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Differentiating Neuropathic and Inflammatory Heel Pain: Clinical Evaluation and Diagnostic Utility of the Sural Nerve Ankle Block

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ABSTRACT

Background: Heel pain is a prevalent issue with diverse aetiologies, including neuropathic and inflammatory causes, each requiring different therapeutic approaches. This study aims to differentiate between these types of heel pain using clinical evaluation and the sural nerve ankle block as a diagnostic tool.

Methods: This prospective analytical study was conducted in the Department of Orthopaedics at Krishna Institute of Medical Sciences, Karad, India, over an 18-month period. A total of 50 patients aged 18 years and above presenting with heel pain were included. After obtaining informed consent, patients underwent clinical assessment, including palpation, Windlass test, Gore's sign, and Visual Analogue Scale (VAS) scoring. A sural nerve block was administered to assess its diagnostic value, and VAS scores were recorded immediately and at various follow-up intervals.

Results: Neuropathic pain was characterized by burning sensations, persistence throughout the day, unilateral distribution, and positive Gore's sign, whereas inflammatory pain showed sharp morning pain, bilateral distribution, and positive Windlass test. Immediately post-block, neuropathic pain patients showed significant pain reduction, which persisted over time, while inflammatory pain patients exhibited minimal improvement. The sural nerve block proved effective in diagnosing neuropathic pain.

Conclusion: Clinical assessment combined with the sural nerve block can effectively distinguish neuropathic from inflammatory heel pain. Neuropathic pain patients experienced significant relief post-block, confirming its utility as both a diagnostic and therapeutic tool in neuropathic cases.

Keywords: Heel pain, Neuropathic pain, Inflammatory pain, Sural nerve block, Diagnostic tool

INTRODUCTION

Plantar heel pain is a common problem in the general population, with one in ten people experiencing inferior heel pain at some point in their life.[1] Heel pain has numerous causes, the most common being plantar fasciitis. This condition, affecting the hind foot, is often a diagnostic and therapeutic challenge for orthopedic doctors.[2] It is primarily an overuse injury leading to inflammation at the origin of the plantar fascia and surrounding structures, such as the calcaneal periosteum.[3] Plantar fasciitis is the most frequent cause of inferomedial heel pain in adults, and a study by Lapidus and Guidotti found that it was more prevalent than any other recorded foot lesion.[4]

Although often considered an overuse injury in athletes, especially runners, plantar fasciitis can also affect the general population. Factors such as aberrant foot biomechanics, improper footwear, and obesity are believed to contribute to its onset.[5] Foot over-pronation, in particular, increases tension on the plantar soft tissues, increasing the risk of injury.[6] The plantar fascia primarily supports the medial longitudinal arch during both static and dynamic loading and aids in midfoot stability, as well as dynamic shock absorption.[7] Due to its critical role in maintaining the arch and absorbing shock, the plantar fascia is susceptible to repetitive injury at its posterior insertion.[8] Plantar fasciitis is often associated with repetitive partial tearing of the enthesis, resulting in chronic inflammation and pain, particularly during the first step in the morning.[9] Continuous stress from weight-bearing activities disrupts the healing process, leading to degenerative changes.[10] Pathologically, this is characterized by tissue edema, thickening of the fascia, and eventually chronic degenerative changes.[11]

While most patients with plantar fasciitis have tightness in the Achilles tendon, the plantar fascia may also shorten due to pain, placing additional stress on the fascia during gait.[13] Most patients do not seek medical help immediately, often presenting after attempting home therapies for weeks or months.[14] Despite the unclear etiology of plantar fasciitis, the condition is self-limiting in most cases, with approximately 95% of patients experiencing symptom resolution within six to eighteen months.[15]

The aim of this study is to differentiate between neuropathic and inflammatory heel pain. The objectives are to evaluate clinical methods for differentiation and to assess the use of the sural nerve ankle block as a diagnostic tool.

