

Asymptomatic Anterior Tarsal Tunnel Syndrome: An Underdiagnosed Entity

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Abstract

BACKGROUND/AIMS: Anterior tarsal tunnel syndrome (ATTS) is an uncommon entrapment neuropathy of the deep peroneal nerve that is frequently overlooked in clinical practice. Prayer-related and ground-sitting postures, which are culturally common in Türkiye, may predispose individuals to this condition. This study aims to evaluate the prevalence, clinical characteristics, and electrophysiological features of asymptomatic ATTS identified incidentally during routine electromyography (EMG) examinations.

MATERIALS AND METHODS: The records of 3,610 patients who underwent electrophysiological evaluation between January 2025 and February 2026 were retrospectively reviewed. Patients with electrophysiological evidence of distal deep peroneal nerve involvement without ATTS-related symptoms were included. L5 radiculopathy, proximal peroneal neuropathy, and polyneuropathy with motor fiber involvement were excluded.

RESULTS: Asymptomatic ATTS was identified in 21 patients (0.58%). The mean age was 56.1 ± 11.9 years; 11 were female and 10 were male. All patients reported prolonged plantar-flexion postures, mainly prayer-related sitting habits (namaz), with a mean duration of 15 years. Ten patients had diabetes mellitus. On the affected side, mean extensor digitorum brevis (EDB) distal motor latency was 5.19 ± 1.57 ms and mean compound muscle action potential amplitude was 1.04 ± 0.52 mV, compared to 4.47 ± 0.8 ms and 3.08 ± 1.52 mV on the contralateral side. Tibialis anterior (TA) motor responses were normal bilaterally. Needle EMG demonstrated neurogenic changes confined to the EDB muscle in all patients.

CONCLUSION: Asymptomatic ATTS may be encountered more frequently in EMG practice than is generally appreciated. Prayer-related and ground-sitting postures may predispose individuals to ATTS. Systematic electrophysiological evaluation, including TA recording and needle EMG, may reduce misdiagnosis of polyneuropathy or lumbosacral radiculopathy in daily practice.

Keywords: Anterior tarsal tunnel syndrome, deep peroneal nerve, electromyography, entrapment neuropathy, prayer posture

INTRODUCTION

Anterior tarsal tunnel syndrome (ATTS) is an uncommon and often underdiagnosed entrapment neuropathy of the deep peroneal nerve at the ankle level. The anterior tarsal tunnel is a flattened fibro-osseous space located between the tendons of the extensor hallucis longus and extensor digitorum longus muscles, bounded superficially by the inferior

extensor retinaculum and deeply by the fascia overlying the talus and navicular bones.^{1,2} The tunnel is narrow proximally and widens distally; its contents include the deep peroneal nerve and the dorsalis pedis artery, both of which are relatively unprotected given the superficial location of this space. Within or just distal to the tunnel, the deep peroneal nerve divides into two terminal branches: the lateral branch, which provides motor innervation to the extensor digitorum brevis (EDB) muscle, and

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the medial branch, which supplies sensation to the first interdigital web space.¹ Compression of the deep peroneal nerve within this tunnel results in ATTS, which is typically associated with dorsal foot pain, paresthesia in the first interdigital web space, and, in some cases, weakness or atrophy of the EDB muscle.^{3,4}

ATTS varies widely in clinical severity and does not always present with all typical findings. Symptoms may be mild or non-specific, and nerve involvement can remain entirely asymptomatic in some patients, making the diagnosis easy to overlook.^{5,6} In these cases, electrophysiological studies, particularly those evaluating the distal deep peroneal nerve, can play a key role in detecting this abnormality. Nevertheless, asymptomatic or subclinical presentations of ATTS are rarely reported, and the condition is mostly discussed in symptomatic patients in the literature.⁷⁻¹¹

In our clinical practice, we observed that ATTS may be encountered more frequently than expected, which may be related to cultural habits such as sitting on the floor and postures adopted during prayer (namaz), both of which involve sustained ankle stretching. Notably, these patients did not report symptoms suggestive of ATTS. Based on this observation, the present study aims to evaluate patients in whom electrophysiological findings consistent with ATTS were incidentally identified during routine electromyography (EMG) examinations. We aimed to examine their clinical and electrophysiological characteristics in detail and to explore potential etiological factors, including daily habits and related risk factors.

