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ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

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Efficacy of Radiofrequency Thermocoagulation Treatment in Patients with Chronic Coccydynia

Kronik Koksidinili Hastalarda Radyofrekans Termokoagülasyon Tedavisinin Etkinliği

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ABSTRACT Objective: Ganglion impar blockade is used for many chronic pain syndromes originating from the pelvic structures. The aim of the study was to evaluate the effectiveness of radiofrequency thermocoagulation (RFT) treatment in patients diagnosed with chronic coccydynia who did not respond to conservative therapy. **Material and Methods:** Patients who underwent RFT for chronic coccydynia between 2015 and 2020 were included in this retrospective cross-sectional study. All patients had had complaints for at least 6 months. Patients' pre-treatment characteristics were obtained from records and post-treatment data were collected by phone (at the 1st, 6th, 12th, and 24th months). While pre-treatment pain intensity was evaluated face-to-face and using visual analogue scale, post-treatment pain level was evaluated over the phone by asking patients to score their pain intensity over 10 (0 is no pain and 10 is the worst pain). **Results:** Forty-one patients (24 females and 17 males) were included into the study. Median age was 43 (range 37-49) years. Median pain score decreased from 9 to 3 six months after RFT. Twenty-three (56.1%) patients had 50% or more decrease in their pain scores at 24 months. Twenty-five (61.0%) patients were satisfied with RFT. No significant relationship was found between the decrease in pain scores and factors such as age, sex, body mass index, and duration of disease. There were no complications during or after the procedure. **Conclusion:** RFT is a reliable and highly satisfactory treatment method in patients with chronic coccydynia who do not respond to conservative treatment methods.

Keywords: Coccydynia; pain; conventional radiofrequency; thermocoagulation; ganglion impar blockade

ÖZET Amaç: İmpar ganglion bloğu, pelvik yapılardan kaynaklanan birçok kronik ağrı sendromunda kullanılmaktadır. Bu çalışmanın amacı, konservatif tedaviye yanıt vermeyen kronik koksidini tanısı almış hastalarda radyofrekans termokoagülasyon tedavisinin [radiofrequency thermocoagulation (RFT)] etkinliğini değerlendirmektir. **Gereç ve Yöntemler:** Bu retrospektif kesitsel çalışmaya 2015-2020 yılları arasında kliniğimizde kronik koksidini nedeniyle RFT uygulanan hastalar dâhil edildi. Tüm hastaların en az 6 aydır şikâyetleri vardı. Hastaların tedavi öncesi özellikleri kayıtlardan elde edildi ve tedavi sonrası veriler telefonla toplandı (1, 6, 12 ve 24. aylarda). Tedavi öncesi ağrı şiddeti yüz yüze ve görsel analog skala kullanılarak değerlendirilirken, tedavi sonrası ağrı şiddeti telefon üzerinden hastalardan ağrı şiddetlerini 10 üzerinden puanlamaları istenerek değerlendirildi (0 ağrı yok, 10 en şiddetli ağrı). **Bulgular:** Çalışmamıza 41 (24 kadın ve 17 erkek) hasta dâhil edildi. Ortanca yaş 43 (37-49 arası) idi. Ortanca ağrı skoru RFT'den 6 ay sonra 9'dan 3'e düştü. Yirmi üç (%56,1) hastanın 24. ay ağrı skorlarında %50 veya daha fazla düşüş gözlendi. Yirmi beş (%61,0) hasta RFT'den memnundu. Ağrı skorlarındaki azalma ile yaş, cinsiyet, beden kitle indeksi ve hastalık süresi arasında anlamlı bir ilişki bulunmadı. İşlem sırasında ve sonrasında herhangi bir komplikasyon gelişmedi. **Sonuç:** RFT, konservatif tedavi yöntemlerine yanıt vermeyen kronik koksidinili hastalarda güvenilir ve oldukça tatmin edici bir tedavi yöntemidir.

