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Improvement in Pain Following Ganglion Impar Blocks and Radiofrequency Ablation in Coccygodynia Patients: A Systematic Review*

Alívio da dor após bloqueio do gânglio ímpar e ablação por radiofrequência, em pacientes com Coccidínia: Uma revisão sistemática

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Abstract

Nearly 90% of cases of coccydynia can be managed with conservative medical treatment; the remaining 10% need other invasive modalities for pain relief, such as ganglion impar block (GIB) or radiofrequency ablation (RFA) of the ganglion impar. A systematic research was conducted of PubMed, MEDLINE, and Google Scholar to identify studies reporting pain relief in terms of visual analogue scale (VAS), or its counterparts, following GIB or RFA in coccydynia patients with the purpose to determine the efficacy of GIB and RFA of the ganglion impar in controlling pain in coccydynia patients. Seven studies were delineated, with a total of 189 patients (104 in GIB group and 85 in RFA group). In the GIB group, the mean VAS improved from 7.83 at baseline to 3.11 in the short-term follow-up, 3.55 in the intermediate-term follow-up, and 4.71 in the long-term follow-up. In the RFA group, the mean VAS improved from 6.92 at baseline to 4.25 in the short-term follow-up, and 4.04 in the long-term follow-up. In the GIB group, a 13.92% failure rate (11/79) and a 2.88% complication rate (3/104) were reported, while in the RFA group, a 14.08% failure rate (10/71) and no complications (0%) were reported. Total success rate was $>$ 85% with either modality. Ganglion impar block and RFA of the ganglion impar are reliable and probably excellent methods of pain control in coccydynia patients not responding to conservative medical treatment. However, a demarcation between responders, non-responders, and late non-responders should be considered, and larger studies with a longer follow-up ($>$1 year) are needed.

Keywords

- coccyx/diagnostic imaging
- coccyx/injuries
- coccyx/physiopathology
- radiofrequency ablation

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Resumo

Quase 90% dos casos de coccidínia podem ser tratados por meio de tratamento clínico conservador; os 10% restantes precisam de outras modalidades invasivas para o alívio da dor, como o bloqueio do gânglio ímpar (BGI) ou ablação por radiofrequência (ARF) do gânglio ímpar. Com o objetivo de avaliar a eficácia do BGI e ARF do gânglio ímpar no controle da dor em pacientes com coccidínia, foi realizada uma pesquisa sistemática nas bases de dados PubMed, MEDLINE e Google Scholar para identificar estudos que relatam o alívio da dor, em termos de escala visual analógica (EVA), ou dos seus homólogos, após o BGI ou a ARF em pacientes com coccidínia de acordo com as diretrizes PRISMA. Foram identificados 7 estudos, com um total de 189 pacientes (104 no grupo BGI e 85 no grupo ARF). No grupo BGI, a média da pontuação EVA melhorou de 7,83 no início do estudo para 3,11 no acompanhamento de curto prazo, 3,55 no acompanhamento de médio prazo, e 4,71 no acompanhamento de longo prazo. No grupo ARF, a média da pontuação EVA melhorou de 6,92 no início do estudo, para 4,25 no acompanhamento de curto prazo, e 4,04 no acompanhamento de longo prazo. No grupo BGI, foram relatadas 13,92% de falhas (11/79) e 2,88% de complicações (3/104), enquanto no grupo ARF foram relatadas 14,08% de falhas (10/71) e nenhuma complicação (0%). A taxa total de êxito foi $>$ 85% em qualquer uma das modalidades. O BGI e a ARF do gânglio ímpar representam métodos confiáveis e provavelmente excelentes no controle da dor em pacientes com coccidínia que não respondem ao tratamento médico conservador. No entanto, deve ser estabelecido um limite entre os pacientes que responderam, os que não responderam, e aqueles não respondedores tardios, sendo necessários estudos mais amplos com acompanhamento mais longo ($>$ 1 ano).