MATERIALS AND METHODS

This hospital-based prospective analytical study was conducted over a period of 18 months, starting from December 2018, in the Department of Orthopaedics OPD, Krishna Institute of Medical Sciences University, Karad. The study was initiated following approval from the institutional ethical committee. All patients were provided with detailed information regarding the procedure, including potential risks and complications, and written informed consent was obtained prior to participation. The study aimed to differentiate between neuropathic and inflammatory heel pain using clinical methods and sural nerve ankle block as a diagnostic tool.

The sample size was calculated using the formula $n= 4pq/l^2$, with an allowable error of 5-10%, resulting in a sample size of 50 patients. The inclusion criteria encompassed patients aged 18 years and above of any gender, experiencing heel pain, and either newly diagnosed or already undergoing treatment for heel pain. Exclusion criteria included patients with a history of trauma or compression fractures of the calcaneum, those who had previously undergone surgery on the heel, or patients unwilling to participate.

Each patient underwent pre-anesthetic check-up, which involved a detailed history and a complete physical examination. The location and nature of the pain were documented using a semi-structured case record form. The heel was examined through palpation to identify areas of tenderness, and specific tests such as the Windlass test, Gore's sign, and the Visual Analogue Scale (VAS) for pain were employed. A xylocaine sensitivity test was performed before administering the sural nerve block. The block, performed with a 23-gauge needle using 2% xylocaine, was followed by repeated VAS assessments at 20 minutes post-block, and then at 1 week, 2nd week, and 3rd week after the procedure.

For the block, patients were placed in a supine position with the affected limb elevated. The sural nerve block was administered after sterile preparation of the ankle region,

with the needle inserted lateral to the Achilles tendon and posteromedial to the lateral malleolus. Local anesthetic spread was monitored, and adjustments were made to ensure effective nerve blocking.

Data collected during the study were entered into Microsoft Excel and analyzed using frequency tables, graphs, and various statistical methods. Measures of central tendency such as mean, median, and mode were calculated, along with standard deviations to assess data dispersion. Associations between parameters were analyzed using the Chi-square test, with statistical significance set at a p-value of less than 0.05. Ethical considerations were carefully observed throughout the study, ensuring patient confidentiality and safety.

RESULTS

Table 1 presents the socio-demographic characteristics of patients with neuropathic pain and inflammatory pain. The mean age for neuropathic pain patients is 54.2 years, while inflammatory pain patients have a slightly higher mean age of 56.3 years, with no statistically significant difference (p=0.716). Both groups have a similar gender distribution, with a higher proportion of females (55.6% in neuropathic and 61.3% in inflammatory pain). Occupations vary across groups, with a larger percentage of farmers and housewives in both, though differences are not statistically significant.

Table 2 compares the nature and timing of pain between neuropathic and inflammatory pain groups. Neuropathic pain patients more commonly report burning or tingling (55.6%), while all inflammatory pain cases experience sharp or stabbing pain (p<0.001). Neuropathic pain tends to persist throughout the day (77.8%), whereas inflammatory pain is often worse in the morning (90.3%, p<0.001). Additionally, neuropathic pain tends to last longer per day compared to inflammatory pain, which typically subsides within 3 hours (p=0.002).

Table 1: Comparison of socio-demographic profile of both the groups

Study variables	Neuropathic Pain (%) (n=9)	Inflammatory Pain (%) (n=31)	P value
Age (mean ±SD) (years)	54.2 ±12.4	56.3 ± 15.8	0.716
Sex			
Male	4 (44.4)	12 (38.7)	0.757
Female	5 (55.6)	19 (61.3)	
Occupation			
Farmer	4 (44.4)	11 (35.5)	0.6773
Housewife	3 (33.3)	16 (51.6)	
Clerical Work	1 (11.1)	3 (9.7)	
Business	1 (11.1)	1 (3.2)	