MATERIALS AND METHODS

Study Design

The records of 3,610 patients who underwent electrophysiological evaluation at the electroneuromyography (ENMG) laboratory at University of Health Sciences Türkiye, Başakşehir Çam and Sakura City Hospital between January 2025 and February 2026 were retrospectively reviewed. All studies were performed by a clinical neurophysiologist. Patients referred for various clinical indications were screened, and those without symptoms suggestive of ATTS but with electrophysiological evidence of distal deep peroneal nerve involvement were included in the study. Asymptomatic ATTS was defined as electrophysiological evidence of distal deep peroneal nerve entrapment in the absence of ATTS-related symptoms.

Patients were included if they were 18 years of age or older; had abnormal compound muscle action potential (CMAP) recordings from the EDB muscle with normal CMAP recordings from the tibialis anterior (TA) muscle; had neurogenic changes on concentric needle EMG confined to the EDB; had normal contralateral peroneal nerve CMAP recordings from both the EDB and TA muscles; and had no ATTS-related clinical complaints.

Patients were excluded if they were younger than 18 years of age, had clinical or electrophysiological evidence of L5 radiculopathy, proximal peroneal neuropathy, or polyneuropathy involving motor fibers, had a history of ankle trauma or surgery, presented with ATTS-related symptoms, or had incomplete electrophysiological data.

Electrophysiological Studies

During the electrophysiologic studies, skin temperature was maintained above 32 °C. Nerve conduction studies (NCS) were performed using

standard techniques with surface electrodes. Bandpass filters were set at 3 Hz-10 kHz for motor conduction studies and at 20 Hz-3 kHz for sensory conduction studies. Sweep speeds were set at 5 ms/division and 2 ms/division for motor and sensory conduction studies, respectively. Sensitivity settings of 10-20 µV/division and 5 mV/division were used for sensory and motor studies, respectively.

Bilateral sural sensory NCS were performed in all patients. In patients where technically feasible, bilateral deep peroneal sensory NCS were performed using the antidromic method, with recording electrodes placed over the first interdigital space, as previously described.^{12,13} For deep peroneal sensory NCS, the normative values reported by Lee et al.¹² were used [onset latency: 2.9 ± 0.4 ms and sensory nerve action potential (SNAP) amplitude: 3.4 ± 1.2 µV]. Motor NCS included peroneal nerve recordings from the EDB and TA muscles and tibial nerve recordings from the abductor hallucis muscle. Normative reference values for peroneal motor NCS recorded from the EDB and TA muscles, as well as for all other routine motor and sensory NCS, were based on the reference values described by Preston and Shapiro,¹⁴ which are routinely used in our electrophysiology laboratory. For peroneal motor recordings, the upper limits of normal distal motor latency (DML) were 6.5 ms for the EDB and 6.7 ms for the TA; the lower limits of normal CMAP amplitude were 2.0 mV for the EDB and 3.0 mV for the TA. All findings were interpreted in comparison with the contralateral side. Needle EMG was performed on all patients, including routine examination of the EDB and TA muscles on the affected side. Additional muscles were examined when clinically indicated.

Demographic and Clinical Data

In all patients diagnosed with asymptomatic ATTS, demographic and clinical data were collected, including age, sex, and history of chronic diseases. Potential risk factors were systematically assessed, with particular attention to daily habits that may lead to sustained compression of, or repetitive microtrauma to the extensor retinaculum at the ankle. Specifically, sitting habits involving prolonged ankle flexion, postures adopted during Islamic prayer (namaz), and the durations of these habits were recorded. Occupational characteristics were also documented. These factors were assessed to explore their potential contribution to the development of distal deep peroneal nerve entrapment. In addition to postural habits, potential risk factors that may predispose to nerve compression, including diabetes mellitus, vasculitis, and other relevant comorbidities and their duration were recorded for each patient.

Ethical Approval

Ethical approval was obtained from the University of Health Sciences Türkiye, Başakşehir Çam and Sakura City Hospital Clinical Research Ethical Committee (approval number: 237, date: 22.04.2026). Patient consent was not obtained because the study was retrospective. The Declaration of Helsinki and good clinical practice procedures were followed in the study.

