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Radiofrequency Denervation for Management of Chronic Sacroiliac Joint Pain

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ABSTRACT

Background Data: The largest axial joint in the body is the sacroiliac (SI) joint**.** Understanding the innervation of the SI joint is essential when contemplating denervation procedures. Current evidence favors lateral branch radiofrequency (RF) lesioning as the most effective treatment option. Moreover, it is an alternative treatment for refractory cases of SI joint pain.

Purpose: To evaluate the efficacy and safety of percutaneous RF lateral neurotomy of sacroiliac joint in chronic back pain states.

Study Design: Clinical prospective study.

Patients and Methods: This study was conducted on 30 patients in Ain Shams University hospitals, Department of Neurosurgery, and Ain Shams Specialized Hospital in the period from 2014 to 2016. Patients included 18 females and 12 males in the study diagnosed clinically and radiologically with sacroiliac joint chronic pain. All patients underwent radiofrequency denervation for L5 dorsal branch, S1, S2, and S3 lateral branches of the dorsal primary rami lateral to the dorsal sacral foramina under fluoroscopy using local anesthesia and conscious sedation technique.

Results: All patients were followed up at 1-, 3-, 6-, and 12-month intervals regarding pain relief, Visual Analogue Scale (VAS), and Patient Satisfaction Index (PSI) and results were analyzed. There was a significant decrease in pain score after radiofrequency denervation at 1 and 3 months (more than half of VAS after procedure) with high statistical significance.

Conclusion: Radiofrequency sacroiliac denervation is a safe and effective procedure in management of chronic sacroiliac joint **(SIJ)** pain syndrome. The effect regarding pain relief seems to be fading with prolonged time interval after the procedure. Longer duration of follow-up and comparison with other placebo group are recommended for future studies (2019ESJ179).

Keywords: Sacroiliac joint, chronic back pain, radiofrequency, denervation.

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INTRODUCTION

The sacroiliac (SI) joint is the largest axial joint in the body.[10] Understanding the innervation of the SI joint is essential and crucial when contemplating denervation procedures.[8] The lateral branches of the S1-S3 dorsal rami comprise the primary innervation of the posterior SI joint in humans, with contribution from the L5 dorsal ramus in most individuals.[1]

Sacroiliac joint (SIJ) pain accounts for approximately 15–20% of all chronic low back pain cases. Sacroiliac joint pain and dysfunction are most often diagnosed based upon the history and physical examination tests. The lower back, buttocks, leg, groin, and hip are the most prevalent complaints.[2,3]

Current evidence favors lateral branch radiofrequency (RF) lesioning as the most effective treatment option. Moreover, it is an alternative treatment for refractory cases of SI joint pain. Percutaneous RF neurotomy of sacroiliac joint innervation has been described as providing long-term pain relief.[4]

In this study, we evaluated the efficacy and safety of percutaneous RF lateral neurotomy of sacroiliac joint in chronic back pain states.

PATIENTS AND METHODS

This study was conducted on 30 patients in Ain Shams University hospitals, Department of Neurosurgery, and Ain Shams Specialized Hospital in the period from 2014 to 2016. There were 17 female and 13 male patients diagnosed clinically and radiologically with chronic sacroiliac joint pain. Patients with either unilateral or bilateral chronic SIJ pain for more than 6 months and failed conservative treatment with medications and physical therapy and those who had favorable outcome to local sacroiliac joint blocks with more than 50% pain relief for at least one week were included in this study. Patients with other pathologies such as disc prolapse or spondylolisthesis were excluded from the study.

All patients underwent radiofrequency denervation for L5 dorsal and S1, S2, and S3 lateral branches of the dorsal primary rami lateral to the dorsal sacral foramina under fluoroscopy using local anesthesia and conscious sedation technique. We utilized Neurotherm NT 2000® radiofrequency generator in our patients (Wilmington, MA 01887 USA) (Figure 1).

All patients were assessed for efficacy of procedure using 0–10 Visual Analogue Scale (VAS) for assessment of pain relief at 1-, 3-, 6-, and 12-month intervals. Patients' satisfaction was also assessed using Patient Satisfaction Index (PSI) postoperatively at same intervals.

Technique

Patient is placed in the prone position on operating table; under c-arm or fluoroscopy, the SI joint of interest is imaged in the A-P position and L5 sacral alar notch and S1, S2, and S3 dorsal sacral foramina are identified. Skin is sterilized and draped in usual fashion; skin is infiltrated with local anesthesia over the targeted 4 areas of lesions to be made.

