Retrospective Study

Comparison of the Effects of Ganglion Impar Pulsed Radiofrequency and Neurolytic Phenol Injection on Pain Levels in Patients with Coccydynia

Emel Basar, MD, Ulku Sabuncu, MD, Sukriye Dadalı, MD, Gulcin Babaoglu, MD, Ali Costu, MD, Seref Celik, MD, Saziye Sahin, MD, Nevcihan Sahutoglu Bal, MD, Ibrahim Asoglu, MD, Hatice Babaoglan, MD, Mustafa Cem Yılmaz, MD, Tolga Kaplan, MD, and Erkan Yavuz Akcaboy, MD

From: Ankara Bilkent City Hospital, Pain Clinic, Ankara, Turkey

Address Correspondence: Emel Basar, MD Ankara Bilkent City Hospital, Pain Clinic, Ankara, Türkiye E-mail: dr_emel86@hotmail.com

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Background: Ganglion impar block is a commonly employed treatment modality for chronic coccydynia, a condition that is characterized by persistent pain localized in the sacrococcygeal region and that affects the quality of patients' lives significantly.

Objectives: This study aims to evaluate and compare the efficacy of ganglion impar pulsed radiofrequency (GIPRF) and neurolytic phenol injection in patients with chronic coccydynia.

Study Design: A single-center, retrospective, comparative observational cohort study.

Setting: Conducted at a tertiary referral center.

Methods: This retrospective study included 64 consecutive patients who were diagnosed with chronic coccydynia and underwent treatment with either ganglion impar pulsed radiofrequency or neurolytic phenol blocks (GINPBs). Patients were divided into 2 groups: GINPB (n = 32) and GIPRF (n = 32). Pain intensity was measured using the Visual Analog Scale (VAS), while patient satisfaction was assessed via the Likert scale (LS).

Results: Baseline VAS pain scores were comparable between the groups. However, at both one and 3 months after treatment, the GIPRF group demonstrated significantly lower VAS scores than did the GINPB group ($P < 0.001$). The magnitude of improvement in VAS scores from baseline at one and 3 months was also greater in the GIPRF group. Correspondingly, significant differences in both pain scores and patient satisfaction were observed between the groups at the 3-month follow-up.

Limitations: The main limitations of this study include the relatively small sample size, the short follow-up duration of 3 months, and the single-center design.

Conclusion: In the early management of chronic coccydynia, pulsed radiofrequency neuromodulation appears to offer superior, more durable pain relief to ganglion impar neurolytic phenol injections and is accompanied by higher patient satisfaction rates.

Key words: Coccydynia, ganglion impar, pulsed radiofrequency, neurolytic phenol injection

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Coccydynia, also known as coccygodynia or coccygeal neuralgia, is characterized by localized pain in the coccyx or tailbone region, typically aggravated by prolonged sitting or pressure on the lower spine. Although the term "coccydynia" was first introduced by Simpson in 1859, descriptions of coccygeal pain date back as far as the sixteenth century (1).

Although the etiology of coccydynia remains largely idiopathic, several contributing factors have been identified. Trauma is the predominant cause and may result from falls, direct impacts, or difficult childbirth. Anatomical abnormalities, such as excessive mobility or malformation of the coccyx, also predispose individuals to this condition (2). Additional risk factors include obesity, which increases mechanical load on the coccyx, and female gender; epidemiological studies indicate that women are approximately 5 times more likely to develop coccydynia than are men (3).