Anahtar Kelimeler: Koksidini; ağrı; konvansiyonel radyofrekans; termokoagülasyon; impar ganglion bloğu

Coccydynia is defined as pain in the lower sacral region and coccyx. Although it can be seen in all age groups, the average age of onset is 40 years. Female sex and obesity are the most important known risk factors. Prevalence is estimated to be 5 times higher in women due to ligamentous laxity, coccyx anatomy, and childbirth.[1,2] The most common causes of coccydynia are internal trauma due to pregnancy or forced birth and external trauma due to falling on the coccyx, while other causes include repetitive micro-

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trauma, arthritis, pelvic floor dysfunction, Tarlov cysts, tumors, and variations in coccyx structure.[1-3] Pain characteristically increases with sitting, leaning back while seated, and rising from a seated position.[1,4] Some patients may experience dyspareunia and painful defecation.[3,5] Coccydynia diagnosis is based on patient history, physical examination, and radiological imaging.[6]

Treatment consists of conservative methods, interventional methods, and surgical procedures. Due to high infection rates with coccygectomy, surgical procedures should be the last option for chronic coccydynia treatment.[7,8] Conservative treatment methods, which are beneficial in 90% of patients, include non-steroidal anti-inflammatory drugs (NSAIDs), opioid analgesics, postural correction, sitting pillow, pelvic floor rehabilitation, coccyx manipulation, and physical therapy (transcutaneous electrical nerve stimulation, extracorporeal shock wave therapy, laser therapy, etc.). Interventional methods, such as ganglion impar blockade, are applied to patients who do not benefit from conservative treatment.[5,9,10] The ganglion of impar (also known as Walther's ganglion) is formed by the union of the paravertebral sympathetic chain in front of the sacrococcygeal region which innervates pelvic and perineal structures.[4,11] Ganglion impar blockade is used for many chronic pain syndromes originating from the pelvic structures, and can be performed with steroids, local anesthetics or chemical agents, cryoablation, and radiofrequency thermocoagulation (RFT).[3,9,12,13]

In RFT, ion channels in the tissue are stimulated by using high frequency alternating currents, and this ion movement causes a local temperature increase in the target tissue.[14,15] By changing nerve conduction compliance and the permeability of the nerve cell membrane simultaneously, molecular collision may alter the molecular structure and physicochemical characteristics of pain-causing components, creating therapeutic benefits.[16] In some previous studies, positive results with RFT application have been reported in cases with chronic pain in different regions.[17-19] RFT has gained considerable popularity today due to its efficacy and safety relative to chemical agents; however, since conservative treatments are usually effective in the majority of patients, data are limited regarding the outcomes of patients receiving RFT.[20] Therefore, the aim of this study was to evaluate the efficacy of RFT in patients with chronic coccydynia who did not respond to conservative treatment.

MATERIAL AND METHODS

STUDY DESIGN AND PATIENT SELECTION

All patients with chronic coccydynia who underwent RFT in our clinic between 2015 and 2020 were included in this retrospective cross-sectional study. All procedures performed in the study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee of İstanbul Kültür University (date: April 25, 2022, no: 2022/74), and patients accepting to participate provided written informed consent. RFT had been applied to patients who had complaints for at least 6 months and had not responded to conservative treatment (NSAIDs, sitting pillow, physical therapy and pelvic floor rehabilitation etc.). Exclusion criteria for applying the RFT were as follows: refusing participation or inability to reach patients at post-interventional assessment, having local infection at the procedure site or systemic infection, having a history of coagulation disorder or receiving anticoagulant treatment, known history of psychiatric disorder, reporting allergy to contrast material or local anesthetic substances, and pregnancy. The records of 55 patients who received this treatment were accessed. A final total of 41 patients who could be reached by phone, met inclusion criteria, and accepted to participate were included. Pre-treatment data were obtained from file records and post-treatment data by telephone questionnaire. Age, sex, body mass index, duration of pain, and treatment history were obtained from file records.

The primary outcomes of this study were to evaluated change in pain scores while sitting after RFT and secondary outcomes were to evaluate relationships between RFT effectiveness and demographic features.

PAIN ASSESSMENT

As a routine procedure, pre-treatment pain intensity was evaluated face-to-face and using visual analogue

scale (VAS). Post-treatment pain level was evaluated over the phone by asking patients to score their pain intensity over 10 according to numerical rating scale (NRS); 0 defined as no pain and 10 defined as the worst pain imaginable.

Pre-treatment pain intensity while sitting was evaluated by using the VAS for pain. Each patient received a detailed explanation of the VAS assessment, and a 10-cm paper-strip VAS was presented. The strip was marked from 0 to 10 from the left to the right. On the left end, the phrase "No pain" was present; whereas, the right end was marked with the phrase, "Unbearable/worst imaginable pain". The patient was instructed to mark a point on the strip that could accurately reflect their pain.[21,22] Since all patients with coccydynia undergo routine VAS assessment, pre-treatment VAS scores were obtained from file records.