Palavras-chave

- cóccix/diagnóstico por imagem
- cóccix/lesões
- cóccix/fisiopatologia
- ablação por radiofrequência

Introduction

In 1859, Simpson introduced the term coccydynia relating to pain and tenderness around the sacrococcygeal region.[1] The pain usually worsens with prolonged sitting on hard, narrow, or uncomfortable surfaces, and rising from a seated position.[2,3] It has a multifactorial origin, which may be idiopathic.[2] Traumatic etiology is most commonly seen, and the cases may present in various forms, such as posterior luxation, hypermobility, and spicules of the coccyx. Infection and tumors of the coccyx might be rare causes.[2,4] Obesity and female gender are associated with an increased risk of developing coccydynia. The incidence is found to be five times higher in women than in men.[2] Moreover, adolescents and adults are more commonly affected, compared with children.[2,5]

Most of the cases of coccydynia can be managed with conservative treatment, such as nonsteroidal antiinflammatory drugs (NSAIDs), modification of sitting style, use of coccygeal cushions, pelvic floor rehabilitation, transcutaneous electrical nerve stimulation (TENS), extra-corporal shock wave therapy (ESWT), and physical therapy, with up to a 90% resolution rate.[6–9]

Few cases which fail to resolve with the aforementioned conservative treatment require invasive intervention, including surgical and non-surgical interventions. Various surgical and non-surgical interventions are mentioned in the literature. Non-surgical interventional treatment modalities, such as caudal epidural steroid injection, ganglion impar block (GIB), radiofrequency ablation (RFA), and chemical neurolysis of the ganglion impar can be used in refractory patients. The surgical intervention consists of coccygectomy, but it is rarely required and used only as a last resort.[3,7,8,10]

The ganglion impar is a solitary retroperitoneal ganglion representing fused termination of the bilateral paravertebral sympathetic chains, located at the level of the coccyx. It is the sensory relay station of nociceptive stimulus from the pelvic and peroneal zone. Ganglion impar blocks were employed for the management of perineal cancer pain (rectum, vulva, prostate) as well as for chronic non-cancer-related pain, such as coccydynia, chronic pelvic pain syndrome, etc. Ganglion impar block can be done utilizing various modalities, like local anesthetics, corticosteroids, clonidine, botulinum toxin, alcohol, RFA, or cryoablation.[11,12]

Steroid injection alone or injection followed by radiofrequency lesioning (radiofrequency thermocoagulation, pulse radiofrequency) therapy of the ganglion impar are commonly used in recalcitrant coccydynia.[7,13–15] However, only a few studies have evaluated the long-term effectiveness of this injection procedure, and no comparative randomized trials are available. The purpose of the present systemic review is to screen the literature regarding the efficacy of GIB and to assess long-term effects of denervation of the ganglion impar.

Materials and Methods

Objectives

1. To study the improvement in the VAS following GIB in coccydynia patients.
2. To study the improvement in the VAS following RFA of the ganglion impar in coccydynia patients.
3. To study the difference in improvement of VAS following GIB and RFA of the ganglion impar in coccydynia patients.

Methodology

A comprehensive and structured search was conducted using the Cochrane Library, Medline, Embase, and Cochrane database of systematic reviews (CDSR) databases. The search strategy used to identify relevant studies was based on the population, intervention, comparison, and outcome measures (PICO) model. The population search terms included were *coccydynia*, *coccyx pain*, *coccydynia*, *chronic*, *recalcitrant* or *> 3 months*. The intervention search terms included were *GIB*, *presacral block radiofrequency ablation*, or *pulse radiofrequency*. No search terms were used for the comparison group. For the outcome group, the search terms consisted of *pain improvement*, *VAS score*, and *NRS score*, and the study should have at least a 6-month follow-up. Population, intervention, and outcomes were combined with 'OR'. Intergroup terms were combined using the search term 'AND'. Citations were stored and organized.

Inclusion and exclusion criteria: Studies were considered for inclusion if they met the following criteria: (1) study with age group $>$ 18 years (2) presence of symptoms for at least 3 months (3) participants failed to show pain improvement after conservative treatment (4) follow-up of at least 6 months. Studies were excluded if they had the following criteria: (1) participants who underwent any kind of other local injection in the coccygeal region; (2) studies describing surgical interventions involving the lumbar spine or pelvis, including patients with cancer and/or cysts (3) case reports, conference presentations, and unpublished trials.

The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) checklist was utilized to screen the search results and select articles for inclusion in the review. Two reviewers (R. C. and K. K.) independently screened and analyzed the search results. The first step of the selection process involved the identification of all possible and relevant studies from the aforementioned databases. These were screened by going through their titles as well as abstracts. After completion of this step, relevant studies were brought out forward for further identification process. This involved retrieving full-length texts of the articles, which were subsequently matched against the prescribed inclusion and exclusion criteria. Duplicate citations and studies found not to match our review parameters were removed, and a final decision was made regarding article selection. Disagreements were resolved by an additional reviewer through discussion and consensus with two main reviewers.