The ganglion impar, a solitary retroperitoneal structure formed by the convergence of the bilateral sympathetic chains in the sacral region, is implicated in nociceptive transmission associated with coccygeal pain (4). This ganglion conveys sympathetic and visceral sensory input from the lower third of the rectum and adjacent structures, including the vagina, vulva, urethra, anus, perineum, and coccyx (5). The precise anatomical location of the ganglion impar on the anterior surface of the sacrococcygeal junction is variable, and the proximity of the ventral rami of the sacral nerve roots to this ganglion adds to the complexity of interventions targeting this structure (6). This anatomical variability, along with the interplay of somatic, visceral, autonomic, and neuropathic mechanisms, complicates the management of coccydynia (7). Clinically, the hallmark symptom of coccydynia is pain localized to the sacrococcygeal region, which intensifies during sitting or rising from a seated position after prolonged durations. Although radiographic identification of coccygeal malposition can support the diagnosis of coccydynia, the primary clinical criterion remains pain elicited by direct palpation of the coccyx. Initial management typically follows a conservative approach, encompassing analgesics, anti-inflammatory agents, ergonomic modifications such as ring-shaped cushions, manual coccygeal manipulation, transcutaneous electrical nerve stimulation, and physical therapy (8). Meanwhile, the ganglion impar block constitutes a minimally invasive therapeutic option with potential long-term benefits. Several techniques for this procedure have been described, including trans-anococcygeal ligament and trans-sacrococcygeal approaches, with the latter being the most widely utilized (9). The block is usually achieved by injecting local anesthetics, phenol, alcohol, or botulinum toxin around the ganglion (10,11).

Recently, radiofrequency procedures targeting the ganglion impar have emerged as promising nonpharmacological interventions for persistent coccydynia. These procedures mainly involve conventional radiofrequency ablation (CRF) and pulsed radiofrequency (PRF). PRF delivers a high-frequency alternating current (420 kHz, 200 mA) in brief 20-millisecond pulses administered twice per second, each followed by a silent phase of 480 milliseconds. This cycle persists for approximately 4 to 6 minutes. During the silent phase, thermal conduction dissipates heat, maintaining tissue temperature below the neurodestructive threshold of 45°C. Unlike thermal ablation, PRF's analgesic effects are hypothesized to result from electromagnetic field–induced modulation of cellular activity, impairing synaptic transmission and disrupting nociceptive signaling (12).

Methods

This retrospective study was conducted following approval from the Ankara Bilkent City Hospital Institutional Ethical Committee (Approval No: 2024/09, 594). The medical records and follow-up data of patients who were diagnosed with chronic coccydynia and presented to the Department of Pain Medicine between September 1, 2022, and September 1, 2024, were reviewed.

Inclusion criteria consisted of intractable coccygeal pain that persisted for more than 3 months and was accompanied by inadequate response to conservative treatments, including nonsteroidal anti-inflammatory drugs, topical local anesthetics, and physical therapy. Exclusion criteria included local or systemic infections, history of allergic reactions to medications or contrast agents, coagulopathy, use of the anococcygeal approach, incomplete follow-up data, and prior coccygectomy.

A total of 64 consecutive patients who underwent either ganglion impar pulsed radiofrequency (GIPRF) or a ganglion impar neurolytic phenol block (GINPB) were included. All procedures were performed by clinicians experienced in those techniques. Written informed consent was obtained from all patients prior to the interventions. Pain intensity was assessed using a 10-point Visual Analog Scale (VAS), with 0 indicating no pain and 10 representing the worst imaginable pain (13). Patient satisfaction was evaluated using a Likert scale (LS), on which scores ≥ 3 indicated satisfaction and ≤ 2 indicated dissatisfaction (14). VAS and LS scores were recorded at baseline, one month, and 3 months after the procedure. All data were extracted from medical records and follow-up documentation.

Each patient was placed in a prone position with a cushion set under the abdomen to optimize the visualization of the sacrococcygeal disc. Standard non-

invasive monitoring of blood pressure, pulse oximetry, and electrocardiography was applied, and intravenous access was secured. After aseptic preparation with 10% povidone-iodine, the skin was anesthetized with 20 mL of 2% prilocaine (Pricain® 2%).

