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Investigation of the effect of cooled radiofrequency ablation and medial branch block on pain in elderly individuals with lumbar facet syndrome

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Abstract

The aim of this study is to evaluate the effect of cooled radiofrequency ablation (CRF) on pain scores in patients with facet joint and sacroiliac joint pain who have not undergone lumbar surgery. In our clinic, CRF was performed under operating-room conditions in 36 patients diagnosed with L5-S1 and sacroiliac joint-related pain over a 6-month period. Subsequently, the preoperative and postoperative VAS (Visual Analog Scale) and ODI (Oswestry Disability Index) scores of these patients were evaluated during a 12-month follow-up period. Among the 36 individuals included in the study, 17 were male and 19 were female. A statistically significant reduction in VAS scores was detected when preoperative values were compared with postoperative measurements ($p<0.05$). Similarly, ODI scores demonstrated a significant improvement after the intervention ($p<0.05$). In contrast, sex did not exert a significant influence on either VAS or ODI outcomes ($p>0.05$). Cooled radiofrequency ablation is effective in achieving pain control in patients with facet joint and sacroiliac joint-related pain. However, the procedure did not demonstrate any differential effect across sexes.

Keywords: Spine, ablation, facet joint

Introduction

Low back pain is one of the leading causes of disability, physical limitation, and related loss of workforce worldwide [1]. Approximately 15-45% of low back pain originates from lumbar zygapophyseal (facet) joints, and additionally from the sacroiliac joints [2,3]. The pain in lumbar facet syndrome is mediated by the medial branch of the dorsal ramus, which innervates the facet joint at each segment as well as the multifidus muscles at the same level. Facet joint pain can be managed with non-interventional treatments, but various interventional techniques may also be utilized [4]. In patients who do not respond to conservative treatment, pain control can be achieved through interventional techniques targeting the facet joint. The primary methods applied to the facet joint include steroid injection of the medial branch nerves, conventional radiofrequency ablation (RFA), and cooled RFA [4,5].

The effectiveness of treatment modalities used for sacroiliac joint pain remains a matter of debate [3]. Unlike conservative therapy and steroid injections, higher treatment efficacy has been demonstrated in patients undergoing RFA [6]. Studies evaluating the effectiveness of radiofrequency denervation of the lower lumbar primary dorsal ramus and the sacral lateral branches have reported success rates ranging from 67% to 89% [3].

In conventional RF ablation, electrodes that are not positioned parallel to the medial branch nerves may fail to affect the nerve within the thermal radius, thereby reducing the effectiveness of the treatment. Cooled RFA (cryotherapy) is a more recently introduced treatment modality compared with conventional RFA and facet steroid injections, producing a forward-projecting lesion [7]. The volume of heated tissue and the resulting thermal lesion size are significantly larger in cryotherapy than in conventional RF [8]. This characteristic facilitates more effective targeting of the medial branch nerve.

The aim of our study was to examine the effects of cryotherapy on pain scores in patients with lumbar facet syndrome and sacroiliac joint pain.

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Material and Methods

Study Group

This study was conducted with the approval of the Ordu University Clinical Research Ethics Committee (No: 2025/338 Date: 17 October 2025). In this study, patients over the age of 65 who presented to our outpatient clinic between January 1, 2023 and July 1, 2023, were retrospectively evaluated. These patients had been diagnosed—based on history, physical examination, and imaging modalities—with lumbar facet syndrome or sacroiliac joint pain that was unresponsive to conservative treatment (e.g., physical therapy and pharmacotherapy), and subsequently underwent cooled RFA under sterile operating-room conditions. Patients with radicular pain based on history or imaging, those with motor deficits, a history of prior lumbar surgery, untreated coagulopathy, or conditions that would preclude performing the procedure under local anesthesia (e.g., cardiac or psychiatric disorders) were excluded from the study.

In our study, 36 patients who underwent two-level cryotherapy for L5-S1 and sacroiliac joint-related pain over a 6-month period were included in the follow-up. Patient records were reviewed to determine sex and preoperative pain score. Subsequently, the patients were contacted by telephone, and postoperative 12-month pain scores were obtained through standardized survey questionnaires.