Statistical Analysis

Descriptive statistics were used to analyze the data. Continuous variables were expressed as mean $\pm$ standard deviation or median values, depending on data distribution, while categorical variables were presented as frequencies and percentages.

RESULTS

Asymptomatic ATTS was identified in 21 of 3,610 patients (0.58%). The demographic characteristics and risk factors of all patients are summarized in Table 1. Eleven patients were female and 10 were male, and the mean age was 56.1 ± 11.9 years (range 27-77 years). Fifteen patients had right-sided ATTS involvement, and six had left-sided ATTS involvement. None of the patients reported symptoms consistent with ATTS despite the presence of clear electrophysiological abnormalities. All patients reported postural habits involving prolonged plantar flexion of the ankle, including prayer-related sitting positions in 18 patients, a combination of prayer-related postures and general sitting habits in two patients, and occupational exposure (tailoring and regular pedal use) in one patient. The mean duration of these habits was 15 years (range: 8-30 years). Additionally, 10 patients had a history of diabetes mellitus.

Electrophysiological evaluation revealed notably differences between the affected and unaffected sides, as detailed in Table 2. In three patients, no motor response could be obtained from peroneal nerve stimulation recorded from the EDB muscle; however, normal responses were obtained from the contralateral side (mean DML: 4.2 ms; mean CMAP: 3.9 mV). Peroneal nerve motor responses recorded from the TA muscle were normal on both the affected and contralateral sides (DMLs 2.85 ms and 3.5 ms, and CMAP amplitudes 4.2 mV and 4.3 mV, respectively). In the remaining 18 patients in whom an EDB-recorded response was obtainable at the ATTS side, the mean DML on the affected side was 5.19 ± 1.57 ms with a mean CMAP amplitude of 1.04 ± 0.52 mV, compared to a mean DML of 4.47 ± 0.8 ms and a mean amplitude of 3.08 ± 1.52 mV on the contralateral side, respectively. TA-recorded motor responses showed no side-to-side difference: on the affected side, mean DML was 3.1 ± 0.5 ms with a mean amplitude of 4.08 ± 2 mV, while on the contralateral side mean DML was 2.9 ± 0.5 ms and mean amplitude was 4.2 ± 1.7 mV (Table 2).

Deep peroneal sensory nerve conduction was assessed in 11 patients, of whom eight had bilaterally absent sensory responses. Among the remaining three patients, two had no response on the affected side, while normal responses were recorded on the contralateral side. In one patient, a reduced SNAP amplitude was noted on the affected side ($4 \mu\text{V}$, latency: 2.8 ms) compared with the contralateral side ($10 \mu\text{V}$, latency: 2.4 ms) (Table 2).

Needle EMG of the EDB muscle demonstrated neurogenic changes in all patients. Rare denervation potentials were observed in the EDB muscle in one patient. During mild voluntary contraction, chronic neurogenic

changes in the EDB muscle were graded as moderate-to-severe in 15 patients and as mild in six patients.

DISCUSSION

In this study, we present a series of patients who had electrophysiological findings consistent with ATTS despite the absence of ATTS-related clinical symptoms. While ATTS is generally described as a symptomatic condition characterized by dorsal foot pain and sensory changes in the first web space, our results support the presence of a subclinical or asymptomatic form that may be more common than previously recognized. The prevalence observed in our study (0.58%) is comparable to that reported by Logullo et al.,⁵ who identified ATTS in 85 of 19,582 patients (0.43%) examined over a ten-year period in a clinical neurophysiology laboratory. In their series, the majority of patients were asymptomatic or had only mild, non-specific complaints, such as a dull ache on the dorsum of the foot. These findings suggest that asymptomatic ATTS may be regularly encountered in ENMG practice when specifically sought,

Table 2. Electrophysiological findings of patients with asymptomatic anterior tarsal tunnel syndrome