In the GINPB group, a 22-gauge Quincke spinal needle was inserted via the sacrococcygeal disc under fluoroscopic guidance with anteroposterior and lateral imaging. After the needle tip placement was confirmed by the injection of a radiopaque contrast agent to be anterior to the sacrococcygeal junction in the retroperitoneal space, a reverse comma-shaped spread was observed laterally. Following negative aspiration for blood and cerebrospinal fluid, 5 mL of 6% aqueous phenol was administered. To minimize phenol-related tissue damage, 1 mL of 0.25% bupivacaine was injected before gradual needle withdrawal.

In the GIPRF group, a 22-gauge radiofrequency cannula (10 cm in length with a 5-mm active tip) was similarly placed through the sacrococcygeal disc under fluoroscopy. Correct placement was verified with radiopaque dye injection. Prior to pulsed radiofrequency application (PRF), tissue impedance and sensory/motor responses were assessed, with acceptable impedance defined as < 500 ohms and sensory paresthesia elicited at less than one V at 50 Hz. PRF was applied at 42°C for 3 cycles of 120 seconds each, using standard parameters (45 V, pulse rate 2 Hz, pulse width one ms). No pharmacological agents were administered during PRF. Procedures were conducted with a NeuroTherm NT 1100 radiofrequency generator (Abbott Medical). All adverse events and complications were recorded in follow-up documentation.

Data analysis was performed using IBM SPSS Statistics 25 (IBM Corporation). The normality of the continuous variables was tested with the Kolmogorov–Smirnov and Shapiro–Wilk tests. Normally distributed variables are presented as mean ± SD, whereas nonnormally distributed variables are expressed as median (interquartile range, 25th–75th percentiles). Categorical variables are reported as frequencies and percentages. Group comparisons of categorical data were performed with Pearson's chi-square test. The independent samples t-test and Mann–Whitney U test were used for parametric and nonparametric continuous variables, respectively. Within-group repeated measures were analyzed using the Wilcoxon signed-rank test. Spearman's correlation assessed relationships between variables and significant pain relief. Statistical significance was set at $P < 0.05$ with a 95% confidence interval.

Results

Table 1 presents the baseline demographic characteristics, Likert scale scores, and VAS pain scores of the treatment groups. There were no significant differences between the groups in terms of age and gender ($P > 0.05$). Pre-treatment VAS scores were similar between the 2 groups; however, at one month and 3 months after the treatment, VAS scores were significantly lower in the GIPRF group than in the GINPB group ($P < 0.001$). At one and 3 months, both groups showed significant reductions in VAS scores from their baseline counterparts ($P < 0.05$) (Table 1).

The magnitude of improvement in VAS scores from baseline to one month and 3 months was significantly greater in the GIPRF group than in the GINPB group ($P < 0.001$ and $P < 0.010$, respectively) (Table 2). The changes in VAS scores during follow-up for treatment groups are demonstrated in Fig. 1.

The proportion of patients who achieved significant pain relief, defined as a ≥ 50% reduction in VAS scores, was 12.5% (4/32) in the GINPB group and 46.9% (15/32) in the GIPRF group at one month ($P < 0.01$). At 3 months, these rates were 18.8% (6/32) and 40.6% (13/32) for the GINPB and GIPRF groups, respectively, with no statistically significant difference between

Table 1. *Baseline demographic characteristics, VAS, and Likert scale scores of the treatment groups.*

	Group 1 (GINPB; n = 32)	Group 2 (GIPRF; n = 32)	*P*-value
	Mean ± SD or Median (IQR)		
Age	47.6 ± 13.1	45.3 ± 13.0	0.428
Gender (n%) Female Male	 18 (56.3%) 14 (43.7%)	 24 (75.0%) 8 (25.0%)	0.114
VAS at baseline	8.5 (2.0)	8.0 (1.0)	0.510
P-value* (VAS at baseline and VAS at first mo)	0.013	< 0.001	
VAS at first mo after treatment	8.0 (2.0)	5.0 (4.0)	< 0.001
P-value* (VAS at baseline and VAS at third mo)	< 0.010	< 0.001	
VAS at third mo after treatment	8.0 (3.0)	5.0 (4.0)	< 0.001
Likert scale	11/32 (34.3%)	28/32 (87.5%)	< 0.001

VAS: Visual Analog Scale; GINPB: ganglion impar block with neurolytic phenol; GIPRF: ganglion impar pulsed radiofrequency.
*Intra-group comparisons for VAS scores (baseline vs. first month and baseline vs. third month) were statistically significant ($P < 0.05$).

them (P = 0.055). The ratio of meaningful pain relief in the groups over time is demonstrated in Fig. 2. No significant correlations were observed between meaningful pain relief at the one- or 3-month mark and patient age, gender, or baseline VAS scores (P > 0.05).