Post-treatment pain intensity at the 1st, 6th, 12th and 24th months and satisfaction level regarding RFT at the 24th month were recorded by contacting the patients by phone. The participants that did not respond to the first phone call were called again, and each participant was reached over the phone. At each follow-up, the patients were contacted again and resultant data were recorded. Treatment success was defined as demonstration of 50% or greater decrease in pain scoring. Satisfaction was assessed on a 5-point Likert-type scale ("very dissatisfied", "dissatisfied", "neutral", "satisfied", and "very satisfied").

APPLICATION OF RFT

For ganglion impar blockade, patients were placed in the prone position with a cushion beneath the abdomen. Sterility was achieved with copious povidone-iodine. First, subcutaneous local anesthesia was performed for the targeted tissue. Then, a 22-gauge, 10-mm, active-tip radiofrequency cannula was inserted through the sacrococcygeal space or Cocc1-Cocc2 disc space under scope (General Electric, OEC Florostar 7900, USA) guidance. Then the guide of the needle was removed and the radiofrequency electrode (a thin wire) was passed through the needle. The device was activated and sensory stimuli was received. Electrical sensory stimulation was applied at 50-Hz cycles/s. Contrast material was given to confirm location (Figure 1). After receiving the sensory stimulus and seeing appropriate contrast material distribution, local anesthesia was administered again to ensure that the procedure was painless. RFT was administered (Cosman RF generator, Boston Scientific, USA) at 70-80°C for 90 seconds, which is a conventional method of radiofrequency treatment.[23] Any side effects or complications that could be associated with the intervention were recorded during and after the procedure.

STATISTICAL ANALYSIS

The classical $p \leq 0.05$ threshold was defined for all statistical analyses which were performed on the SPSS version 25.0 software (IBM, Armonk, NY, USA). Distributions of continuous variables were evaluated with the Shapiro-Wilk test. Data are summarized as mean±standard deviation or median (1st quartile-3rd quartile) for continuous variables according to normality of distribution, and as frequency (percentage) for categorical variables. Repeated measurements of pain scores were analyzed with the Friedman's analysis of variance by ranks. Pairwise comparisons were adjusted by the Bonferroni correction method. Between-groups comparisons of continuous variables were performed with the independent samples t-test or Mann-Whitney U test depending on normality of distribution. Between-groups comparisons of categorical

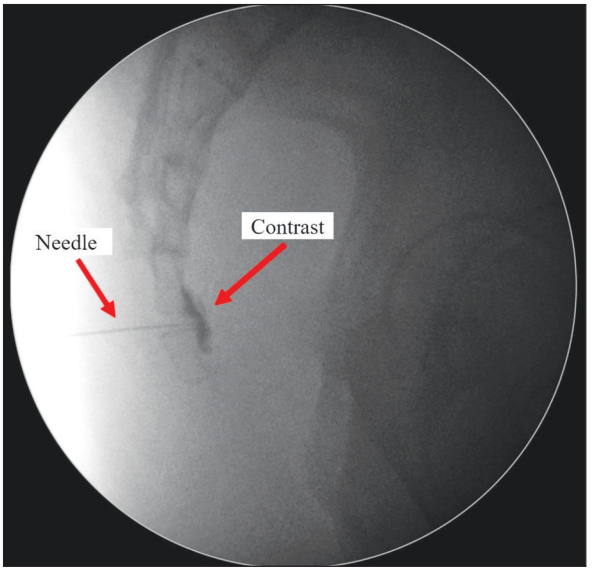

FIGURE 1: Contrast material was given to confirm location.

variables were performed with chi-square tests (Pearson or continuity correction) or the Fisher's exact test.

RESULTS

Analyses were performed with 41 (24 females and 17 males) patients, median age was 43 (range 37-49) years. Baseline pain score was 9 (8-9) which was significantly higher compared to 1st month, 6th month, 12th month, and 24th month scores ($p<0.001$ for all), while all post-treatment pain scores were similar to each other ($p>0.05$ for all) (Figure 2). Twenty-three (56.1%) patients had 50% or more decrease in pain scores at the 24th month (relative to baseline). Twenty-five (61.0%) patients were satisfied or very satisfied with RFT. Nine (22.0%) patients had received additional treatment after RFT, including manual therapy, corticosteroid injection, and surgery (Table 1). No side effects or complications were observed during or after the procedures.

Patients were divided into 2 groups according to the definition for treatment success (≥50% decrease in pain at 24 months). No significant differences were found between the <50% and ≥50% groups in terms of age, sex, body mass index, duration of pain, and baseline pain scores. The frequency of receiving additional treatment was significantly higher in those with less than 50% pain improvement compared to patients with ≥50% improvement (38.9% vs 8.7%, $p=0.028$) (Table 2).

