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Effectiveness of Ultrasound-Guided Tarsal Tunnel Block in Patients with Chronic Coccydynia: A Prospective Observational Study

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ABSTRACT

Introduction: Chronic coccydynia is a debilitating condition causing persistent coccygeal pain and functional impairment. Ultrasound-guided tarsal tunnel block targets nerve modulation to provide effective analgesia. This study evaluates its effectiveness in pain reduction, functional improvement, and patient outcomes, offering a minimally invasive alternative for managing refractory chronic coccygeal pain.

Aims: To evaluate the effectiveness of ultrasound-guided tarsal tunnel block in reducing pain and improving functional outcomes in patients with chronic coccydynia.

Materials and methods: Fifteen patients with chronic coccydynia refractory to conservative treatment underwent ultrasound guided posterior tibial nerve block at the tarsal tunnel using 2% lignocaine. Pain was assessed using the Visual Analog Scale (VAS) and disability using the Oswestry Disability Index (ODI)Assessments were performed at baseline and at 1, 3, and 6 weeks after intervention.

Result: Mean VAS improved from 8.93±0.88 to 5.2±1.14 at 6 weeks ($p<0.001$). Mean ODI improved from 23.13±3.93 to 15.53±1.68 ($p<0.001$).

Conclusion: Ultrasound guided tarsal tunnel block appears to be a safe and effective minimally invasive option for chronic coccydynia. Larger randomized studies are required to confirm these findings.

Keywords: *Coccydynia; Tarsal tunnel block; Posterior tibial nerve; Ultrasound-guided injection; Pain management.*

INTRODUCTION

Coccydynia, or coccygodynia, describes pain originating from the coccyx that is usually aggravated while sitting or when rising from a seated position. The coccyx represents the terminal segment of the vertebral column and is typically composed of three to five fused vertebrae forming a triangular structure. It serves as an attachment site for several ligaments and pelvic floor muscles that contribute to pelvic stability and weight bearing during sitting. [1,2]

Although coccydynia represents a relatively small proportion of spinal disorders, it may account for approximately 1–3% of low back pain cases and significantly affects quality of life in affected individuals. [3] The condition is reported to be three to five times more common in women than men, possibly due to anatomical differences in pelvic structure and the effects of childbirth on the coccyx. [4,5]

The etiology of coccydynia is multifactorial and includes trauma, repetitive microtrauma, degenerative changes of the sacrococcygeal joint, childbirth-related injury, and idiopathic causes. (6) Trauma remains the most frequently reported cause, often resulting from falls onto the buttocks or direct impact injuries. [7] Additional risk factors include obesity, rapid weight loss, abnormal coccygeal mobility, and degenerative joint disease. [8]

Clinical diagnosis is primarily based on history and physical examination, with patients typically presenting with localized tenderness over the coccyx and pain exacerbated by prolonged sitting. Radiological investigations such as dynamic radiographs or MRI may assist in identifying abnormal coccygeal mobility, fractures, or degenerative changes. [9]

Conservative treatment remains the first-line management for most patients and includes non-steroidal anti-inflammatory drugs, physiotherapy, ergonomic seating cushions, and pelvic floor rehabilitation. [10] Recent literature also highlights the role of extracorporeal shock wave therapy and manual therapy as effective non-invasive interventions in selected cases. [11]

When conservative measures fail, interventional pain management techniques such as ganglion impar block, sacrococcygeal joint injections, and radiofrequency ablation have demonstrated promising results in reducing chronic coccygeal pain. [12] In severe refractory cases, surgical removal of the coccyx (coccygectomy) may be considered, although the procedure carries potential complications and is typically reserved as a last resort. [13]

Peripheral nerve modulation techniques have recently gained attention as potential therapeutic approaches for chronic pain syndromes. The tarsal tunnel block, which targets the posterior tibial nerve, may modulate nociceptive pathways through sodium channel blockade and neuromodulation effects. [14] However, clinical evidence regarding its role in the management of chronic coccydynia remains limited.

Therefore, the present study aimed to evaluate the effectiveness of ultrasound-guided tarsal tunnel block in patients with chronic coccydynia, focusing on pain reduction, functional improvement, and quality-of-life outcomes.

MATERIALS AND METHODS

Study design: Prospective observational study.

Place of study: Swami Vivekanand National institute of Rehabilitation Training and Research, Odisha

Period of study: 12 months

Study Population: Study included patients with chronic coccydynia refractory to conservative treatment. All underwent ultrasound-guided tarsal tunnel block and were followed for 6 weeks to assess pain and functional improvement outcomes.

Sample size: 15 Patients

Inclusion Criteria:

- Patients diagnosed with chronic coccydynia (pain persisting >3 months) refractory to conservative treatment.
- Patients aged 18–65 years, of either gender, willing to undergo ultrasound-guided tarsal tunnel block.
- Patients who provide informed written consent and agree to regular follow-up.

Exclusion criteria:

- Patients with acute coccydynia, traumatic coccygeal fractures, or active infection at or near the injection site.
- Patients with coagulopathy, bleeding disorders, or on anticoagulant therapy contraindicating nerve block.
- Patients with prior coccygeal surgery, spinal malignancy, or systemic neurological disorders affecting pain perception.

