World Journal of Surgery and Surgical Research

Research Article
Published: 05 Apr, 2021

Single Strip Lesions Radiofrequency Denervation and Combined L5 Dorsal Rami Denervation for Treatment of Sacroiliac Joint Pain: 4 Years Follow-Up of 72 Patients

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Abstract

Objective: To report long term follow-up results of patients with Positive Sacroiliac Joint (SIJ) provocative pain and diagnostic tests treated with single strip with L5 dorsal rami Radiofrequency (RF) denervation to evaluate the efficacy of combined ablation for long-term pain relief.

Design: This retrospective study was included 72 patients with Sacroiliac Joint Syndrome (SJS). Visual Analogue Scale (VAS) scores collected preoperatively, postoperatively, and 3, 6, 12 months, 2 and 4 years post-procedure were statistically evaluated.

Results: The cohort included 23 males (32%) and 49 females (68%) with a mean age of 55.7 years (range 38 to 81 years). Post-procedure pain relief at 1st, 3rd, 6th, 12th months, 2nd and 4th years were 85%, 69%, 23%, 15% and 12%, respectively. No complications or adverse effects were observed.

Conclusion: Patient selection and appropriate surgical technique are important for successful outcomes in SJS. In practice, percutaneous applications are not being used enough. However, with technological developments, the application is technically easy and safe. Single strip and combined L5 dorsal rami RF denervation are effective in providing long-term pain relief.

Keywords: Sacroiliac joint; Pain management; Percutaneous radiofrequency ablation; Single strip

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Received Date: *05 Mar 2021*
Accepted Date: *01 Apr 2021*
Published Date: *05 Apr 2021*

Citation:
Oguzoglu AS, Senol N. Single Strip Lesions Radiofrequency Denervation and Combined L5 Dorsal Rami Denervation for Treatment of Sacroiliac Joint Pain: 4 Years Follow-Up of 72 Patients. World J Surg Surgical Res. 2021; 4: 1298.

Introduction

Persistent low back pain in about 10% to 25% of patients originates at the Sacroiliac Joint (SIJ), the largest axial joint in the human body [1]. This percentage is higher in patients with lumbar fixation, ankylosing spondylitis and other spondyloarthropathies [2-4]. Pain arising from the SIJ during pregnancy has been reported in 20% to 80% of pregnant women [1]. Pain generated in the SIJ or the surrounding structures can present as low back, leg, sacral, pelvic or gluteal pain, and also can be present in the groin and thighs. Unilateral pain is more common than bilateral. In many cases, it can be difficult to determine the exact source of the pain [1,5]. The lateral branches of the S1-S3 dorsal rami comprise the primary innervation of the posterior SIJ in humans, with contribution from L5 dorsal ramus in most individuals [6]. Relief from pain after a diagnostic SIJ block remains the gold standard for diagnosing SIJ pain but should be interpreted in combination with the results of multiple provocative tests. Percutaneous Radiofrequency (RF) neurotomy of SIJ innervation has been described to provide long-term pain relief [7]. RF ablation utilizes an ablation probe or probes placed near the dorsal sacral foramina targeting the dorsal lateral branches of S1-S4. Several techniques have been described to achieve this ablation with varying degrees of success [8,9]. Previously reported techniques include both traditional and cooled RF ablation, both of which utilize multiple needles placed under fluoroscopy on each side of the lesion in the sacral lateral branches, as well as the L4 and L5 dorsal rami [10]. A meta-analysis of the management of pain arising from lumbar facet and sacroiliac joints suggested that RF interventions showed better improvement in pain and functional outcomes over several other techniques at the 1-year follow up [11]. In the current study, we retrospectively reviewed data from 72 patients to evaluate the efficacy of both strip lesion of sacral branches and L5 dorsal rami with RF ablation in a long-term follow up study.