TABLE 1: Summary of patient characteristics and pain assessment results.

Age	43 (37-49)
Sex	
Female	24 (58.5%)
Male	17 (41.5%)
Body mass index (kg/m²)	25.39±4.57
Duration of pain, months	24 (18-36)
Other treatment after RFT	9 (22.0%)
Pain score, sitting	
Baseline	9 (8-9)
1st month	3 (2-6)
6th month	3 (2-8)
12th month	3 (2-8)
24th month	3 (2-8)
Improvement in pain score, sitting (%)	
1st month	62.5 (25-77.78)
6th month	62.5 (0-77.78)
12th month	62.5 (0-77.78)
24th month	62.5 (0-77.78)
Improvement in pain score, sitting (≥50%)	
1st month	24 (58.5%)
6th month	24 (58.5%)
12th month	23 (56.1%)
24th month	23 (56.1%)
Patient satisfaction	
Very dissatisfied	5 (12.2%)
Dissatisfied	7 (17.1%)
Neutral	4 (9.8%)
Satisfied	12 (29.3%)
Very satisfied	13 (31.7%)

Data are given as mean±standard deviation or median (1st quartile-3rd quartile) for continuous variables according to normality of distribution, and as frequency (percentage) for categorical variables. RFT: Radiofrequency thermocoagulation.

DISCUSSION

Although conservative methods are largely successful in coccydynia treatment, ganglion impar blockade can be performed in patients with chronic coccydynia who do not benefit from first-line treatment.[5] Ganglion impar blockade has become a valuable option for coccygeal pain treatment since its first description by Plancarte in patients with malignancy.[24] In the present study, the changes in pain level after RFT application to the ganglion impar was examined in patients with coccydynia. Treatment success was defined as demonstration of ≥50% decrease in pain score. According to this definition, 23 of the 41 (56.1%) patients included in this study had successful treatment and 25 (60.1%) patients reported they were either "satisfied" or "very satisfied" with RFT. It was determined that pain decreased significantly within the first month after RFT and the improvement

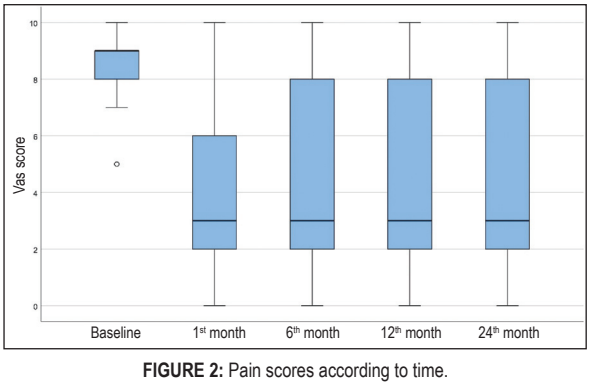

FIGURE 2: Pain scores according to time.

TABLE 2: Summary of patient characteristics with regard to benefit from intervention.

	Improvement in pain score, 24th month		
	<50% (n=18)	≥50% (n=23)	p value
Age	43.5 (38-49)	42 (33-52)	0.331
Sex			
Female	11 (61.1%)	13 (56.5%)	1.000
Male	7 (38.9%)	10 (43.5%)	
Body mass index (kg/m²)	25.28±4.91	25.48±4.39	0.891
Duration of pain, months	33 (24-48)	24 (12-36)	0.253
Other treatment after RFT	7 (38.9%)	2 (8.7%)	**0.028**
Baseline VAS score, sitting	9 (8-9)	9 (8-9)	0.422

Data are given as mean±standard deviation or median (1st quartile-3rd quartile) for continuous variables according to normality of distribution, and as frequency (percentage) for categorical variables. RFT: Radiofrequency thermocoagulation; VAS: Visual analogue scale.

remained consistent until the 24th month. Further treatments were utilized at a greater frequency among those whose RFT treatment was deemed unsuccessful (pain score improvement <50%).