Parameter	Affected side	Contralateral side
Motor nerve conduction studies-peroneal nerve		
NR on EDB at affected side (n=3, 15%)		
EDB recording		
DML, ms	NR	4.2
CMAP amplitude, mV	NR	3.9
TA recording		
DML, ms	2.85	3.5
CMAP amplitude, mV	4.2	4.3
EDB response present at affected side (n=18, 85%)		
EDB recording		
DML, mean ± SD, ms	5.19±1.57	4.47±0.80
CMAP amplitude, mean ± SD, mV	1.04±0.52	3.08±1.52
TA recording		
DML, mean ± SD, ms	3.1±0.5	2.9±0.5
CMAP amplitude, mean ± SD, mV	4.08±2.0	4.2±1.7
Sensory nerve conduction studies-deep peroneal nerve		
Patients assessed	n=11	
No response bilaterally	n=8 (72.7%)	
NR affected/normal contralateral (n=2)	NR	1. patient: 9.9 μV/2.71 ms 2. patient: 7.5 μV/3.02 ms
SNAP amplitude/onset latency at affected & contralateral (n=1)	4 μV/2.8 ms	10 μV/2.4 ms
Needle EMG-EDB muscle (n=21)		
Spontaneous denervation potentials	1 (4.8%)	
Neurogenic changes	n=21 (100%)	
Moderate-to-severe	15 (71.4%)	
Mild	6 (28.6%)	
Values are mean ± SD unless otherwise stated. DML: Distal motor latency, CMAP: Compound muscle action potential, SNAP: Sensory nerve action potential, EDB: Extensor digitorum brevis, TA: Tibialis anterior, NR: No response, NCS: Nerve conduction study, EMG: Electromyography, SD: Standard deviation.		

Table 1. Demographic characteristics and risk factors of patients with asymptomatic anterior tarsal tunnel syndrome

Demographics	
Age, mean $\pm$ SD (range), years	56.1 ± 11.9 (27-77)
Sex, female/male	11/10
Side affected, right/left	15/6
Diabetes mellitus, n (%)	10 (47.6%)
Postural risk factors	
Prayer-related sitting only, n (%)	18 (85.7%)
Prayer-related + general sitting, n (%)	2 (9.5%)
Occupational exposure, n (%)	1 (4.8%)
Duration of postural habits, mean (range), years	15 (8-30)
SD: Standard deviation.	

and that its real frequency may be underestimated due to a lack of awareness. However, both studies were conducted in EMG laboratory settings, and the figures obtained therefore reflect referral-based populations rather than the true prevalence in the general population.

Entrapment neuropathies are generally considered clinical disorders, with electrodiagnostic studies serving as complementary tools to confirm the diagnosis, localize the lesion, assess its severity, and exclude alternative diagnoses.^{15,16} Accordingly, electrodiagnostic evaluation has become an integral component in the assessment of suspected entrapment neuropathies, particularly when the clinical presentation is atypical or the diagnosis is uncertain. Nevertheless, our findings suggest that ATTS may also exist in a subclinical form, in which characteristic electrophysiological abnormalities are present despite the absence of typical symptoms. In such cases, electrodiagnostic studies may identify distal deep peroneal nerve entrapment before overt clinical manifestations appear.

The most notable finding in our cohort was the strong association between asymptomatic ATTS and postures involving chronic stretching and compression of the deep peroneal nerve. Eighteen patients had prayer-related sitting habits (namaz), two had both prayer and general ground-sitting habits, and one had occupational exposure involving regular pedal use and tailoring. The mean duration of these habits was 15 years. Previous studies from Türkiye have also linked ATTS to prayer-related and ground-sitting postures.^{8,17} Chronic stretching of the deep peroneal nerve during kneeling and prolonged sitting positions in namaz, together with body weight-related compression at the anterior tarsal tunnel, have been proposed as the underlying mechanism.⁸ Sociocultural sitting habits and repetitive mechanical exposure may, therefore, play an important role in the development of ATTS. Our series is the largest prayer-related ATTS cohort reported to date, and the first to demonstrate this association exclusively in asymptomatic individuals. Beyond prayer-related posture, deep peroneal nerve compression has also been reported in other repetitive occupational and mechanical settings, including toddy tappers in South India and dancers wearing tight footwear, suggesting that diverse cultural and occupational exposures may converge on a shared compressive mechanism at the anterior tarsal tunnel.^{6,18}