Material and Methods

The files of 115 patients with chronic back pain who were referred to neurosurgery clinics at

the Izmir Atatürk Research and Training Hospital and Malatya Government Hospital between January 2010 and November 2014 and diagnosed as SIJ pain were retrospectively studied. The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (20/290). During the 4-year follow-up period, the patients were called *via* telephone to visit the clinic where they were evaluated and VAS scores were obtained.

Forty three patients who did not respond to the phone calls or could not come to the clinic were excluded. The final study cohort consisted of 72 patients. The patient group consisted of 23 male (32%) and 49 female (68%) patients. The median age was 55.7 years (ranging between 38 to 81 years). In patients with persistent low back pain below L5 and pain in the buttock, physical and neurological examination included the following pain provocation tests: Gaenslen's test, Yeoman's test, Patrick (or FABERE) test and dorsal long sacroiliac ligament palpation test. Patients with other differential diagnoses, and those who had even one negative pain provocation test were excluded. If all four pain provocation tests were recorded as positive, the patients underwent CT guided diagnostic intra-articular SIJ injections. A 22 gauge 3-1/2 inch (10 cm) spinal needle was used for diagnosal blocks. Initially, intra-articular injection of 0.5 cc of the contrast was carried out under C-armed fluoroscopy, after the needle was placed to determine the correct location. Afterwards, 1 cc Prilocaine hydrochloride was injected and pain relief was evaluated on the basis of patient feedback. The period of pain relief was noted. Total or partial relief was noted as positive; no pain relief was noted as negative. The positive patients underwent another injection of 1.5 cc of Marcaine. Patients with 50% improvement in Visual Analog Scale (VAS) pain score in the following 24 h underwent RF ablation in another session and were included in the final study cohort (Figure 1). The patients who showed post-injection pain relief were taken to the operating room under sedation on a different day. The procedures were performed on the patient in a prone position with a pillow beneath the abdomen to reduce the lumbar curvature. An anteroposterior scan was obtained with C-armed fluoroscopy. The skin entry point was ipsilateral, lateral, inferior border of the sacrum, 1 cm lateral to and below the S4 foramen. A pathway between the sacral bone surface and ligaments was used under intermittent lateral and anteroposterior fluoroscopic control. A 22-gauge Chiba needle (Galini, Mantova, Italy) was advanced medial to the sacroiliac joint and lateral to the sacral foramen. The end point of the RF probe was ensured to not go above the superior end plate of S1 vertebra under fluoroscopic control, and three independent active contacts were positioned adjacent to the S1, S2, S3, and S4 lateral branch innervation pathways (Figure 2). Both sensory and motor testing was

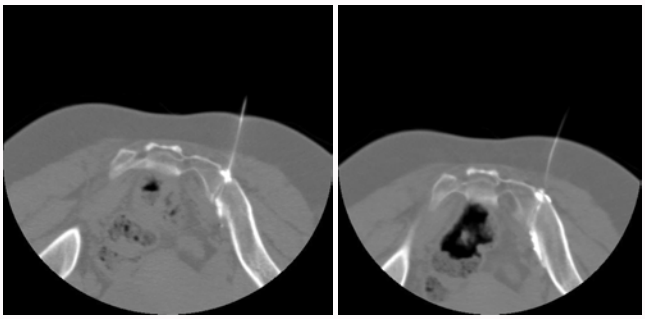

Figure 1: Computed Tomography (CT) guided diagnostic intra-articular injections of bupivacaine.