Surgical Technique

All interventions were conducted with the patients placed in the prone position and administered local anesthesia. The lumbar area was disinfected with chlorhexidine and then covered using routine sterile draping techniques. After identifying the target area under fluoroscopic guidance, local anesthesia was administered to the skin and subcutaneous tissue. A 17-G C-RFA electrode was advanced under fluoroscopic visualization, targeting the medial-middle third junction of the transverse process and pedicle for the L4 medial branches. For the L5 medial branch, the electrode was placed inferior to the concave margin of the sacral ala, and a separate trajectory was used for localization of the sacroiliac joint. Motor testing at 2 Hz was performed at each target site to confirm the integrity of the corresponding exiting spinal nerve. After verification of the target location, a lesion was created at -75°C for 90 seconds. Following the procedure, patients were monitored for 2 hours postoperatively and then discharged. They were scheduled for follow-up evaluation at 4-6 weeks.

Statistical Analysis

Statistical analyses were performed using Python software (Version 3.8). The Shapiro-Wilk test was used to assess the normality of distribution, and all groups were found to deviate from a normal distribution ($p<0.001$). Differences between baseline and follow-up values were evaluated using the Wilcoxon test.

Results

In our study, the data of 36 patients were retrospectively analyzed. Of these patients, 17 were male and 19 were female. Preoperative and 12-month postoperative outcomes were recorded. The mean and standard deviation values for the Oswestry Disability Index (ODI) and Visual Analog Scale (VAS) scores were calculated for both the preoperative and postoperative assessments. For male patients, the mean ± standard deviation of the preoperative ODI score was 81.53 ± 8.99, and the postoperative value was 30.71 ± 16.72. For female patients, these values were 82.95 ± 8.52 preoperatively and 30.63 ± 15.83 postoperatively.Regarding VAS scores, the mean ± standard deviation for male patients was 8.24 ± 0.9 preoperatively and 3.18 ± 1.55 postoperatively. For female patients, the preoperative VAS score was 8.37 ± 0.9, and the postoperative value was 3.37 ± 1.74 (Table 1). The recorded values were first assessed using the Shapiro-Wilk test, which indicated non-normal distribution ($p<0.01$). Subsequently, the Wilcoxon test was performed, revealing a significant difference between preoperative and postoperative VAS scores ($p<0.05$) (Figure 1). These findings strongly support that the procedure effectively reduces pain in patients, as evidenced by the decrease in VAS scores. The obtained data were then further analyzed to determine whether the intervention had any differential effect on pain between male and female patients. Following the Wilcoxon test, a significant difference was observed between the baseline and postoperative values in female patients ($p<0.05$). A significant difference was also noted between the baseline and postoperative values in male patients ($p<0.05$) (Figure 2). However, the Mann-Whitney U test conducted to compare postoperative outcomes between male and female patients revealed no significant difference ($p>0.05$). These results indicate that there was a significant reduction in VAS scores after the procedure in both male and female patients; however, no difference was observed between the sexes in terms of baseline or postoperative values. Based on the Wilcoxon test performed on the patients' ODI scores, a significant difference was observed between the preoperative and postoperative ODI values ($p<0.05$). The Wilcoxon test results for male patients also demonstrated a significant difference ($p<0.05$). In other words, both female and male patients showed a significant decrease in ODI scores following the procedure (Figure 3). To evaluate the effect of sex on ODI improvement, the available data were compared using the Mann-Whitney U test, which demonstrated no significant difference ($p>0.05$)

Table 1. Mean and standard deviation values

Group	ODI score		VAS score	
Preoperatif male	81.53	±8.99	8.24	±0.9
Postoperatif male	30.71	±16.72	3.18	±1.55
Preoperatif female	82.95	±8.52	8.37	±0.9
Postoperatif female	30.63	±15.83	3.37	±1.74

Continuous variables were analyzed using independent samples t-tests (*). Categorical variables were analyzed using chi-square tests (**). Values are presented as mean ± SD or n (%)