Discussion

In this study, the efficacy of GIPRF and GINPBs in the treatment of chronic coccydynia was evaluated and compared. Our findings indicate that while both treatments provided significant pain relief, GIPRF demonstrated superior short-term outcomes. However, the long-term benefits were comparable between the 2 groups.

The ganglion impar block is increasingly recognized as an important adjunct to pharmacological treatments for intractable perineal pain, of both malignant and non-malignant origins (15). PRF offers a sophisticated neuromodulatory approach distinct from traditional continuous radiofrequency ablation by minimizing neural tissue damage. By delivering brief, intermittent high-frequency electrical pulses, PRF maintains tissue temperatures below neurodestructive thresholds, thereby reducing adverse effects commonly seen with thermal ablation, such as neuritis and deafferentation pain. Although the exact mechanisms underlying PRF-mediated analgesia have not been fully elucidated, emerging evidence suggests its analgesic effects are mediated primarily through electromagnetic field influences on neuronal function rather than direct thermal lesioning.

Kuthura et al reported a case of a 48-year-old patient with multiple sclerosis and refractory coccygeal pain. After unsuccessful caudal epidural steroid injections and local anesthetic ganglion impar blocks, PRF denervation of the patient's ganglion impar led to significant pain reduction (16). Similarly, Usta et al described a 54-year-old patient with chronic benign coccydynia who experienced dramatic improvement following a 4-minute PRF treatment, with Numeric Rating Scale (NRS) pain scores decreasing from 8 to 0 and sustained low scores over 4 months (17). Karaman et al, in a retrospective study, found that 6 out of 8 patients who were treated with PRF for chronic coccydynia experienced at least a 50% reduction in pain (18).

The success of a ganglion impar block depends on the accurate identification of the ganglion's anatomical location (6,19). Although traditionally described as anterior to the sacrococcygeal joint (SCJ), the position of the ganglion varies considerably—from anterior to the SCJ to the coccygeal tip (20). Oh et al (6) conducted a morphological study showing high anatomical variability: the ganglion exhibited oval, irregular, triangular, elongated, rectangular, and U-shaped morphologies, with size ranges of 1.8–4.4 mm (long axis) and 0.7–2.5 mm (short axis). Those researchers introduced a relative index to quantify location along the coccyx: "0" at the SCJ (18% of specimens), "0.6" below the midpoint (2%), and, most frequently, "0.3" at the first intercoccygeal joint (ICJ1) (6,16). For an effective blockade, targeting ICJ1 rather than the SCJ is recommended (21). Lin et al noted that injectate tended

Table 2. *Comparison of change in VAS scores between treatment groups during follow-up.*

	Group 1 (GINPB; n = 32)	Group 2 (GIPRF; n = 32)	*P*-value
Difference between VAS at baseline and VAS at first mo	0.0 (1.8)	4.0 (2.8)	<0.001
Difference between VAS at baseline and VAS at third mo	1.0 (4.5)	3.0 (3.8)	<0.010