Under fluoroscopic guidance, 18-gauge, 1-cm active tip RFN needles were positioned parallel to the targeted nerves. To ensure needles were positioned properly, the c-arm fluoroscope was positioned AP with a cephalic tilt, so that the S1 to S3 foramen was visible. We used the Epsilon technique for neurotomy so as the lateral branches of foramens S1 to S3 each were targeted by 3 RF needles at their lateral aspects (Figures 2, 3).

Once all needles were positioned, the c-arm was moved to a lateral position, allowing final adjustments (needles should be flushed to bone and not through foramen). Once the needles were in the correct position, 2% lidocaine was injected. Using the active RFN needles at 70 degrees C for 90 seconds, 3 lesions were made from the inferolateral corner to the superolateral corner of the S1 to S3 foramen using 3 RF needles simultaneously. To ensure proper denervation, the dorsal, lateral, and L5 descending branch were all targeted (Figure 3).

RESULTS

All patients were followed up at 1-, 3-, 6-, and 12-month intervals and Visual Analogue Scale (VAS), and Patient Satisfaction Index (PSI) was reported at each visit and results were analyzed. The mean age of our population was 59.53±11.15 (range, 30–78 years). Population gender distribution showed that 12 patients were males (40%) and 18 were females (60%).

The preoperative mean VAS was 8.43±1.006 (range, 7–010). Using the modified paired sample *t*-test for comparison of the means for the preoperative VAS and the postoperative VAS after 1-, 3-, 6-, and 12-month follow-up showed that there was a statistically significant decrease in the postoperative VAS score (more than half decrease in preoperative VAS at 1, 3, and 6 months) (Table 1, Figure 4)

According to PSI, all patients were satisfied with degree of pain relief after procedure; however, PSI decreased at 12 months of follow-up. By using the modified paired sample *t*-test for comparison of the means for the one-month postoperative PSI and 3- and 6-month postoperative PSI, there was no statistically significant change in the PSI. However, there was highly statistically significant change at 12-month follow-up in favor of 1-month follow-up (Table 2, Figure 5)

Table 1. Comparison of preoperative and postoperative VAS in our study patients' group.

Pair	Paired Differences					t	df	p
	Mean	SD	S. Error	95% Confidence Interval of Difference				
PreOp Vs PostOp VAS 1 mo	4.23333	2.93238	.53538	3.13836	5.32830	7.907	29	.001
PreOp Vs PostOp VAS 3 mo	3.96667	2.84645	.51969	2.90378	5.02955	7.633	29	.004
PreOp Vs PostOp VAS 6 mo	4.00000	2.97113	.54245	2.89056	5.10944	7.374	29	.012
PreOp Vs PostOp VAS 12 mo	3.23333	2.76285	.50442	2.20167	4.26500	6.410	29	.033

PreOP: preoperative, PostOp: postoperative, mo: months, Vs: versus

Table 2. Postoperative PSI through the follow up period.

PAIR	Paired Differences			95% Conf. Interval of Difference		t	df	P
PSI	Mean	SD	Std. Error	Lower	Upper			
PostOp: 1 Vs 3 mos	.03333	.49013	.08949	-.14969	.21635	.372	29	.712
PostOp: 1 Vs 6 mos	.30000	.74971	.13688	.02005	.57995	2.192	29	.037
PostOp: 1 Vs 12 mos	.76667	.97143	.17736	.40393	1.12940	4.323	29	.001

PreOP: preoperative, PostOp: postoperative, mo: months, Vs: versus, PSI: Patient Satisfaction Index

Figure 1. Neurotherm® NT 2000 radiofrequency generator (Wilmington, MA 01887 USA).

Figure 3. RF needles at the lateral margin of S1 foramen targeting all lateral branches according to Epsilon technique.

Figure 2. Radiofrequency needles in position under fluoroscopy.