The assessment of methodological strength and validity of included studies (risk of bias assessment) was done by utilizing a framework to ensure reproducibility to the process. The framework used was the National Institutes of Health (NIH) quality assessment tool for before-after (pre-post) studies. Using the NIH tool, both reviewers analyzed, evaluated, and graded the studies independently into three categories—*good*, *fair,* and *poor.* The 12th parameter on the questionnaire (group-intervention) did not apply to any of our studies, and, hence, only 11 items were used to ratify the study quality. If the study checked 9 or more items on the questionnaire as *yes,* it was graded as *good*, if 6 to 8 questions were marked as *yes,* then the study was graded as *fair,* and if only 5 or fewer items were marked as *yes*, then the quality of the study was described as *poor.*

Data extraction: the demographic and epidemiological data of the studies included in the review were tabulated on a Microsoft Excel spreadsheet (Microsoft Corp., Redmond, WA, USA) (►**Tables 1** and **2**). The parameters studied included the number of patients in each study; history of trauma; mean age; body mass index (BMI); ganglion block approach; material of injection/technique of ablation, scoring system used. As per the purpose of review, in primary outcome, pain scores were assessed with numeric VAS and numerical rating scale (NRS) at pre-injection/pre-ablation and after the procedure. According to availability of data, it was divided into short-term (3–4 weeks), intermediate term (3 months) and long term (6 months). Other variables measured were complications and failures (patients showing no improvement or little quantifiable improvement as per author of the study in question) in secondary outcome.

Visual analogue scale and NRS scores were used for primary outcome assessment. The NRS has a strong positive correlation with the VAS scale and, therefore, NRS can be substituted for VAS for follow-up pain assessment.[16] Data analysis involved computing the weighted mean of the various demographic parameters. Although we were unable to perform meta-analyses due to heterogeneity of the study data (analyzed using the I^2 test), we did describe statistical results in the form of *p*-values and 95% confidence intervals (95%CIs) if they were reported by any study

Screening process: A total of 50 citations were identified following the literature search in the Cochrane Library, Medline, Embase and CDSR databases. After the first screening, 21 studies met the inclusion criteria. The latter were then subjected to the second step of the screening process, whereby full-length texts of all articles were obtained and closely scrutinized.

Seven studies were finally selected for the review—four in the GIP and four in the RFA category (one article by Sir and Eksert was common to both). A flowchart depicting the screening and identification process along with the reasons for exclusion is given in ►**Fig. 1**.

Two studies were prospective while the remaining five were retrospective studies. None was a randomized controlled trial. Two studies assessed the effect and efficacy of GIB with local anesthetic agent and steroid. Three studies evaluated the role of conventional RFA of the ganglion impar. One study compared the two groups mentioned above, while another one compared between only block and block + ablation. So, in the latter study, only the data of the first group of

Table 1 Characteristics of various studies comparing ganglion impar block for coccydynia

	Gonnade et al.	Sencan et al.	Sir and Eksert	Sagir et al.
Year	2017	2018	2019	2020
Number	31	28	25	20
Age (mean, in years)	42.9	–	42.64	–
BMI (mean, in kg/m^2)	–	29.49	24.73	–
H/o trauma	12	–	–	21
Approach	Sacrococcygeal	Sacrococcygeal	Sacrococcygeal	Sacrococcygeal/ transcoccygeal
Scoring system (s) used	NRS, ODI	VAS, LANSS, SF-12	NPRS, LS	VAS
Material	3–5 ml bupivacaine (0.5%) + 1 ml methylprednisolone (40 mg)	3 ml bupivacaine (0.5%) + 1 ml methylprednisolone (40 mg)	2 ml bupivacaine (0.25%) + 1 ml triamcinolone (40 mg)	Bupivacaine (0.25%) + 1 ml methylprednisolone (40 mg) totaling 10 ml
VAS-baseline	7.9	7.89	8.0	7.4
VAS-short term	2.03	2.39	3.36	5.5
VAS-intermediate term	2.48	3.11	4.04	5.2
VAS-long term	3.23	3.89	7.24	5
No improvement	1	7	–	3
Complication	0	2 (minor vasovagal reaction and transient increase in pain)	1 (bradycardia and hypotension)	0