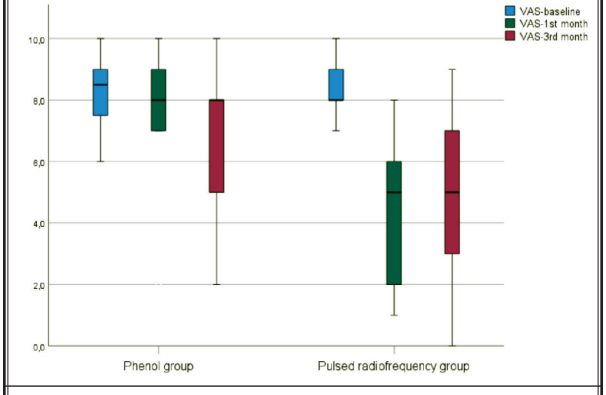

Fig. 1. *The box-plot graphics of the treatment groups' VAS scores during follow-up.*

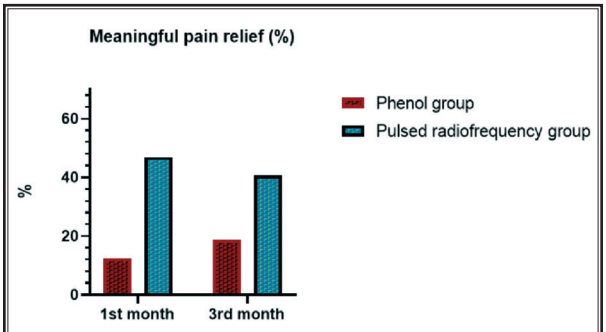

Fig. 2. *The ratio of meaningful pain relief between the 2 groups at the first and third months.*}

to flow cephalad, making the ICJ1 approach more advantageous than the SCJ approach for coverage with lower neurolytic volumes (22,23).

In our study, the lower efficacy of phenol in reducing pain when compared to the PRF group at both the first and third months may be attributed to several factors related to the procedural approach and technical aspects. We employed a transsacrococcygeal approach, which might have contributed to variability in the exact placement of the injection, since the ganglion impar exhibits notable anatomical variability along the coccyx. Previous studies have demonstrated that the ganglion impar can be located anywhere from anterior to the sacrococcygeal joint (SCJ) to the tip of the coccyx, with varying shapes and sizes that may affect the precise delivery of the neurolytic agent. Oh et al have highlighted this variability, showing that the ganglion's position differs significantly among individuals, potentially influencing the success of the block. Such anatomical variation might explain why the phenol injections in our study did not consistently cover the ganglion impar completely, resulting in comparatively lower pain relief than that observed with PRF.

Additionally, the volume and concentration of phenol used in our study might have impacted the efficacy of the treatment. Toshniwal et al (24) conducted a prospective observational study evaluating ganglion impar interventions—including blocks (GIB) and neurolysis (GIN)—in patients with chronic perineal pain (CPP). This study involved 16 patients (10 with malignancy-related pain and 6 with nonmalignant causes), all treated via transsacrococcygeal injection under fluoroscopic guidance. Patients received either neurolytic phenol or therapeutic blocks after a positive diagnostic block response (≥ 50% reduction in VAS scores) and were followed for 2 months. The neurolysis group received 4–6 mL of 8% phenol, whereas the block group was treated with a combination of 10 mL of 0.25% bupivacaine and 40 mg methylprednisolone. Successful needle placement was achieved on the first attempt in most cases. The study concluded that the transsacrococcygeal approach was a reliable, technically feasible, and safe technique for refractory CPP (24). In contrast, our study utilized a smaller volume (5 mL) of 6% aqueous phenol. Previous research suggests that higher volumes or more concentrated phenol solutions may result in more complete neurolysis and prolonged pain relief. Therefore, the relatively lower concentration and volume used in our study could partially explain the less pronounced analgesic effect observed during follow-up.

Furthermore, the lower patient satisfaction observed in the phenol group (34.3% on the Likert scale) compared to the PRF group (87.5%) might be explained by the chemical effects of phenol on adjacent tissues. Westerlund et al demonstrated in a rat model that 7% phenol-aqua caused significant endoneural damage even with perineural application, suggesting phenol's potential to diffuse into surrounding tissues and induce local inflammation and chemical neuritis (25). Although our study did not measure post-procedural pain exacerbation directly, the significantly lower satisfaction scores in the phenol group may reflect discomfort linked to such chemical toxicity and collateral tissue injury. Conversely, PRF achieves analgesia through neuromodulation without causing neural tissue destruction, aligning with the higher patient satisfaction and more sustained pain relief observed in the PRF group.