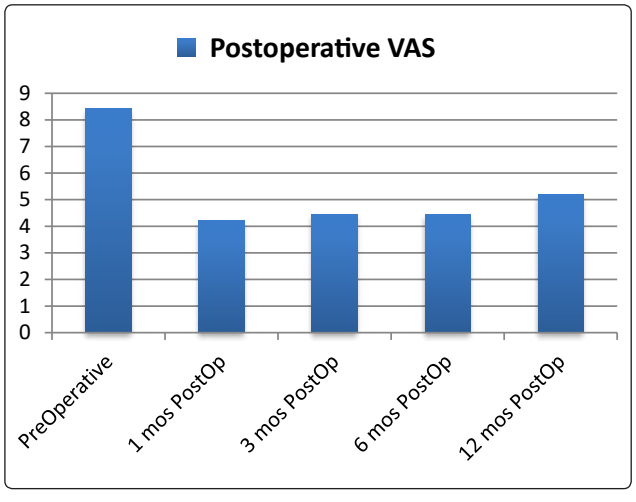

Figure 4. The postoperative in comparison to preoperative VAS.

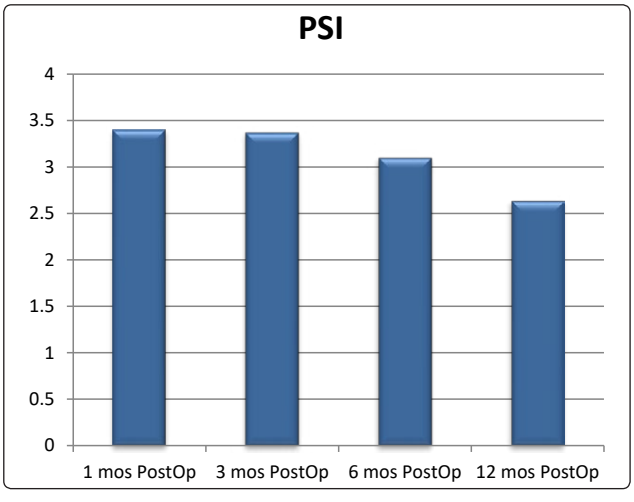

Figure 5. Postoperative patient satisfaction index (PSI) along time intervals of follow up.

DISCUSSION

SIJ connects spine to pelvis and provides shock absorption for spine through a gliding-type motion. Movement of this joint is minimal and equals 2–4 millimeters with weight-bearing activity. Many conditions can cause sacroiliac joint pain including heavy lifting, traumatic injury or sudden impact, spondyloarthropathies, degenerative arthritis, pregnancy, and infection of the sacroiliac joint (brucellosis).[7]

International Association for the Study of Pain (IASP) diagnostic criteria for sacroiliac syndrome include the following: pain in the region of the sacroiliac joint with possible radiation to the groin, medial buttocks, and posterior thigh; reproduction of pain by physical examination techniques that stress the joint; elimination of pain by intra-articular injection of local anesthetic.[3]

Radiofrequency denervation procedures provide a minimally invasive technique for pain relief from SIJ dysfunction. Many studies have reported effectiveness of RF in patients with refractory SIJ pain. These studies employed a vast variety of subject selection, outcome measurement, and techniques. Romero et al.[12] in his study on 32 patients demonstrated the long-term radiofrequency denervation efficacy of sacroiliac joint pain management. No serious complications or side effects were observed in their patients. Almost seventy-five percent of the patients showed a clinically relevant degree of pain relief, with at least a three-point reduction in Numeric Rating Scale (NRS) for pain, representing a statistically significant reduction in mean pain intensity scores.

In our study, a significant decrease in pain score after radiofrequency denervation at 3, 6, and 12 months with high statistical significance was found. Yet the decrease in pain scores at 12 months after the procedure was less than the effect at 3 and 6 months postoperatively, which justifies our next study on the effect of redo sacroiliac denervation on the prolongation of pain relief and patient satisfaction.

In a pilot study, Cohen and Abdi.[1] used radiofrequency denervation at the medial branch of L4, the dorsal rami of L5, and the lateral branches of S1–S3 to treat patients with sacroiliac joint pain. Eight of nine patients had more than 50% pain relief that lasted for more than nine months; these results are in agreement with our results as regards pain relief effect and duration of pain relief.

Vallejo et al.[13] used pulsed radiofrequency denervation of the medial branch of L4, posterior ramus of L5, and lateral branches of S1 and S2. Seventy-three percent of their patients had more than 50% pain relief for 6–32 weeks, which is concordant with our results, yet their study had longer duration of follow-up.

Ho et al.[9] demonstrated the efficacy of cooled radiofrequency in 2 years to treat twenty patients with sacroiliac joint pain with nearly the same results as in our study. They reported results of fifteen of 20 patients showing a significant reduction in pain (a decrease of at least three points on the scale). Mean VAS for pain decreased from 7.4±1.4 to 3.1±2.5, and mean Patient Global Impression of Change was "improved" (1.4±1.5).