Abbreviations: BMI, body mass index; LANSS, Leeds assessment of neuropathic symptoms and signs; LS, likert scale; NPRS, numerical pain rating scale; NRS, numerical rating scale; ODI, Oswestry disability index; SF-12, 12-item short-form survey; VAS, visual analogue scale.

patients were used for review purpose. For discussion purposes, two groups were created: GIB (receiving GIB only) and RFA (receiving RFA of the ganglion impar only—either by single or multiple pulses)

Risk-of-bias assessment: Out of seven, six studies by Gonnade et al.,[17] Adas et al.,[15] Sagir et al.,[6] Sencan et al.,[13] Sir and Eksert,[18] and Demircay et al.[14]–achieved *good* study grade, while one study by Gopal and McCrory[19] achieved *fair*

Table 2 Characteristics of various studies comparing radiofrequency ablation of the ganglion impar for coccydynia

	Demircay et al.	Gopal and McCroy	Adas et al.	Sir and Eksert
Year	2010	2012	2016	2019
Number	10	20	41	14
Age (mean, in years)	49.2	51.3	46.68	42.52
BMI (mean, in kg/m^2)	–	–	26.46	27.98
H/o trauma	4	15	24	–
Approach	Transcoccygeal (preferred)	Sacrococcygeal	Transcoccygeal	Sacrococcygeal
Scoring system (s) used	VNS	VAS	VAS	NPRS, LS
Method	80 C x 120 second	Pulsed @ 42 C	80 C x 90 second	42 C x 120s x3 cycles
VAS-baseline	8.7	6.82	6.22	7.85
VAS-short term	2.1	3.55	5.37	3.5
VAS-intermediate term	–	–	–	3.14
VAS-long term	2.9	2.55	5.05	4.05
No improvement	1	5	4	–
Complication	–	0	–	0

Abbreviations: LS, likert scale; NPRS, numerical pain rating scale; VAS, visual analogue scale;