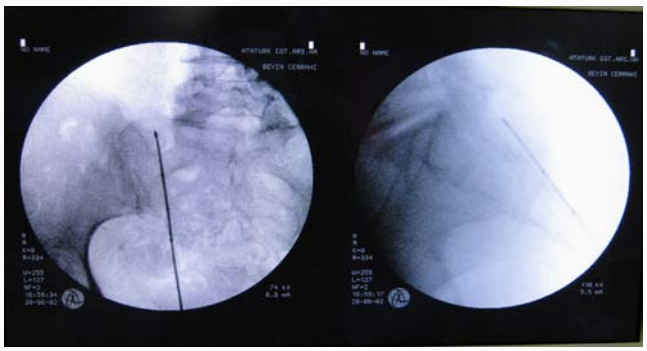

Figure 2: The final position of Simplicity III probe.

carried out. For sensory testing, correct placement was confirmed by using electro stimulation and the patients were asked to state if they were feeling sensory symptoms like pressure, tingling, pain, or burning. In motor testing, the absence of any contractions of the leg was noted. RF denervation was carried out at 85°C with 90 sec for each step. Simplicity III (Neurotherm, Middleton, MA) is a curved multi-electrode RF probe that allows for the creation of a continuous ablation line across all sacral nerves using a single RF probe. This probe has 3 active areas along its electrode that can generate 2 bipolar and 3 monopolar lesions. Conventional RF with RF canula, inserted from the entry point determined for the L5 dorsal rami ablation, was also added to each procedure. The insertion passed through the skin slightly lateral to medial obliquity, passing the posterior joint capsule to reach the groove formed between the superior articular process and the sacral ala. The depth was confirmed with lateral views. Pain was measured and recorded with VAS scores, a unidimensional single-item scale that provides an estimate of patients' pain intensity. The VAS scores were determined preoperatively, postoperatively and at 3, 6, 12 months, 2 years and 4 years after the procedure. Success rate was determined as reduction of at least 50% of the VAS score compared with the preoperative period. This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Results

No complications or adverse effects such as paresthesia, bleeding or needle soreness were noted during the procedure. In addition to low back pain, all patients had posterior and lateral thigh pain that showed a positive response to a diagnostic SIJ block. Eleven patients had bilateral pain affirmed to be more severe on one side. Ankylosing spondylitis was reported in three patients. Based on the changes in the VAS scores, the success rate of RF denervation for SIJ was determined to be 85% (61 patients) at the postoperative 3rd month, 69% (50 patients) at the postoperative 6th month, 23% (17 patients) at

Table: VAS scores of the patients.

	VAS scores Mean ± SD	P vavlue (Compared with the initial score)
Preoperative	77 ± 3.9	
1st month	24 ± 3.1	<0.0001
3rd month	29 ± 2.7	<0.0001
6th month	44 ± 2.2	<0.0001
12th month	56 ± 4.0	<0.0001
2nd year	61 ± 3.0	<0.0001
4th year	64 ± 3.7	0.0786

the postoperative 12th month, 15% (11 patients) at the postoperative 24th month, and 12% (9 patients) at the postoperative 48th month. The VAS scores are listed in the table.

