

COMPARATIVE EFFECTS OF COCCYGEAL NERVE BLOCK AND GANGLION IMPAR BLOCK ON PAIN, FUNCTION, AND QUALITY OF LIFE AMONG FEMALE PATIENTS WITH CHRONIC COCCYDYNIA

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Abstract

Background: Chronic coccydynia causes disability and reduces quality of life due to extreme pain and intolerance to sitting. Certain blocks, such as a coccygeal nerve block (CnB) or a ganglion impar block (GIB), may be considered if conservative treatments are unsuccessful.

Objective: The aim of this study is to compare CnB and GIB on pain, function and quality of life among patients with chronic coccydynia.

Methods: This study was a randomized, parallel group trial. Forty-four (44) women, 40 to 60 years of age with chronic coccydynia were randomly assigned to undergo either a CnB or a GIB. Pain was measured with a 100 mm Visual Analog Scale (VAS), functional disability with the Oswestry Disability Index (ODI) and quality of life with the Short-Form 36-Item Health Survey (SF-36). All measures were completed prior to the block and at 4 and 12 weeks post block.

Results: The two groups were similar at baseline. Both blocks, at their respective time points, improved all measures. At 4 weeks post block, patients in the GIB group had a significantly lower VAS score than patients in the CnB group (3.02 vs. 4.66). The difference in VAS scores between the two groups was also significant at the 12 week time point (2.50 vs. 4.25). The GIB group also had greater improvement in ODI scores at 4 and 12 weeks when compared to the CnB group. At 12 weeks post block, all 8 domains of the SF-36 questionnaire were statistically higher in the GIB group when compared to the CnB group. Conclusions: In the sample population, GIB was more effective than CnB for the short to medium term improvement of the primary and secondary outcomes.

1. Introduction

Coccydynia is defined as pain and tenderness over the coccyx that gets worse with activities that touch or load the coccyx. This pain can be severe enough to disturb sleep and other activities of daily living. Coccydynia can cause a significant decrease in quality of life. It has been reported that women are four to five times more likely than men to have this condition. This may be because of obstetrics and/or higher mobility of the coccyx in women (Ahadi et al., 2022; Andersen et al., 2022).

Pain and tenderness over the coccyx can be caused by many things, such as, trauma, poor posture, obesity, degenerative changes, abnormal mobility of the coccyx, and micro or macrositiation of the coccyx. Sometimes, there is no obvious cause and it is considered idiopathic. Coccydynia is usually an acute condition, but if it lasts longer than three months, it is considered chronic. It is thought that pain and tenderness over the coccyx may be caused by local inflammation and irritation, and may also be caused by changes in the nervous system (Chen et al., 2017; Lee et al., 2023). Sympathetically mediated pain may occur outside the area of local inflammation and may not be relieved by treatment directed to the area of local inflammation.

Conservative treatment usually involves analgesics, non-steroidal anti-inflammatory drugs, activity and posture management, ergonomic changes, pressure-relieving aids, physiotherapy, and manual therapy. The majority of patients experience improvement with these measures. Approximately 25% of patients do not improve with these treatments and are candidates for more invasive procedures (Gopal & Mc Crory, 2014; Govardhani et al., 2021). Among these invasive procedures, coccygeal nerve block (CnB) and Ganglion impar block (GIB) are the most relevant, as they provide pain relief by affecting different structures of the coccygeal pain pathway.

Compared to GIB, CnB is a more limited intervention to moderate nociceptive signaling from the coccyx. GIB is a more proximal intervention targeting the termination of the sympathetic chain (ganglion impar), located in the sacrococcygeal region. The ganglion impar

is a relay for nociceptive and sympathetic signals from the coccyx and perineum. Therefore, a blockade of the ganglion impar may modify nociceptive signals in the transmission of chronic pain (Kircelli et al., 2019; Malhotra et al., 2021). Overall, there is a paucity of evidence to support the use of CnB and GIB. Most of the studies that assessed CnB and GIB evaluated them separately. A randomized controlled trial, published by (Perdecioğlu et al., 2024), documented improvements in both groups following CnB and GIB. Other studies show GIB has beneficial short and long term effects.