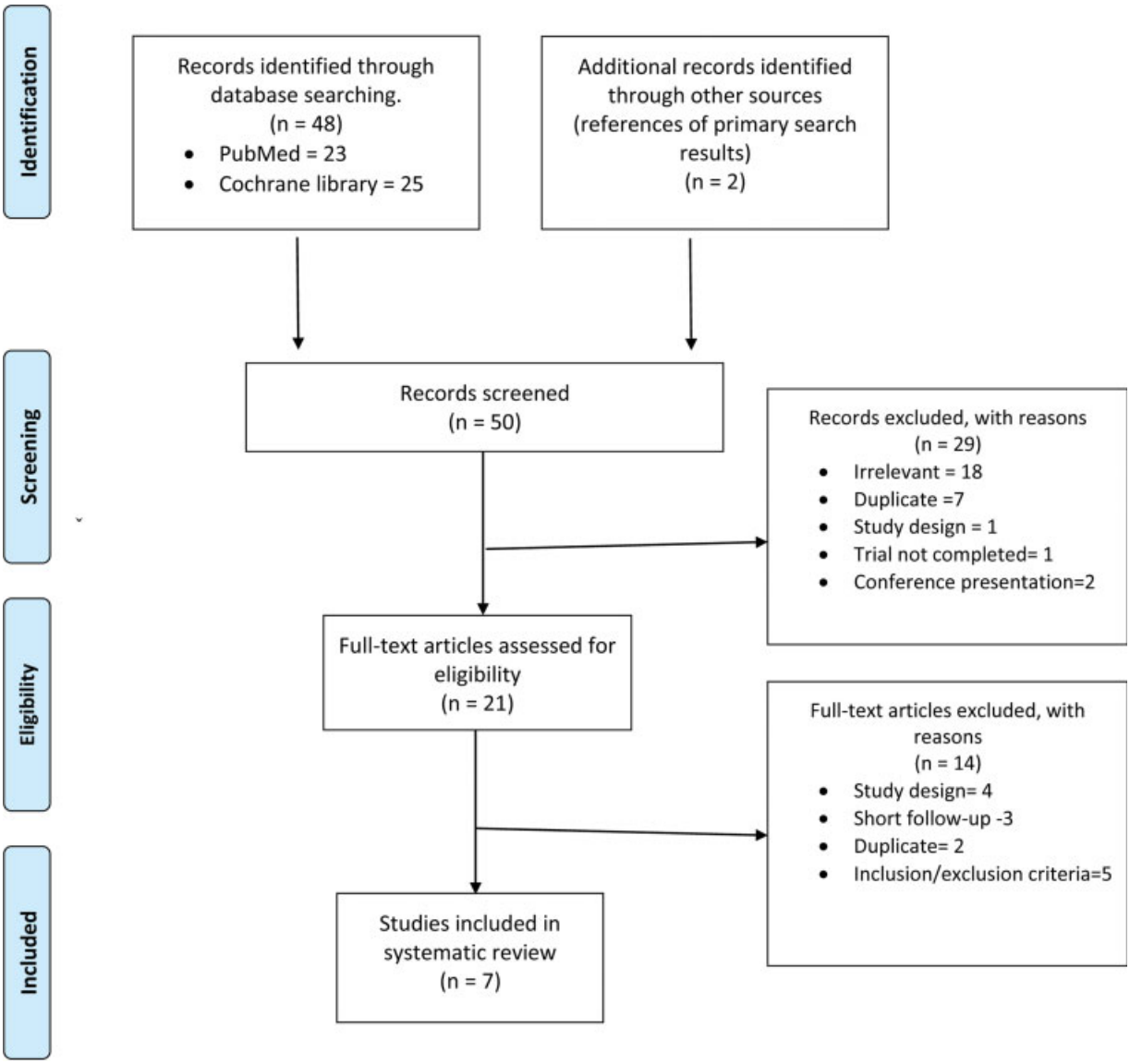


Fig. 1 PRISMA flowchart showing inclusion and exclusion of studies for systematic review.

grade because it did not statistically analyze pre-to-post changes and calculate the *p*-value. One study mentioned lost to follow-up of a few of the participants; however, it was less than 20% of total participants, so there was no down-grading of the quality of assessment. The detailed risk-of-bias assessment and grading of the included studies are presented in ►**Table 3**.

Results

Population Characteristics

A total of 189 patients were studied (104 in GIB group and 85 in RFA group). The mean age ranged between 42.64 and 42.9 years in the GIB group and 42.52 to 51.3 in the RFA group. The weighted BMI was 27.24 kg/m^2, and the mean BMI ranged between 24.73 and 29.49 kg/m^2 in the GIB group. The weighted and the mean BMIs for the RFA group were 26.85 kg/m^2 and 26.46 to 27.98 kg/m^2, respectively. A history of trauma to the coccygeal region was reported in 64.7% patients (33/51) in the GIB group and 60.6% patients (43/71) in the RFA group. All the patients were treated with a sacrococcygeal approach in the GIB group, whiletwo authors preferred the transcoccygeal approach in the RFA group. The most commonly used scoring system for pain was VAS or its similar counterparts, including VNS, NRS, or numerical pain rating scale (NPRS). Since all the scoring was done on a scale of 0 to 10, they were considered similar for the purpose of the present review, and VAS was used as a common term to denote all the scales. The mean VAS was 7.83 in the GIB group and 6.92 in the RFA group

Primary Outcome

In the GIB group (►**Tables 1**, **4** and **5**), the mean VAS was 7.83 at baseline, 3.11 in the short-term follow-up, 3.55 in the intermediate-term follow-up, and 4.71 in the long-term follow-up, marking a decrease in pain score by 60.28%, 54.66%, and 39.85% at respective follow-up durations, which is termed as PIS and calculated as the difference between