Table 2: Comparison of presentation of pain in both the study groups

Study variables	Neuropathic Pain (%) (n=9)	Inflammatory Pain (%) (n=31)	P value
History of type of Pain			
Sharp /stabbing	2 (22.2)	31 (100)	<0.001
Burning/tingling	5 (55.6)	0 (0)	
Sharp and burning/tingling	2 (22.2)	0 (0)	
Time of day pain is worst			
Persistent throughout the day	7 (77.8)	3 (9.7)	<0.001
Morning	0 (0)	28 (90.3)	
Evening	2 (22.2)	0 (0)	
Duration of pain in a single day			
3 hours or less	1 (11.1)	21 (67.7)	0.002
3-6 hours	3 (33.3)	7 (22.6)	
6-9 hours	5 (55.6)	2 (6.5)	
>9 hours	0 (0)	1 (3.2)	
Co-morbidities			
Diabetes	2 (22.2)	3 (9.7)	0.202
Hypertension	2 (22.2)	4 (12.9)	0.311
Other chronic condition	1 (11.1)	2 (6.5)	0.436
No co-morbidities	4 (44.4)	22 (71)	Ref

Table 3: Comparison of clinical features of pain in both the study groups

Study variables	Neuropathic Pain (%) (n=9)	Inflammatory Pain (%) (n=31)	P value
Side of heel pain			
Right only	5 (55.6)	4 (12.9)	0.002
Left only	4 (44.4)	6 (19.4)	
Bilateral	0 (0)	19 (61.3)	
Location of tenderness at heel and foot			
Plantar only	0 (0)	22 (71)	<0.001
Medial only	2 (22.2)	1 (3.2)	
Lateral only	2 (22.2)	0 (0)	
Plantar + Medial	3 (33.3)	8 (25.8)	
Plantar + Lateral	2 (22.2)	0 (0)	
Gore's sign			
Positive	9 (100)	0 (0)	<0.001
Negative	0 (0)	31 (77.5)	
Windlass test			
Positive	0 (0)	31 (100)	-
Negative	9 (100)	0 (0)	

Table 4: Cases according to findings of Pain Severity pre and immediate post block

Pain Severity based on VAS Score	Follow up after block									
	Neuropathic Pain Cases					Inflammatory Pain Cases				
	Pre	Immediate Post	Post 1 week	Post 2 weeks	Post 3 weeks	Pre	Immediate Post	Post 1 week	Post 2 weeks	Post 3 weeks
No pain (0)	0(0)	0(0)	3(33.3)	4(44.4)	8(88.9)	0(0)	0(0)	0(0)	0(0)	0(0)
Mild Pain (<4)	0(0)	5(55.6)	5(55.6)	5(55.6)	1(11.1)	1(3.2)	2(6.5)	2(6.5)	2(6.5)	2(6.5)
Moderate Pain (4-6)	2(22.2)	4(44.4)	1(11.1)	0(0)	0(0)	11(35.5)	10(32.3)	11(35.5)	10(32.3)	11(35.5)
Severe Pain (≥7)	7(77.8)	0(0)	0(0)	0(0)	0(0)	19(61.3)	19(61.3)	18(58.1)	19(61.3)	19(61.3)

Table 3 outlines the clinical characteristics of heel pain in neuropathic versus inflammatory pain groups. Neuropathic pain patients more frequently experience unilateral pain (55.6% right-sided), whereas inflammatory pain patients tend to have bilateral symptoms (61.3%, p=0.002). Tenderness varies, with inflammatory pain affecting the plantar region (71%), while neuropathic pain involves different areas. All neuropathic cases show a positive Gore's sign, while inflammatory cases test positive for the Windlass test (p<0.001).

Table 4 details changes in pain severity based on VAS scores at different follow-ups. Initially, severe pain (≥7) is predominant in both groups but is significantly reduced immediately post-block for neuropathic pain cases, with 55.6% experiencing mild pain. By the third week, 88.9% of neuropathic pain cases report no pain, whereas inflammatory pain cases maintain higher pain levels, with 61.3% still in the severe category. This suggests a marked improvement in neuropathic pain severity post-block compared to inflammatory pain.

DISCUSSION

Heel pain is a prevalent foot condition with varied names like plantar fasciitis and jogger's heel, often resulting from mechanical factors. Common causes include plantar fasciitis, heel spurs, and Achilles tendinopathy, primarily diagnosed through clinical examination, where pain location and absence of systemic symptoms indicate the cause. Treatment ranges from rest, physical therapy, and orthotics to anti-inflammatories, with surgery as a last resort. This study differentiates between neuropathic and inflammatory heel pain.