Assessing pain levels provides one way to measure progress toward treating chronic coccydynia. However, other considerations are necessary to fully evaluate treatment response. Coccygeal pain can affect numerous domains of a person's everyday life and may include, but is not limited to, the ability to perform activities of daily living, level of functioning when sitting, traveling, and working, as well as psychological and emotional well-being. Therefore, assessment of treatment response should include the aforementioned domains as well as pain. The Visual Analog Scale (VAS), Oswestry Disability Index (ODI), and Short Form-36 (SF-36) Health Survey are appropriate instruments to assess treatment response.

Research focused on the local population of Pakistan is extremely limited. There are also differences in the profiles of patients treated in different geographic locations as well as in the therapies and procedures performed by various practitioners. With that in mind, the present study evaluated the effects of cryoneurolysis and glycerol injection therapy (GIB) on pain and functioning of women with chronic coccydynia who did not improve with prior conservative therapies. The assessment was repeated at the beginning of the study and at 4 and 12 weeks thereafter. It was anticipated that GIB would result in greater improvement in pain and functioning than CnB, and that this improvement would be sustained for the 12 week duration of the study. It is hoped that this information will assist health care providers in making more informed decisions regarding treatment of their patients with chronic coccydynia.

2. Materials and Methods

2.1 Study design and setting

This study was conducted at the Bashir Neurospine Institute in Lahore over a period of 4 months. It included 44 females, 22 in each group, CnB and GIB. Coccydynia-related pain was chronic and refractory to Conservative management. Participants were selected by non-probability consecutive sampling. It was assumed that 20% of the selected participants would not complete the study; therefore, the sample size was increased by 20% from the calculated sample size of 36.

2.2 Participants

The participants were females 40 to 60 years of age who had coccygeal pain for more than 3 months. Participants were not included in the study if they had other causes of acute coccydynia, infection at site of proposed injections, had coagulation disorders, were on anticoagulants, had coccygectomy, or had malignancies involving the sacrococcygeal region.

2.3 Interventions

The pain management physician performing the procedures has significant training and experience in nerve blocks. All participants in the study provided written informed consent. The CnB group participants underwent a diagnostic coccyx nerve block. The GIB group participants underwent a diagnostic ganglion impar block. The anesthetic and corticosteroid solution was injected in each of the groups to block the affected nerves. Participants of the study were monitored for a short time and given the same aftercare information.

2.4 Outcome measures

Pain was measured using a 0-10 Visual Analog Pain Scale. Functions disability was measured by the Oswestry Disability Index (Raw score 0-50). The lower the raw score the less the disability. The raw scores of the Quality of Life (QOL) were measured by the Short Form 36 Health Survey (SF-36). Each domain of the SF-36 is measured on a 0-100 scale, with 100 representing best health. QOL was measured at the baseline, at 4 weeks and at 12 weeks after the intervention.

2.5 Statistical analysis

Data were analyzed using SPSS. Continuous and categorical variables were summarized appropriately. Test of normality was performed using the Shapiro-Wilk test prior to any inferential test. Comparisons among groups were performed at the baseline and at the end of the 4th and 12th weeks. The test of within-group change over time was performed using repeated measures analysis of variance, and comparison of means was performed where applicable. Categorical variables at the baseline were compared using chi-square (or Fisher's exact) test. All the tests were two-tailed. The effects of repeated measures were reported using eta squared (η^2).

2.6 Ethical considerations

This study was conducted in accordance with the guidelines set by The Superior University. Informed written consent was obtained from all the participants. Before the consent, the participants were given a detailed information about the study, including the potential risks and benefits, and the confidential nature of the study, and their right to refrain from the study, or withdraw at any point of time without affecting the standard and usual care. Ethics approval number: [insert approval/reference number before journal submission].