Study Variable:

Primary Outcome Variable

- Pain relief assessed using Visual Analog Scale (VAS) score at baseline and post-procedure follow-up intervals.

Secondary Outcome Variables

- Functional improvement, including sitting tolerance and daily activity performance.
- Patient-reported outcome measures (overall satisfaction and quality of life improvement).

Procedure-Related Variables

- Onset of analgesia (time taken for pain relief after block).
- Duration of analgesia (how long pain relief persists).

- Need for repeat block or additional analgesics.

Safety Variables

- Incidence of procedure-related complications such as hematoma, infection, or nerve injury.

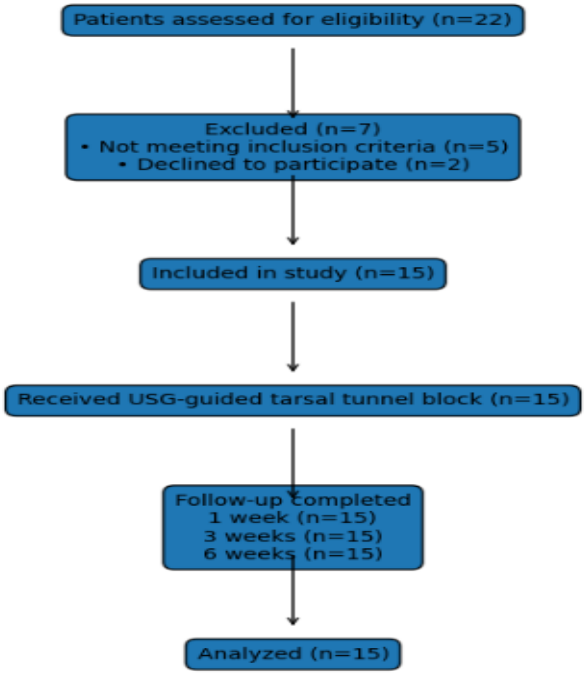
Image Gallery:

Figure 1: Ultrasound imaging being performed on a patient's lower limb for vascular or soft tissue assessment.

Figure 2: Ultrasound imaging being performed

on a USG guided 2% lignocaine in tarsal tunnel.

FLOW CHART



Study Procedure: Baseline investigations included complete blood count, ESR, CRP, random blood sugar, and pelvic radiographs. The posterior tibial nerve was identified in the tarsal tunnel using a highfrequency ultrasound linear probe placed posterior to the medial malleolus. Using an in-plane technique, a 25gauge needle was advanced under ultrasound guidance adjacent to the nerve and 2 mL of 2% lignocaine was injected under aseptic precautions. (Fig:1,2)Outcome measures included Visual Analog Scale (VAS) for pain and Oswestry Disability Index (ODI) for functional disability. Patients were assessed at baseline and at 1 week, 3 weeks, and 6 weeks after intervention. Statistical analysis was performed using paired Student's ttest and a p value <0.05 was considered statistically significant.

Statistical Analysis: For statistical analysis, data were initially entered into a Microsoft Excel spreadsheet and then analysed using SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Numerical variables were summarized using means and standard deviations, while Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

RESULTS

Table 1: Biosocial characteristics of study participants

Biosocial Parameters	**Particulars (n=15)**
Age (Mean ± SD) in Years	39.3 ± 9 years
Gender	
Female	14 (93.33%)
Male	1 (6.67%)
BMI Kg/m^2 (Mean ± SD)	25.53 ± 2.93 Kg/m^2
Profession	
1. Home Maker	7 (46.67%)
2. Semiskilled Worker	3 (20%)
3. Skilled worker	5 (33.33%)

Table 2: Comparison of VAS among preintervention phase with 1st, 3rd and 6th week

Intervals	**VAS Score (Mean ± SD) (n=15)**	**p-Value**
Comparison of VAS at Preintervention phase and 1st Week		
Preintervention phase	8.93 ± 0.88	< 0.001
1st Week	7.2 ± 0.94	
Comparison of VAS at the Preintervention phase and 3rd Week		
Preintervention phase	8.93 ± 0.88	< 0.001
3rd Week	5.7 ± 0.70	
Comparison of VAS at the Preintervention phase and 6th Week		
Preintervention phase	8.93 ± 0.88	< 0.001
6th Week	5.2 ± 1.14	

Table 3: Comparison of ODI among preintervention phase with 1st, 3rd and 6th week

Intervals	**ODI Score (Mean ± SD) (n=15)**	**p-Value$^{\$}$**
Comparison of ODI score at Preintervention phase and 1st Week		
Preintervention phase	23.13 ± 3.93	**< 0.001**
1st Week	18.86 ± 3.33	
Comparison of ODI Score at Preintervention phase and 3rd Week		
Preintervention phase	23.13 ± 3.93	**< 0.001**
3rd Week	16.06 ± 2.34	

Comparison of ODI score at Preintervention phase and 6th Week		
Preintervention phase	23.13 ± 3.93	**< 0.001**
6th Week	15.53 ± 1.68	