In a large study with 215 patients, Mitchell et al.[11] demonstrated an average pain reduction of 2.3±2.1 NRS points following RFN (baseline pain score of 6.9±1.7 to a follow-up average of 4.6±2.7 NRS points) ($P \leq 0.01$). At a mean follow-up period of 14.9±10.9 months (range 6–49 months), an overall 42.2% of patients reduced their analgesic use. Overall, 67% of patients were satisfied with their outcome of post-RFN treatment and the effect regarding pain relief and patient satisfaction is concordant with our study, yet they had a much larger group of patients than in our study.

Ferrante et al.[6] conducted a prospective study where RF ablation was performed intra-articularly for SIJ pain in 33 patients. A successful RF ablation was at least 50 % reduction in SIJ pain for more than 6 months, and 36.4 % of subjects met the criteria; our results were more favorable regarding pain relief and duration of patient satisfaction as we used the novel epsilon technique with denervation of L5 dorsal branch and lateral branches of S1–S3.

In 2018, El-Sayed A.[5] reported the effect of radiofrequency facet denervation on 18 patients with mean Visual Analog Score for back pain significantly improving from 7.1±1.4 to 3.0±1.2 (P=0.01); his results were nearly similar to our results in regard to pain relief yet slightly more favorable due to vast innervation of large SIJ in comparison to facet joints.

Although the safety and efficacy of SIJ radiofrequency denervation as a minimally invasive procedure for management of chronic sacroiliac joint pain was evident in this study, yet larger group of patients and longer duration of follow-up are needed in further studies.

CONCLUSION

Radiofrequency sacroiliac denervation is a safe and effective procedure in management of chronic sacroiliac joint (SIJ) pain syndrome. The effect regarding pain relief seems to be fading and reduced with prolonged time interval after the procedure. Longer duration of follow-up and comparison with other placebo group are recommended for future studies.

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الملخص العربى

الترددالراديوي لعلاج آلام التهابات المفصل العجزى الحرقفى المزمنة

البينات الخلفية: أكبر مفصل محوري في الجسم هو المفصل العجزي الحرقفي (SIJ). فهم التعصيب من المفصل (SIJ) أمر ضروري عند التفكير في إجراءات التعصيب. الأدلة الحالية تفضل التواتر الراديوي للفرع الراديوي (RF) باعتباره الخيار العلاج الأكثر فعالية. علاوة على ذلك ، فهو علاج بديل للحالات المقاومة لألم المفاصل العجزية الحرقفية.

الغرض: لتقييم فعالية وسلامة العصب الراديوي الجانبي عن طريق الجلد من المفصل العجزي الحرقفي في حالات الألم المزمن أسفل الظهر.

تصميم الدراسة: دراسة استطلاعية سريرية.

المرضى والطرق: أجريت هذه الدراسة على 30 مريضًا في مستشفيات جامعة عين شمس ، قسم جراحة الأعصاب ومستشفى عين شمس التخصصي في الفترة من 2014 حتى 2016. شمل المرضى 17 أنثى و 13 ذكرًا في الدراسة تم تشخيصهم سريريًا وشعاعيًا لديهم ألم مزمن مشترك. خضع جميع المرضى للتشويع بالترددات اللاسلكية لفروع L5 و S1 و S2 و S3 للوردي الجانبي الظهري الجانبي إلى الثقالة العجزية الفجائية تحت التنظير باستخدام التخدير الموضعي وتقنية التخدير الواعي.

النتائج: تمت متابعة جميع المرضى في فترات 1 ، 3 ، 6 ، و 12 شهرا فيما يتعلق بتخفيف الألم مؤشر (VAS) ومؤشر رضا المريض (PSI) وتم تحليل النتائج. كان هناك انخفاض كبير في درجة الألم بعد إزالة التعتيم اللاسلكي في 3 و 6 و 12 شهرا مع أهمية إحصائية عالية.

الاستنتاج: الانحراف التعسفي بالموجات الراديوية هو طريقة فعالة لعلاج متلازمة آلام المفصل العجزي الحرقفي (SIJ) ، ومع ذلك يبدو أن تأثير تخفيف الألم يتلاشى مع الفترة الزمنية لفترات طويلة بعد العملية.