Considering these findings, the anatomical variability of the ganglion impar and procedural factors (including injection site, volume, and concentration of the neurolytic agent) likely contributed to the differences in efficacy observed between the 2 treatment groups. Both phenol neurolysis and pulsed radiofrequency (PRF) are regarded as effective and generally well-tolerated interventions with low complication rates. However, phenol neurolysis carries a relatively higher risk of adverse effects, particularly chemical neuritis or unintended neural injury, primarily due to the potential diffusion of phenol beyond the targeted area, resulting in collateral damage to adjacent neural or soft tissues. In contrast, PRF achieves analgesia through neuromodulation without causing neural tissue destruction, which may explain the procedure's favorable safety profile and the higher patient satisfaction observed in our study.

Limitations

This study is limited by its relatively small sample size, retrospective design, and short-to-mid-term follow-up period. Additionally, the anatomical variability of the ganglion impar and technical factors related to the injection procedure might have affected the efficacy outcomes. Future randomized controlled trials with larger patient populations and longer follow-up durations are necessary to confirm these results and to optimize procedural parameters, including phenol concentration, volume, and injection site selection.

Conclusion

In summary, our findings indicate that both GINPB

and GIPRF treatments provide significant pain relief in the management of chronic coccydynia. However, PRF demonstrated superior patient satisfaction and more pronounced short-to-mid-term analgesic effects than did phenol neurolysis. The neuromodulatory mechanism of PRF likely contributes to its favorable safety profile and sustained pain control, whereas the chemical neurolytic properties of phenol carry a risk of collateral tissue damage that may affect patient tolerance. Considering the anatomical variability of the ganglion impar and procedural factors, further well-designed randomized controlled studies with larger cohorts and extended follow-up periods are warranted to better delineate the optimal therapeutic approach. Based on our results, PRF appears to be a promising and safer alternative for chronic coccydynia treatment.

Author Contributions

EB: Conception and design of the study, study registration, data collection, manuscript writing, manuscript editing, and final approval of the manuscript.
US: Study design, manuscript editing, and final approval of the manuscript.
SD: Study design, data analysis, and final approval of the manuscript.
GB: Literature review, manuscript proofreading and editing.
AC: Technical support, equipment management, and procedural assistance.
SC: Patient recruitment, clinical assessment, and data management.
SS: Statistical analysis, data interpretation, and results validation.
NSB: Patient recruitment, clinical assessment, and data management.
IA: Technical support, equipment management, and procedural assistance.
HB: Patient recruitment, clinical assessment, and data management.
MCY: Patient recruitment, clinical assessment, and data management.
TK: Technical support, equipment management, and procedural assistance.
EYA: Data analysis, manuscript editing, and final revisions.