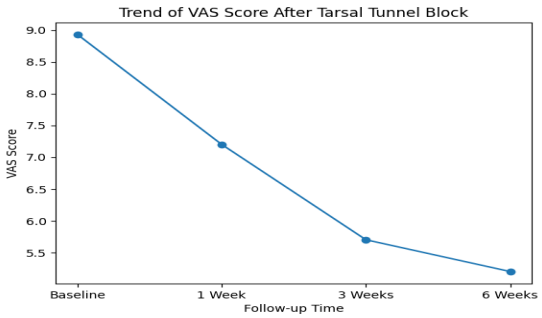


Figure:3

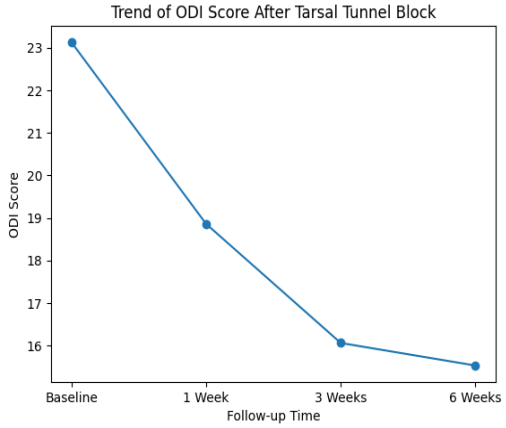


Figure: 4

Fifteen patients were included in the study. The mean age was 39.3±9 years and the majority were female (93.3%). The mean body mass index was 25.53±2.93 kg/m². (Table:1) The mean VAS score significantly decreased from 8.93±0.88 before intervention to 7.2±0.94 at 1 week, 5.7±0.70 at 3 weeks, and 5.2±1.14 at 6 weeks ($p<0.001$). (Table :2) (Fig:3) The ODI score improved from 23.13±3.93 before intervention to 18.86±3.33 at 1 week, 16.06±2.34 at 3 weeks, and 15.53±1.68 at 6 weeks ($p<0.001$). (Table:3) (Fig:4)..

DISCUSSION

The present study demonstrates that ultrasound-guided tarsal tunnel block may provide clinically significant pain relief and functional improvement in patients with chronic coccydynia. The demographic distribution observed in this study, with a predominance of female patients, is consistent with previously reported epidemiological trends showing that coccydynia occurs three to five times more frequently in women. Ryder I et al [4], Lirette LS et al [5]

The mean age of patients in this study was approximately 39 years, which aligns with previous studies reporting a peak incidence of coccydynia in middle-aged adults. Thiele GH.et al [6] In addition, elevated body mass index has been recognized as a significant risk factor due to increased mechanical stress on the coccyx during sitting. Patijn J et al [8]
Several treatment modalities have been described for chronic coccygeal pain. Conservative management remains effective in a majority of cases, with physiotherapy and ergonomic modifications showing significant benefits in reducing pain and improving function. Maigne JY, et al [10], Mohanty PP, et al [11] However, persistent symptoms are reported in a subset of patients who require interventional procedures.

Interventional approaches such as ganglion impar block and sacrococcygeal joint injections have demonstrated substantial improvement in pain scores in patients with refractory coccydynia. Datir A et al. [14] Extracorporeal shock wave therapy has also shown promising outcomes by promoting tissue healing and reducing inflammation in the affected region. Gönen Aydın C, et al [12], Lin SF, et al [13]

Surgical management through coccygectomy has been reported to provide long-term pain relief in approximately 80–85% of cases, although the procedure is associated with complications such as wound infection and delayed healing. Datir A et al. [14]

In the present study, ultrasound-guided tarsal tunnel block resulted in significant reductions in pain scores as measured by the VAS scale and improvements in functional disability measured by the ODI. The mechanism of action may involve blockade of voltage-gated sodium channels in peripheral nerves, thereby reducing ectopic neuronal activity and nociceptive transmission. Sagoo NS et al. [15]

Additionally, peripheral nerve blocks may exert neuromodulatory effects that influence central pain processing pathways, contributing to sustained analgesic benefits. This mechanism has been proposed in previous case reports demonstrating relief of coccygeal pain following tibial nerve blockade. Hammodi A.et al [16].

However, the study has several limitations. The sample size was relatively small, and the follow-up period was limited to six weeks. Furthermore, the absence of a control group limits the ability to draw definitive conclusions regarding the comparative effectiveness of the intervention.

Future randomized controlled trials with larger sample sizes and longer follow-up durations are required to establish the long-term efficacy and safety of ultrasound-guided tarsal tunnel block in patients with chronic coccydynia.

CONCLUSION:

Ultrasound-guided tarsal tunnel block appears to be a safe, minimally invasive, and potentially effective intervention for patients with chronic coccydynia who fail to respond to conservative management. The procedure resulted in significant improvements in pain, functional disability, and quality of life in the present study. Further large-scale randomized studies are necessary to confirm these findings and establish standardized treatment protocols.

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