The median age of patients included in this study was consistent with the literature concerning coccydynia, demonstrating that our patient group was successful in representing the population with this condition.[1] Prior studies have also demonstrated that RFT reduced pain in patients with chronic coccydynia. Reig et al. applied RFT to 13 patients with chronic perineal, noncancer-related pain by using the two needle (transcoccygeal and transdiscal) technique, they found greater than 50% decrease in VAS scores in all patients after 6 months follow-up.[17] Contrary to the current study, the significant pain reduction in all patients in the mentioned study is probably due to lesioning at both levels in their technique. Because there are several variations regarding the impar ganglion level, only performing RFT on only one level may not cover the whole impar ganglion. Kırcelli et al. evaluated visual numeric scale (VNS) score and EQ-5D index scores at the 1st, 6th and 12th months in patients with chronic coccydynia who underwent RFT of the ganglion impar. They demonstrated that improvement in VNS scores at the 6th and 12th months were 90% and 75%, respectively, while EQ-5D improvements at the 6th and 12th months were 67.4% and 61.1% respectively.[18] Adas et al. applied RFT with transsacro-coccygeal approach to 41 patients who had no benefit from other treatment modalities. After 6-month follow-up, success rate was 90%.[19] In this study, a significant decrease in pain scores was also observed after RFT application. The current findings are remarkable for the fact that improvements were detected within 1 month after treatment and that pain decrease was sustained until the last assessment (24 months), depicting long-term benefit. However, compared to other studies, overall success rate was lower. This may be explained by the inclusion of a greater number of patients relative to other studies, possibly increasing the likelihood of hetegeneity. In addition, although patients were experienced with the use of the VAS, questioning follow-up pain level through telephone contact may have affected the results.

Atim et al. applied caudal pulsed radiofrequency to 21 patients with coccydynia who had received conservative treatment before. In that study, according to the subjective satisfaction questionnaire performed at the 6th month, excellent results were identified in 57% of patients, good results in 24%, and poor results in only 19%.[25] In the present study, satisfaction level was found to be high in more than half of the patients; however, 12 (29.3%) patients were dissatisfied with RFT. Future studies assessing the reasons for dissatisfaction could be valuable, particularly with the assessment of clinical characteristics and, possibly, imaging findings.

Nine (22.0%) patients underwent additional treatment after RFT, including manual therapy, corticosteroid injection, and surgery. Since relevant data were not recorded, the reasons for non-response to

RFT could not be identified. It is feasible to suggest that non-reponse may have been due to innaccurate administration of treatment. The localization of the ganglion impar varies between the sacrococcygeal junction and the coccyx tip.[26] Therefore, if the RFT localization is not correct, the success rate of coccydynia treatment decreases.[10] This can be associated with the presence of patients who did not benefit from RFT. Also, when discussing the use of other treatments in patients with lower than 50% success, it is important to remember the fact that patients who experience pain relief usually do not seek further treatment. However, if pain is not sufficiently relieved, the patients seek other treatments. The metioned significant difference may be associated with this situation.

Although complications such as neurologic disorders and infection of injection site can be observed in RFT treatment, no side effects were observed in the present study.[23,27] This result was similar to the majority of the literature on this topic, as demonstrated by studies by Usmani et al., Kırcelli et al., and Reig et al. who also did not observe any side effects or complications in their patient groups.[17,18,23]

There are some limitations that must be noted. First, this study was designed retrospectively on patients who had received RFT as determined via standard clinical assessments; therefore, different parameters that could affect the level of pain after treatment and the possible problems with treatments could not be assessed even though follow-up assessments were prospectively performed. No control group (conservative treatment, placebo) was included, and thus, outcomes may have been biased based on group characteristics or other parameters. Another limitation is that follow-up pain scores were acquired by phone calls using the NRS; whereas pretreatment pain levels were assessed face-to-face using the VAS. This may have caused inconsistency between consecutive scores. Additionally, since the need for further treatment would have been directly associated with non-response to RFT, the pain score improvements in patients receiving additional treatments cannot be directly attributed to RFT; however, it is evident that this distribution difference would have had minimal impact on the outcomes of the patient group with ≥50% pain score improvement (only 2 patients who received further treatment). Detailed evaluation of demographic characteristics, clinical features, comorbidities and imaging studies may have been valuable to ascertain parameters associated with treatment success. Therefore, further studies are necessary to identify factors that are independently associated with the outcomes of RFT treatment.

CONCLUSION

In conclusion, the current study showed that RFT treatment associated with significant pain relief among patients with chronic coccydynia who had not responded to conservative therapy. More than half of the cases had successful treatment according to predefined outcome assessment, and more than 60% reported being satisfied with this treatment. It was determined that patients who did not respond to treatment required further treatment at a greater frequency. Randomized controlled prospective studies are needed for more reliable results on this matter. According to pain scores and satisfaction levels, RFT appears to be a safe procedure that can be applied in patients with chronic coccydynia who were non-responsive to conservative treatment.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

This study is entirely author's own work and no other author contribution.

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