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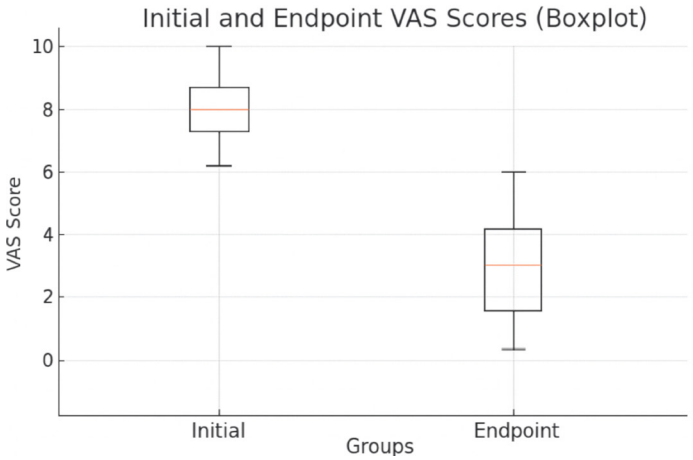

Figure 1. Comparison of preoperative and postoperative VAS scores of patients

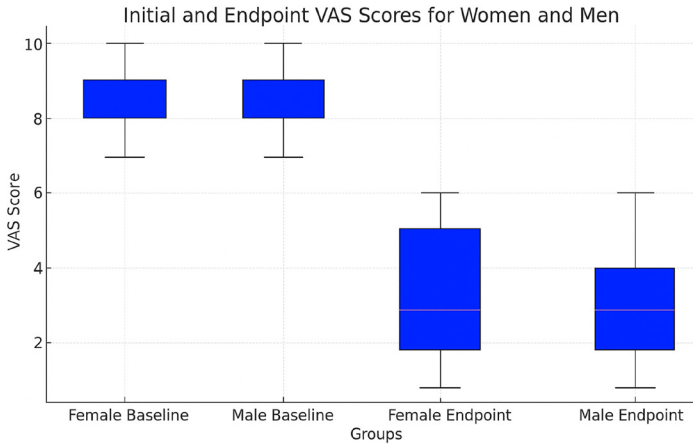

Figure 2. Comparison of preoperative and postoperative VAS scores of patients according to gender.

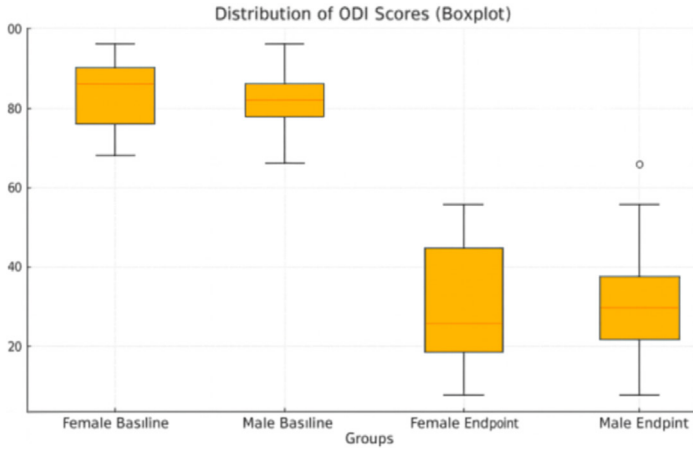

Figure 3. Comparison of preoperative and postoperative ODI scores of patients according to gender

In this study, cryotherapy resulted in a significant improvement in both VAS and ODI scores in patients aged 65 years and older. The observed reduction in pain intensity and functional disability indicates that this technique provides effective pain control in the elderly population and has the potential to improve quality of life. These findings support the view that cooled RFA may represent a safe and clinically beneficial treatment option for pain management in this patient group.

Discussion

It has been shown that age-related degeneration alters the anatomical structure of the lumbar facet joint, weakens it, and consequently increases its susceptibility to injury, ultimately leading to pain [5]. As a result of such injury, activation of nociceptors within the facet joint and surrounding tissues triggers pain and a burning sensation. In addition, studies conducted in both patients and healthy individuals have demonstrated that the facet joint can generate pain through chemical and mechanical mechanisms [9]. Most importantly, medial branch blocks administered for facet-related pain have been shown to reduce pain scores in patients with chronic low back pain [5,10-12]. Despite the difficulty in establishing a differential diagnosis for lumbar facet joint pain, these findings indicate that it is an important and treatable cause of chronic low back pain.

Conservative and pharmacological interventions are among the first-line treatment options. Among conservative approaches, individualized exercise programs and yoga are commonly applied. In a study by Williams et al., these exercises were shown to provide a moderate level of pain control in patients with facet joint-related pain [13]. Nonsteroidal anti-inflammatory drugs are the primary treatment for facet joint-related low back pain and none has been shown to be superior to another [14]. In cases where adequate pain control cannot be achieved with these therapies, intra-articular injections and ablation procedures are utilized. Studies evaluating local anesthetic and intra-articular steroid injections have demonstrated that these interventions may provide pain relief by reducing inflammation; however, their effect is generally short-lived [5].