3. Results

3.1 Baseline characteristics

The analysis includes all 44 participants. Each group consisted of 22 participants. Each group was balanced at the baseline for all variables including age, weight, height, BMI, symptom

duration, marital status, occupation, and history of trauma, VAS, ODI and all domains of SF-36. The equal groups at baseline suggests

that any differences observed between the groups later on in the study is most likely due to the effect of the treatment.

Table 1. Selected baseline demographic and clinical characteristics.

Variable	CnB (n=22)	GIB (n=22)	p-value
Age, years	50.23 ± 4.99	49.82 ± 4.98	0.787
Weight, kg	69.28 ± 10.13	69.39 ± 9.98	0.972
Height, cm	160.54 ± 5.16	160.43 ± 4.72	0.944
BMI, kg/m ²	26.99 ± 4.43	27.02 ± 4.15	0.981
Symptom duration, months	15.59 ± 5.04	15.95 ± 5.47	0.820
Baseline VAS	7.66 ± 1.00	7.73 ± 0.86	0.810
Baseline ODI	23.05 ± 3.72	23.00 ± 3.48	0.967

3.2 Pain outcome

Pain was reduced in both groups and met the objective of the study. CnB group patients had an average VAS at baseline of 7.66 which reduced to 4.66 and 4.25 at week 4 and week 12 respectively ($p < 0.001$). In the GIB group patients, the average baseline VAS was 7.73 which reduced to 3.02 and 2.50 at week 4 and week 12 respectively ($p < 0.001$). At week 4 and week 12, the GIB group patients had significantly more reduction in VAS compared to the CnB group patients ($p < 0.001$).

3.3 Functional disability

Both groups demonstrated significant functional improvement. ODI in the CnB group decreased from 23.05±3.72 at baseline to 14.77±3.91 at Week 4 and 13.41±4.12 at Week 12 ($F=263.06$, $p < 0.001$, partial $\eta^2=0.926$). In the GIB group, ODI decreased from 23.00±3.48 to 8.05±3.62 and 9.09±3.10 ($F=761.47$, $p < 0.001$, partial $\eta^2=0.973$). Between groups, disability was significantly lower following GIB at both Week 4 and Week 12 (both $p < 0.001$). Improvements for the GIB group between weeks 4 and 12 were not statistically significant, $p = 0.055$.

Table 2. Between-group comparison of pain and functional disability.

Outcome	Time	CnB Mean ± SD	GIB Mean ± SD	t (df=42)	p-value
VAS	Baseline	7.66 ± 1.00	7.73 ± 0.86	-0.242	0.810
VAS	Week 4	4.66 ± 1.18	3.02 ± 1.09	4.789	<0.001
VAS	Week 12	4.25 ± 1.21	2.50 ± 1.00	5.223	<0.001
ODI	Baseline	23.05 ± 3.72	23.00 ± 3.48	0.042	0.967
ODI	Week 4	14.77 ± 3.91	8.05 ± 3.62	5.919	<0.001
ODI	Week 12	13.41 ± 4.12	9.09 ± 3.10	3.925	<0.001

3.4 Health-related quality of life

Significant improvements were seen across all domains of the SF-36 in both groups at all time points ($p < 0.001$). At baseline, there was no difference between groups in any SF-36 domain. At Week 4, participants in the GIB group reported better Physical Functioning, Role Physical, Bodily Pain, General Health, Vitality, Social Functioning, Role Emotional, and Mental Health compared to the CnB

group ($p < 0.05$). These differences were also observed at Week 12. Throughout, the GIB group demonstrated large effect sizes for all domains of the SF-36 (partial $\eta^2 = 0.818$ to 0.982). The results of this study indicate the treatment improved the participants' quality of life and gave them a better sense of general and social well-being, which included emotional and mental health and function, and alleviated their physical pain.

Table 3. SF-36 domain scores across assessment points. All between-group comparisons were non-significant at baseline and significant at Weeks 4 and 12 (all $p < 0.05$).