References

1. Simpson J. Coccygodynia and diseases and deformities of the coccyx. *Med Times Gaz* 1859; 40:1-7.
2. Malhotra N, Goyal S, Kumar A, Kanika, Singla V, Kundu ZS. Comparative evaluation of transsacrococcygeal and transcoccygeal approach of ganglion impar block for management of coccygodynia. *J Anaesthesiol Clin Pharmacol* 2021; 37:90-96.
3. Hong DG, Hwang SM, Park JM. Efficacy of ganglion impar block on vulvodynia: Case series and results of mid- and long-term follow-up. *Medicine (Baltimore)* 2021; 100:e26799.
4. Raj PP, Erdine S. Interventional pain procedures in the pelvic and sacral regions. In: *Pain Relieving Procedures: The Illustrated Guide*. Wiley Blackwell, 2012, pp 337-383.
5. Marker DR, U-Thainual P, Ungi T, et al. MR-guided perineural injection of the ganglion impar: Technical considerations and feasibility. *Skeletal Radiol* 2016; 45:591-597.
6. Oh CS, Chung IH, Ji HJ, Yoon DM. Clinical implications of topographic anatomy on the ganglion impar. *Anesthesiology* 2004; 101:249-250.
7. Usmani H, Dureja GP, Andleeb R, Tauheed N, Asif N. Conventional radiofrequency thermocoagulation vs pulsed radiofrequency neuromodulation of ganglion impar in chronic perineal pain of nononcological origin. *Pain Med* 2018; 19:2348-2356.
8. Gunduz OH, Sencan S, Kenis-Coskun O. Pain relief due to transsacrococcygeal ganglion impar block in chronic coccygodynia: A pilot study. *Pain Med* 2015; 16:1278-1281.
9. Scott-Warren JT, Hill V, Rajasekaran A. Ganglion impar blockade: A review. *Curr Pain Headache Rep* 2013; 17:306.
10. Plancarte R, Michálek P. Presacral blockade of the ganglion of Walther (ganglion impar). *Anesthesiology* 1990; 73:751.
11. Lim SJ, Park HJ, Lee SH, Moon DE. Ganglion impar block with botulinum toxin type a for chronic perineal pain -a case report-. *Korean J Pain* 2010; 23:65-69.
12. Sluitjer ME, Cosman E, Rittman I. The effects of pulsed radiofrequency field applied to the dorsal root ganglion-a preliminary report. *Pain Clinic* 1998; 11:109-117.
13. Ferreira-Valente MA, Pais-Ribeiro JL, Jensen MP. Validity of four pain intensity rating scales. *Pain* 2011; 152:2399-2404.
14. Hsiao YY, Yao G. Pmc27. Do Likert-type scale and visual anlogue scale measure the same quality of life? *Value in Health* 2008; 11:A567.
15. McAllister RK, Carpentier BW, Malkuch G. Sacral postherpetic neuralgia and successful treatment using a paramedial approach to the ganglion impar. *Anesthesiology* 2004; 101:1472-1474.
16. Kuthuru M, Kabbara AI, Oldenburg P, Rosenberg SK. Coccygeal pain relief after transsacrococcygeal block of the ganglion impar under fluoroscopy: A case report. *Arch Phys Med Rehabil* 2003; 84:E24.
17. Usta B, Gozdemir M, Sert H, Muslu B, Demircioglu RI. Fluoroscopically guided ganglion impar block by pulsed radiofrequency for relieving coccydynia. *J Pain Symptom Manage* 2010; 39:e1-e2.
18. Karaman H, Tüfek A, Kavak GO, Yildirim ZB, Celik F. Would pulsed radiofrequency applied to different

anatomical regions have effective results for chronic pain treatment?. *J Pak Med Assoc* 2011; 61:879-885.

19. Nebab EG, Florence IM. An alternative needle geometry for interruption of the ganglion impar. *Anesthesiology* 1997; 86:1213-1214.
20. Loev MA, Varklet VL, Wilsey BL, Ferrante FM. Cryoablation: A novel approach to neurolysis of the ganglion impar. *Anesthesiology* 1998; 88:1391-1393.
21. Foye PM, Buttaci CJ, Stitik TP, Yonclas PP. Successful injection for coccyx pain. *Am J Phys Med Rehabil* 2006; 85:783-784.
22. Lin CS, Cheng JK, Hsu YW, et al. Ultrasound-guided ganglion impar block: A technical report. *Pain Med* 2010; 11:390-394.
23. Foye PM. Ganglion impar blocks for chronic pelvic and coccyx pain. *Pain Physician* 2007; 10:780-781.
24. Toshniwal GR, Dureja GP, Prashanth SM. Transsacrococcygeal approach to ganglion impar block for management of chronic perineal pain: A prospective observational study. *Pain Physician* 2007; 10:661-666.
25. Westerlund T, Vuorinen V, Kirvelä O, Röyttä M. The endoneurial response to neurolytic agents is highly dependent on the mode of application. *Reg Anesth Pain Med* 1999; 24:294-302.