Age and Gender Distribution: The study found an average age of 54.2 years in neuropathic heel pain cases and 56.3 years in inflammatory cases, with no statistically significant difference (p >0.05). Heel pain, common among seniors over 65, affects daily activities and increases fall risk [16, 17, 18, 19, 20, 21, 22]. In this study, 60% of cases were female, without significant gender differences in heel pain [23, 24, 25].

Occupation-Based Distribution: Housewives (47.5%) and farmers (37.5%) comprised the majority of cases, with no significant occupational variation between pain types (p

>0.05). Jobs involving prolonged standing, physical strain, or heavy lifting elevate heel pain risk, along with obesity and pregnancy stress [26, 27, 28].

Types of Heel Pain: Most cases (82.5%) had sharp pain; inflammatory cases showed sharp pain, while over half of neuropathic cases exhibited burning pain ($p < 0.01$). Plantar fasciitis is the leading heel pain cause, affecting 10% of the population [29, 30, 31]. Neuropathic heel pain, often unilateral, may stem from nerve entrapment or neuroma [32, 33].

Time of Day and Pain Duration: Morning pain was prevalent in inflammatory cases (90%), while neuropathic cases mostly reported persistent pain (77.8%) ($p < 0.01$). Inflammatory cases typically experienced pain for less than 3 hours, whereas neuropathic cases felt it for 6-9 hours daily [34].

Comorbidities: About 12.5% of cases had diabetes, 15% hypertension, and 7.5% other conditions, with no significant differences between pain types. Obesity, tight Achilles tendons, and foot structure abnormalities (pes cavus, pes planus) are linked to plantar fasciitis [35, 36].

Heel Pain Side and Tenderness Location: In 67.5% of cases, pain was bilateral, more common in inflammatory cases (61.3%), while neuropathic pain was strictly unilateral ($p < 0.01$). Tenderness was typically on the plantar side, primarily in inflammatory cases (71%), with medial or lateral pain more frequent in neuropathic cases [37, 38, 39].

Diagnostic Signs: In neuropathic cases, Gore's sign was positive (100%), but negative in all inflammatory cases ($p < 0.01$) [40]. The Windlass test was positive in 90.3% of inflammatory cases, indicating plantar fascia strain, and negative in 88.9% of neuropathic cases ($p < 0.01$) [37].

Nerve Block and Pain Relief: All cases received sural nerve blocks. Neuropathic pain cases had significant immediate and sustained pain reduction post-block, while inflammatory cases showed no notable change. Sural nerve block, though understudied, is effective for neuropathic pain but requires careful dosing to avoid complications [41, 42].

This concise assessment highlights key differences in age, type, duration, and distribution of heel pain, as well as effectiveness of targeted treatments like nerve blocks for neuropathic cases.

CONCLUSION

This study demonstrates that neuropathic and inflammatory heel pain can be effectively differentiated through clinical signs and the use of the sural nerve ankle block as a diagnostic tool. Neuropathic heel pain is characterized by burning sensations, persistence throughout the day, and unilateral distribution, whereas inflammatory heel pain often presents with sharp pain, primarily in the morning, and affects both feet. The sural nerve block provided immediate and sustained pain relief for neuropathic cases but did not significantly alter pain in inflammatory cases, underscoring its value in both diagnosing and managing neuropathic heel pain. This study was the first of its kind and has not been done before and also as the sample size and the number of cases done in this study were less, it's inconclusive that Sural nerve block can definitely be used to differentiate between Neuropathic and Inflammatory heel pain as that requires a study of larger sample size with more patients willing to undergo the procedure.

Approval of Institutional Ethical Review Board: The study protocol was approved by the Institutional Ethical Committee of Krishna Institute of Medical Sciences University, Karad.

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Manuscript preparation was performed by DT, with critical revisions provided by KT. All authors reviewed and approved the final version of the manuscript.

Availability of Data: The data supporting this study's findings are available from the corresponding author upon reasonable request. Data are restricted to protect participant privacy and are not publicly available.

No Use of Generative AI Tools: This study was conducted and the manuscript was prepared without the use of generative AI tools.

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