RFA is one of the effective treatment options used in patients with facet joint pain that is resistant to medical therapy. In the study by Son et al., RFA was shown to be successful in achieving pain control [12]. However, subsequently introduced cryotherapy techniques—although providing a pain control effect comparable to that of the conventional approach—have demonstrated superiority in terms of procedural efficiency [4].cryotherapy, the mechanism involves the rapid cooling produced by the expansion of pressurized gas through a probe, resulting in the formation of an osmotic gradient that leads to cellular and organelle injury [15]. This mechanism subsequently causes regional ischemia and vascular damage. It has been shown that ice crystal-induced injury to the vasa vasorum and the development of endoneurial edema result in Wallerian degeneration, followed by physical damage to axons and disruption of axonal transport due to microtubule disintegration [16]. The faster therapeutic effect achieved through this mechanism has led to increased utilization and a growing body of research on the technique. Nabiyev et al. demonstrated that

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patients treated with cryotherapy experienced significant clinical improvement, and they reported a higher success rate compared with conventional therapy [17]. McCormick et al. reported in their study on cryotherapy that this technique is effective and contributes to a reduction in medication use [4] In the study published by Cohen et al. in 2025, cryotherapy was shown to be more effective than other pain management modalities, including exercise and non-steroidal anti-inflammatory drug (NSAID) therapy [18]. Similarly, Abd-Elsayed et al. reported that cryotherapy applied to the lumbar region provided effective pain control for approximately one year in patients with chronic low back pain [19]. Moreover, the same group demonstrated that cryotherapy was successful in achieving pain control in patients with chronic, medically refractory meralgia paresthetica [20]. In a study conducted by Kapural et al. involving patients with knee osteoarthritis, cryotherapy was compared with conventional RFA, and cryotherapy was shown to yield superior clinical outcomes [21]. Likewise, Terasa et al. demonstrated that cooled RFA was effective in controlling shoulder pain in patients with chronic shoulder disorders [22]. In the same study, it was reported that cryotherapy creates a larger lesion volume, thereby increasing the likelihood of target nerve capture and reducing treatment failure rates. Collectively, these findings suggest that cryotherapy offers significant advantages over conventional RFA techniques.

Effective pain control can also be achieved through intra-articular injections and interventional procedures in cases of sacroiliac joint pain accompanying lumbar facet joint pain. Cohen et al. demonstrated that cryotherapy provided significant pain relief in patients with sacroiliac joint-related pain [3]. Similarly, in a study by Tinnirello evaluating patients who underwent cryotherapy targeting the sacroiliac joint, the analgesic effect was reported to persist for up to one year [23]. Consistent with the existing literature, our study demonstrated that cryotherapy applied to the L4-L5 facet joints and the sacroiliac joint resulted in a significant reduction in pain intensity and provided effective pain control in patients.

Limitations

This study has several important limitations. First, the retrospective and single-center design may limit the generalizability of the findings. In addition, the absence of a control group restricts direct comparison of the observed clinical improvements with other treatment modalities. Furthermore, the follow-up period being limited to 12 months prevents definitive conclusions regarding the long-term efficacy and durability of cryotherapy. Future studies would benefit from longer-term follow-up to better assess the durability of treatment outcomes. Another limitation is the lack of stratification of patients according to age groups. Differentiating acute facet joint pain related to mechanical loading in younger individuals from chronic low back pain and facet degeneration-related symptoms in older patients may provide more objective and clinically informative results in future research.

Conclusion

Although the diagnosis of pain originating from the facet and sacroiliac joints can be challenging, appropriate identification of the pain source allows local injection techniques to achieve effective pain control. Among these modalities, cryotherapy appears advantageous, as it offers a shorter procedural time compared with conventional RFA and provides more effective pain relief than injections performed with local anesthetics.

Ethical Approval
Approved by the Ordu University Clinical Research Ethics Committee (No: 338 Date: 17 October 2025).

Patient Consent
Informed consent was waived due to the retrospective design.

Conflict of Interest
The authors declare no conflict of interest.

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