Table 3 Risk of bias assessment of various studies included in the review

Criteria	Gonnade et al. (2017)	Adas et al. (2016)	Sagir et al. (2020)	Demircay et al. (2010)	Gopal and McCroy (2014)	Sir and Eksert (2020)	Sencan et al. (2018)
1. Was the study question or objective clearly stated?	Y	Y	Y	Y	Y	Y	Y
2. Were selection criteria for the study population prespecified and clearly described?	Y	Y	Y	Y	Y	Y	Y
3. Were the participants in the study representative of those who would be eligible for the intervention in the general or clinical population of interest?	Y	Y	Y	Y	Y	Y	Y
4. Were all eligible participants that met the prespecified entry criteria enrolled?	Y	Y	Y	Y	Y	Y	Y
5. Was the sample size sufficiently large to provide confidence in the findings?	N	N	N	N	N	N	N
6. Was the intervention clearly described and delivered consistently across the study population?	Y	Y	Y	Y	Y	Y	Y
7. Were the outcome measures prespecified, clearly defined, valid, reliable, and assessed consistently across all study participants?	Y	Y	Y	Y	Y	Y	Y
8. Were the people assessing the outcomes blinded to the participants' interventions?	N	CD	CD	CD	CD	CD	N
9. Was the loss to follow-up after baseline 20% or less? Were those lost to follow-up accounted for in the analysis?	Y	Y	Y	Y	Y	Y	Y
10. Did the statistical methods examine changes in outcome measures from before to after the intervention? Were statistical tests done that provided *p*-values for the pre-to-post changes?	Y	Y	Y	Y	N	Y	Y
11. Were outcome measures of interest taken multiple times before the intervention and multiple times after the intervention (i.e., did they use an interrupted time-series design)?	Y	Y	Y	Y	Y	Y	Y
12. If the intervention was conducted at a group level (e.g., a whole hospital, a community, etc.) did the statistical analysis take into account the use of individual-level data to determine effects at the group level?	NA	NA	NA	NA	NA	NA	NA
	Good	Good	Good	Good	Fair	Good	Good

Abbreviations: CD, cannot be determined; N, no; NA, not applicable; Y, yes.

baseline VAS and follow-up VAS, expressed as percentage of baseline VAS. In the RFA group (►**Tables 2**, **4** and **5**), the mean VAS was 6.92 at baseline, 4.25 in the short-term follow-up and 4.04 in the long-term follow-up, making for a percent improvement score (PIS) of 38.58% and 41.62%, at respective follow-up durations.

Secondary Outcome

In the GIB group, a 13.92% failure rate (11/79) and a 2.88% complication rate (3/104) were reported, while in the RFA group, a 14.08% failure rate (10/71) and no complications (0%) were reported. The total failure rate was 14% (21/150), and the complication rate was 2.18% (3/138). No complications like infection or persistent injection site pain were reported.

Discussion

It has been found that Coccydyniacoccydynia commonly occurs in females.[20] Overweight and obese people are more prone to developing coccydynia.[2] The weighted mean BMI of the study population was 27.04 kg/m^2. The most

Table 4 Comparison of primary outcome on the two modalities for coccydynia

Primary outcome	Ganglion block	Radiofrequency ablation	Ganglion block (% improvement score)	Radiofrequency ablation (% improvement score)	Total	Total (% improvement)
VAS-baseline	7.83	6.92			7.42	
VAS-short term (3–4 weeks)	3.11	4.25	60.28	38.58	3.62	51.21
VAS-intermediate term (3 months)	3.55	–	54.66	–	–	–
VAS-long term (6 months)	4.71	4.04	39.85	41.62	4.41	40.57
Failure	11	10	–	–	21	–
Complications	3	0	–	–	3	–

Abbreviation: VAS, visual analogue scale.

Table 5 Comparison of percent improvement score (% improvement score) of the two modalities for coccydynia for short term and long term

PIS	GIB	RFA	Total
Short term	60.28	38.58	51.21
Long term	39.85	41.62	40.57

Abbreviations: GIB, ganglion impar block; PIS, percent improvement score; RFA, radiofrequency ablation.

common cause was found to be posttraumatic (62.29%). A traumatic injury could happen in various ways, such as fall from a height, slip and fall, road traffic accidents (RTA), childbirth trauma as well as repeated unnoticed micro-trauma from long-duration bike rides could be a cause for developing coccydynia.

Chronic irritation of the coccygeal nerve roots due to the biomechanical alterations in the coccyx may be a cause of coccydynia. The ganglion impar is the relay point for the coccygeal nociception. Chronic irritation of the coccygeal nerve causes increased sensitization of ganglion impar and somatosensory system.[21] Inhibition of nociceptive transmission via the blocking of the ganglion impar has an analgesic effect and decreases sensitization.[13] The success of the blockade depends upon accurately locating the ganglion. The anatomic location of the ganglion impar, however, remains uncertain.

Various agents have been used for GIB: local anesthetics, steroids, neurolytic, and radiofrequency ablation.[22] Blockage of ganglion impar with local anesthetics provides fast and good relief for coccydynia (coccyx pain), but the pain control is short-lived.[23] The duration of pain control can be prolonged by neurolysis of the ganglion.