SF-36 domain	Baseline CnB	Baseline GIB	Week 4 CnB	Week 4 GIB	Week 12 CnB	Week 12 GIB
Physical Functioning	57.73±15.25	56.59±14.99	69.77±16.58	80.45±12.72	73.64±15.29	83.86±11.01
Role Physical	35.23±25.19	35.23±25.19	59.09±29.42	78.41±19.36	61.36±28.58	81.82±19.18
Bodily Pain	37.73±10.20	36.36±10.82	53.41±10.16	65.68±12.08	57.73±10.66	70.91±12.11
General Health	52.73±12.22	53.64±13.20	60.91±14.53	73.64±14.07	64.55±14.38	77.73±13.78
Vitality	50.23±10.85	48.64±10.71	63.64±10.37	71.82±11.29	68.18±10.97	77.05±12.21
Social Functioning	51.14±13.86	49.43±15.18	67.05±16.16	77.84±16.78	68.75±15.79	81.25±16.70
Role Emotional	43.93±23.89	45.45±21.95	62.12±29.64	81.84±16.97	63.64±27.05	81.83±19.85
Mental Health	62.55±12.86	61.45±11.81	71.27±13.89	81.27±12.61	74.18±13.51	85.09±12.23

3.5 Hypothesis testing

Prior hypotheses indicated CnB and GIB would diminish pain and disability and improve quality of life, with CnB and GIB differences being significant. At baseline, the groups had equivalent conditions; however, differences between the groups at follow up were statistically significant for the VAS and ODI, and for all the SF-36 domain scores. Therefore, for the sample being studied, the alternative hypothesis was supported and the null hypothesis was refuted.

4. Discussion

This study examined the effects of CnB and GIB on women with chronic coccydynia, and for all three main study issues, indicated similar effects for both interventions, with improvements starting from baseline. Compared to CnB, GIB was more effective for reducing coccydynia-related pain and disability and improving all of the SF-36 domain scores. Prior to the intervention, the women in the study had similar symptoms for duration, and at baseline all measures of disability, health-related quality of life and coccydynia related pain. Thus, post-intervention differences in the women of the study were due to the effects of the interventions and no other factors.

The biggest comparative finding was in regard to pain. GIB and CN-B groups began with similar levels of pain. By Week 4, the mean pain score for GIB was 3.02 and for CN-B was 4.66. By Week 12, the mean pain scores for the groups were 2.50 and 4.25, respectively. In regard to pain, both groups, small (within-group), and large (between-group) effects were found. This supports that pain was reduced for both groups post intervention, however, more pain was reduced for the GIB group compared to the CN-B group. Research has shown that a GI blockade reduced pain in patients with chronic and refractory coccydynia (Choudhary et al., 2021; Gonnade et al., 2017; Jevotovsky et al., 2026). The Ganglion impar is innervated by the sympathetic system and receives nociceptive input from the perineum and coccyx. Thus, blockade of the Ganglion Impar may result in reduced perception of pain in areas above and beyond the Coccyx.

The following results should be reviewed in the context of the limitations in the studies. (Perdecioğlu et al., 2024) reported positive results following both CnB and GIB and found no supremacy of GIB at 4 or 12 weeks. The 12 week GIB group pain level was comparable to the 12 week GIB group in our study. It could be that different results are attributed to variances in techniques, type of anesthetic used

and powered by different sample sizes. The results of the studies suggest GIB is more effective compared to CnB in the case of refractory coccygodynia. However, in other cases, CnB may be more effective.

Functional disability improved in both the CnB and GIB groups, however the GIB group had less disability at both 4 and 12 weeks. The GIB group improved from a baseline of 23.00 to 8.05 at 4 weeks and to 9.09 at 12 weeks. Improvement within the GIB group occurred in the first 4 weeks and no improvement occurred after 4 weeks. It makes sense that in cases where pain is alleviated, function returns and further improves. Improvement in function also was reported in other studies. Improvement in function may be reported in a variety of ways and depending on the methodology of the study may not be comparable to other studies.

