cooled versus traditional radiofrequency ablation of the lateral branches for sacroiliac joint pain. Clin J Pain 2013;29:132-7.
11. Ramasubba C, Cohen SP. Cooled sacroiliac radiofrequency denervation for the treatment of pain secondary to tumor infiltration: A case-based focused literature review. Pain Physician 2013;16:1-8.
12. Petersohn JD, Conquergood LR, Leung M. Acute histologic effects and thermal distribution profile of disc biacuplasty using a novel water-cooled bipolar electrode system in an *in vivo* porcine model. Pain Med 2008;9:26-32.
13. Lorentzen T. A cooled needle electrode for radiofrequency tissue ablation: Thermodynamic aspects of improved performance compared with conventional needle design. Acad Radiol 1996;3:556-63.
14. Pino CA, Hoeft MA, Hofsess C, Rathmell JP. Morphologic analysis of bipolar radiofrequency lesions: Implications for treatment of the sacroiliac joint. Reg Anesth Pain Med 2005;30:335-8.
15. Smith HP, McWhorter JM, Challa VR. Radiofrequency neurolysis in a clinical model. Neuropathological correlation. J Neurosurg 1981;55:246-53.

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