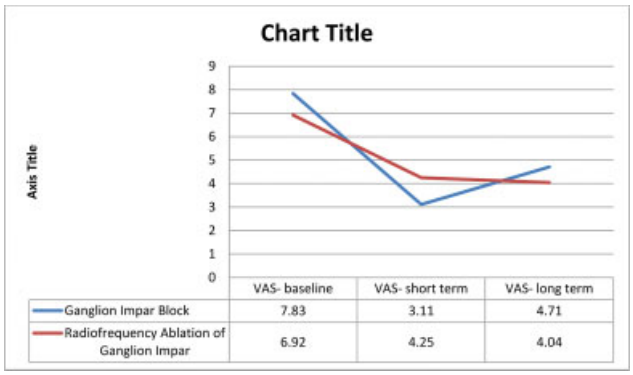
Various techniques of GIB have been described in the literature. Fluoroscopy-guided injection reduces the risk of complications like intravascular, too far anterior (within the rectum), or too superficial (within the sacrococcygeal disc) position of the needle. To augment the accuracy of the injection, the location of the needle tip can be confirmed with contrast injection before the procedure. Plancarte et al. used bent needle through the anococcygeal ligament.[24] The author placed the non-dominant hand index finger in the rectum to avoid an accidental breach. Wemm and Saberski suggested inserting a needle through the sacrococcygeal ligament via the trans sacrococcygeal approach directly into the retroperitoneal space.[25] This approach was modified by Munir et al.[26] to needle-inside-needle technique to avoid patient discomfort due to multiple time needle insertions. Foye et al. described the first intercoccygeal joint (ICJ) approach and stated that this approach carries the advantage of allowing the injectant to be closer to the anatomical location of the ganglion and thus easy to visualize on lateral fluoroscopy compared with sacrococcygeal joint (SCJ).[27] The SCJ gets obscured by cornu of the first coccyx in lateral fluoroscopy. Moreover, SCJ fusion is noticed in 52% of patients with idiopathic coccydynia compared with intercoccygeal joint fusion, which is seen in 12% of cases. To overcome this difficulty, Hong et al.[28] also used first ICJ approach. Toshniwal et al.[23] described an alternate technique in case of the calcified sacrococcygeal ligament; they inserted the needle-through-needle via short and thick introducer needle. Alternatively, the paramedian approach was developed by Huang et al.,[29] they inserted needle below the transverse process of the coccyx and redirected it toward the midline. Foye and Patel[30] utilized the paramedian approach with corkscrew maneuver.

Besides these fluoroscopic image-guided techniques, other imaging modalities like computed tomography (CT), ultrasonography (USG), and magnetic resonance imaging (MRI) are also used for locating the ganglion. In this review, all studies utilized fluoroscopic guidance and injected non-ionic contrast material to confirm the exact location of the needle tip and spread of injectant.

Gonnade et al.[17] found the success of GIB with a single time injection encouraging; however, the follow-up duration was limited to 6 months and, thus, they recommended a longer period of follow-up to assess for the efficacy of GIB. They also backed up their findings with another scoring

system—the Oswestry Disability Index, which showed significant improvement after GIB. Along with GIB, physiotherapy was added to the treatment regime, including pelvic floor exercises, kneeling groin exercises, and pyriformis stretching exercises to prevent recurrence. In a similar study by Sencan et al.,[13] they used the 12-item short form survey (SF-12) to evaluate the overall quality of life (QoL), and the Beck depression inventory (BDI) to evaluate patient's mood. They found that even though the SF-12 did not show significant improvement for physical and mental parameters in the short (1 month) and long terms (6 months), BDI showed significant improvement, thus backing their results by showing improvement in the VAS with GIB. The systematic review shows a percent improvement score (PIS) of 60.28% in the short term and 39.85% at 6 months, with a mean VAS of 3.11 and 4.71, respectively. These data also include failures, and, thus, further improvement in VAS and PIS can be expected with those responding to treatment, which is a whooping majority of $>85\%$.