The results of the SF-36 strengthen the case that the improvement was not related to change in symptom level. At all-time points, both groups demonstrated improvement in all eight domains, with the GIB group scoring higher at the 4 and 12 week follow up evaluations. Compared to the scores of the CnB group, the GIB group scored higher in several domains including Physical Functioning (83.86 vs. 73.64) and Role-Physical (81.82 vs. 61.36) at Week 12. Other domains, including Bodily Pain and General Health, also showed improvement in the GIB group compared to the CnB group. Improvement in all domains suggest that the effects of satisfactory treatment of coccygodynia extends beyond the effects of reduced pain and/or discomfort.

The differences in quality of life were prominent and long lasting. A study conducted by (Sencan et al., 2022) reported that use of GIB over CESI led to short term improvement in quality of life; however, the authors used different questionnaires from the ones used in the present study. Based on the results, it is clear that improvements in quality of life extended to the eighth week in the GIB group. Additionally, within the GIB group, significant improvements in the domains of quality of life were observed and repeated at the time of each evaluation.

The results of the study are summarized and analyzed here. As expected, both treatments reduced pain, improved function, and increased quality of life. However, the larger effect sizes in all outcomes measured post-treatment, especially at the second post-treatment assessment, were in favor of the GIB group. Thus, the alternative hypothesis was supported. Improvement in a single outcome measure would have likely been the result of chance. Convergence of all outcome measures pre- and post-treatment, in all 3 measure instruments (Visual Analog Scale, Oswestry Disability Index, and Short Form Health Survey 36), supported the treatment effect and the alternative hypothesis.

There are several reasons for the alternative hypothesis being supported, including the mechanism of action of each treatment. Of note, the CnB treatment was expected to act more distally and therefore address pain of largely nociceptive origin from the coccyx. The GIB treatment was postulated to act more proximally, and therefore address both the nociceptive and sympathetic components of pain. It is postulated that in the presence of sympathetic amplitude, coccygeality may contribute to the chronic nature of the pain. Since not all patients were evaluated for the aforementioned, it is postulated that the GIB treatment may have been more effective.

There are several positive aspects to this study. It examined 3 different outcomes and assessed them at clinically relevant time points. The focus on females was a strength as females are reported to have coccydynia more often. There are a number of limitations. It was a single center study with a small sample size and only evaluated females. There was no blinding of participants or clinicians. Measures assessed (VAS, ODI and SF-36) are all self-reported. As such, there are numerous factors that could affect the outcomes of these measurements. Additionally, other factors such as the psychological status of the patient and other biomechanical factors were not assessed. Other factors such as the length of time a patient has had their coccydynia, the patient's body mass index, and other factors (i.e. history of trauma) should be evaluated in larger, multicenter studies.

Based on the results, both procedures are good options when more conservative methods of treatment have failed. GIB may be better in the short to medium term. CnB may still be an option if GIB is too difficult or inappropriate. When making a decision about which procedure to do, the pain level of the individual and which procedure the doctor is most comfortable doing are also things to consider. In some cases, a person may not want to do any procedure at all.

5. Conclusion

For women with chronic coccydynia, both ganglion impar block and coccygeal nerve block improved pain and function and increased quality of life. Blocks to the ganglion impar region, however, resulted in better scores on the SF-36, as well as lower values on the VAS and ODI. This supports the alternative hypothesis of the study, and indicates that blockade of the ganglion impar region was of greater benefit to the women in this study.

6. Limitations

The small sample size and single-center nature of the study restricts generalizability. Neither the participants nor the treating clinicians were blinded. Most of the outcomes were subjective, and several potential variables that could affect outcomes were not assessed. A 12 week period establishes very little regarding the duration of the effects of the procedure.

7. Clinical Implications and Future Research

Clinical and research initiatives should be directed at addressing the mentioned shortcomings of this and similar research studies. Objective function or biomechanical measures should be included in addition to traditional self-report outcomes. It is also necessary to evaluate if various possible contributing factors including trauma, psychosocial factors, neurological factors, and pain duration impact the benefit obtained from CNB versus GIB.

Declarations

Ethics approval and consent to participate: Written informed consent was obtained from participants. Ethical approval was obtained

from The Superior University. Approval number should be inserted before submission.

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