Discussion

The prevalence of low back pain caused by SIJ is reported as 22.5% [12]. Sacroiliac pathology is mostly caused by the soft tissues surrounding the joint and diagnosis can be complicated by concomitant discogenic pain or facet joint arthritis [1,12]. Several factors such as degenerative joint disease, joint laxity and trauma have been implicated in the etiology. Although radiological evaluation is important to rule out inflammation, fractures or neoplasms, it remains challenging for the SIJ as subcondral sclerosis, joint space narrowing and osteophytes are natural aging variations [1,13,14]. There are several tests to determine SIJ dysfunction. We preferred to record 4 tests (Gaenslen's test, Yeoman's test, Patrick (or FABERE) test, and dorsal long sacroiliac ligament palpation test), as a positivity score in one test does not allow to directly implicating pathology of the SIJ; multiple tests can also exclude other adjacent structures for pain evaluation. Moreover, these tests are the most reliable examination techniques with 80% clinical reliability [15,16]. Although anesthetic blocks of the SIJ are considered as "gold standard", the false positive rate is reported as 38% [17]. The treatment modalities for sacroiliac dysfunction remain controversial. Physical therapy, manipulative therapies, injection therapies, prolotherapy, radiofrequency denervations and surgery are the main options for treatment. Corticosteroid injections in the SIJ has been shown to ameliorate pain for several months; however, the anti-inflammatory effect is not permanent and repeated injections are needed for continuous pain relief [18,19]. Cooled RF to perform lateral branch neurotomy in the treatment of SIJ pain has also been demonstrated as an acute but safe technique with no significant or unusual complications [20]. RF ablation of the dorsal lateral sensory innervation has been reported as the most effective treatment option for SIJ pain as surrounding soft tissue damage is minimized by fluoroscopic guidance and the procedure provides long term pain relief [6,7,10,21]. In the literature, >50% pain reduction at 3 months to 6 months has been reported [8-10], but our knowledge, long-term results after RF SIJ denervation is currently not available in the published literature. Many techniques and approaches have been described for sacral plexus RF ablation. Single strip lesions are preferable as a single percutaneous entry point is used, and multiple punctures are avoided [7]. The superiority of the Simplicity III comes from obtaining a large ablation area with a single probe. The probe is placed along the sacrum, lateral to the sacral foramina and medial to the SIJ [22]. Complications such as inability to ablate each sacral nerve, wrong placement of the probe and undesired nerve damage are possible; however, none of these complications were seen in the patients in the current study. The Simplicity III probe has 3 active areas along its electrode that can generate 2 bipolar lesions and 3 monopolar lesions to overall create a 9 mm × 52.5 mm lesion. The probe is easily positioned by using a single entry point and in total five RF lesions are created by three active areas along the probe. First, a bipolar lesion is created between electrodes 1 and 2, and then the second bipolar lesion between electrodes 2 and 3, and three monopolar lesions are created on electrodes 1, 2 and 3. Using this technique, Schmidt et al. reported pain relief of 71.4% at the 6th week, 54.4% at 6 months, and 15.6% at the 12th month post-procedure in 60 patients [22].

Bellini et al. reported a case series of 60 patients that confirmed the long term (2 years) efficacy of the Simplicity III probe for SIJ pain [7]. In the current study, we have conducted a longer follow-up period of 4 years and also included denervation of the L5 dorsal rami. The L5 Dorsal Ramus (L5DR) and lateral branches of the S1-S3 are frequently implicated in SIJ pain [20], as the upper dorsal portion of the SIJ is primarily innervated by the L5DR and lateral branches of S1-S3 [23-25]. Adding RF denervation to the L5DR therefore provides a more effective lesion [26,27] and pain relief. L5DR neurotomy cannot be established independent of the lateral branch lesions [20]. Proper patient selection and diagnoses will obviously reduce the number of failed back surgeries. We observe that many patients with SIJ syndrome are misdiagnosed and undergo surgery; these patients are generally the candidates of failed back surgery. The two most important criteria for success reported in the literature are the combination of correct patient selection and appropriate surgical technique. In our opinion, provocative maneuvers and diagnostic applications are not used enough at the diagnostic stage of chronic low back pain in clinical practice. However, these applications are technically easy and safe when conducted in line with current technological developments. Use of RF denervations can help avoid unnecessary and improper surgical interventions.

The main reason for the high success rate obtained in the current study in comparison to the data available in the literature stems from choosing very detailed and closely examined inclusion criteria that excluded all other pathologies, detailed evaluation of what might explain the cause of the pain, the use of radiological diagnoses, as well as neurological and physical examinations. Other parameters that may explain the high success rate include presence of a positive score from all four sacroiliac pain provocative test that was applied to all patients, examination of all patients by two different physicians independently and then coming up with mutual agreement on the findings, the use of diagnostic blocks and very careful implementation of the RF treatment.

Conclusion

Preference of a specific technique mainly depends on its efficacy and the side-effect profile. Both of these factors were superior in the technique we carried out in the current study compared to intra-articular steroid injection and multiple entries conventional RF. Moreover, our study showed for the first time in the literature that single strip RF denervation and combined L5 dorsal rami denervation is an effective treatment of SJS for long term (follow-up period of 4 years) pain relief.

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