Adas et al.[15] showed transcoccygeal radiofrequency thermocoagulation (RFT) to be easy, effective, and associated with fewer complications. Higuchi et al.[31] showed that pulsed RFA to the dorsal ganglion produces long-term relief from spinal pain without causing thermal ablation. Gopal and McCroy[19] showed no adverse effect with RFA and a PIS of 88.88% at 6 months in those responding to RFA; however, the failure rate was 25%. This was the highest PIS reported by any study, making this modality more alluring than GIB. Demircay et al.[14] showed significant improvement in VAS with transcoccygeal RFA in a limited number of patient and reported a PIS of 81.61% in the immediate postprocedure period, which gradually declined to 66.67% at 6 months follow-up. Also, there is some inconsistency in the reporting of VAS in the short and long terms, with an improvement shown by Gopal and McCroy,[19] and Adas et al.[15] for RFA, and Sagir et al.[6] for GIB. All other studies showed a decrease in the PIS (increase in VAS) at long term compared with short term. This is still unexplained; however, a plausible reason could be individual variations resulting in late identification of non-responders. A more long-term follow-up could demarcate between this group of late non-responders (having a response in early treatment period but ultimately not responding to treatment modality) and true responders (having long-term benefits with the modalities). Not surprisingly, late non-responders are more commonly seen with GIB than those with RFA, as blocking the ganglion does not cause permanent damage to the ganglion as seen with RFA. Sagir et al.[6] also reported a significant difference at long term in patients treated with both modalities and with GIB alone, resulting in an absolute mean VAS of nearly half (2.4) in the former when compared with the latter (5), and a PIS of more than double for the former (68%) when compared with the latter (31.83%). Sir and Eksert[18] also showed a significantly higher improvement in VAS with RFA than with the GIB modality, though the distribution of number of patients was fairly uneven in both groups, with only 14 patients in the RFA group compared with 25 in the GIB group. From ►**Fig. 2** and ►**Tables 4** and **5**, one can assume that pain relief was better in the GIB group in the short term, but in the long term, it was numerically higher in the RFA group.



	VAS- baseline	VAS- short term	VAS- long term
Ganglion Impar Block	7.83	3.11	4.71
Radiofrequency Ablation of Ganglion Impar	6.92	4.25	4.04

Fig. 2 Line diagram depicting fall and rise of the visual analogue scale in two groups (ganglion impar block and radiofrequency ablation) following treatment for coccydynia.

We define a separate group of late non-responders, other than responders and non-responders, who are easily identified with an immediate postop score. Late non-responders are those patients who did respond to treatment at immediate stage (denoted by a decrease in VAS) but had a tendency to reach pre-procedure VAS levels in the intermediate and long terms (3 months after the procedure). The reason for the existence of these patients could be the presence of higher threshold to block or ablation, or inadequate placement of needle or probe. Also, we recommend the use of PIS for quantification of the decrease in the VAS. Rather than an absolute decrease, PIS shall be more vocal in correlating with improvement in QoL, although this is an early statement and will need validation in further studies. But theoretically speaking, the amount of mental satisfaction and physical relief cannot be equated by absolute increment and decrement in VAS, say, when we talk about an absolute reduction in VAS by 4; it will have different effects for reduction from 6 to 2 than from 9 to 5, marking a PIS of 66.67% in the former and 44.44% in the latter.

The strength of the present review is that all included studies had a good or fair quality of evidence determined by utilizing the NIH tools. The effect of the intervention was observed in the long term (6 months) in all studies. There are a few limitations also, such as no comparative randomized trial was available and, therefore, not included in the review; besides, since some of the patients did not report basic demographic parameters, a detailed review could not be performed on basis of demographics. Also, coccydynia patients coccydyniawith traumatic, idiopathic, and malignant etiology were not assessed separately due to non-availability of separate data. Again, continuous and pulsed radiofrequency were considered the same and included under the category of RFA. There is certainly a need for large randomized comparative studies on GIB with steroid and neuromodulation with radiofrequency. However, looking at the results of published studies, it would not be unwise to state that they provide excellent pain relief in a majority of patients, irrespective of the modality used.

Conclusion

Ganglion impar block and RFA are intermediate treatment options between a conservative option of medical treatment and a radical option of surgical excision. They are minimally invasive and can eliminate unnecessary surgical burden in a majority of patients unresponsive to conservative medical management. Considering a success rate $> 85\%$ with either modality, and nearly 90% with conservative means, the need for surgical excision is reduced to $< 1.5\%$ of coccydynia patients . The authors of the present study recommend a trial with GIB or RFA, along with physiotherapy, in those patients not responding to conservative medical treatment. The choice of GIB or RFA shall depend on the availability of resources, the skill of the treating doctor, and patient's choice.

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Conflict of Interests
The authors declare that there is no conflict of interests.

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