The conventional Islamic prayer sitting posture is characterized by the left foot positioned beneath the body in plantar flexion and the right foot upright with the toes flexed and the ankle in slight dorsiflexion. In this position, the right foot appears to be subjected to greater mechanical stress, which is consistent with the predominance of right-sided involvement observed in our cohort (71%). However, when patients were asked to describe their habitual sitting posture during prayer, considerable individual variation was observed. These variations may also explain the occurrence of left-sided involvement in some patients. Indeed, previous reports have described right-sided, left-sided, as well as bilateral ATTS.^{8,17} In addition, patients with habitual floor-sitting practices reported adopting sitting positions in which the right knee was flexed and the right foot was positioned beneath the contralateral leg with the ankle in dorsiflexion, potentially placing greater mechanical stress on the right foot and the anterior tarsal tunnel. Our observations suggest that individual variations in prayer and floor-sitting positions may generate varying degrees and distributions of mechanical stress on the deep peroneal nerve and further contribute to the observed predominance of right-sided involvement among patients in our cohort.

The anterior tarsal tunnel is a narrow anatomical region where the deep peroneal nerve is particularly susceptible to external pressure.^{1,2} In our cohort, all patients reported long-standing postural habits characterized by ankle plantar flexion. Repetitive stretching and compression of the nerve during these postures may contribute to gradual nerve injury. Unlike acute compression injuries, chronic low-grade mechanical stress may develop slowly and remain clinically silent for years. This may explain why clear electrophysiological abnormalities were detected despite the absence of symptoms in our patients. Similar mechanisms have been suggested in previous reports of postural and occupational forms of ATTS.^{6,19} Although this remains speculative, all patients in our cohort reported similar long-standing postural habits, which suggests that chronic mechanical stress may contribute to asymptomatic involvement of the distal deep peroneal nerve.

The absence of symptoms despite clear electrophysiological abnormalities may partly reflect the limited functional role of the EDB muscle, whose function is largely compensated for by the extensor digitorum longus and extensor hallucis longus.^{3,6} Additionally, ten of our patients had diabetes mellitus, a condition known to increase susceptibility to entrapment neuropathies through axonal vulnerability and impaired nerve repair mechanisms. While diabetes alone was not sufficient to cause symptoms in our cohort, its coexistence with chronic postural compression may lower the threshold for nerve injury and contribute to more severe electrophysiological findings.

The electrophysiological findings were consistent across all patients. On the affected side, peroneal motor responses recorded from the EDB showed prolonged distal latency and reduced amplitude, while contralateral EDB responses were normal. In three patients, no response was obtained from the affected side. TA motor responses were normal and bilaterally symmetric in all patients. Needle EMG demonstrated chronic neurogenic changes confined to the EDB muscle, with normal findings in all other examined muscles, thereby excluding lumbosacral radiculopathy and polyneuropathy, and confirming a focal axonal lesion at the anterior tarsal tunnel. This distribution also argued against age-related EDB atrophy or technical artifact as alternative explanations.^{3,5} Sensory deep peroneal nerve conduction was evaluated in only 11 patients because of the well-known technical challenges in recording sensory responses from this nerve, particularly in older individuals. In this context, motor conduction studies provide more reliable and consistent results in the diagnosis of ATTS. Among the 11 patients studied, responses were absent bilaterally in 8, absent on the affected side only in 2, and reduced in amplitude in 1. The asymmetric findings observed in three patients provided additional support for a focal lesion at the anterior tarsal tunnel.³

ATTS is frequently underdiagnosed in routine ENMG practice, as isolated EDB abnormalities may be attributed to polyneuropathy, lumbosacral radiculopathy, or age-related changes.¹⁹ In this context, a clinically important diagnostic pitfall was previously raised by Al-Hashel et al.²⁰ in response to McNeish et al.,²¹ who proposed that a fibular motor CMAP amplitude below 3.6 mV recorded from the EDB may predict L5 radiculopathy in patients with radiating limb pain. Al-Hashel et al.²⁰ pointed out that this threshold may be misleading in Middle Eastern and Asian populations, where habitual floor-sitting and kneeling during Islamic prayer involve sustained plantar flexion of the ankle, potentially compressing the EDB muscle and the lateral branch of the deep peroneal nerve.²² Similarly, Kishimoto et al.²² reported that bilateral EDB atrophy is significantly associated with distal symmetric polyneuropathy in

Japanese men, but only after excluding individuals with a seiza habit (the traditional Japanese style of kneeling and sitting over one's heels) as this posture independently causes EDB atrophy through a mechanism similar to ATTS. Our findings are consistent with these observations. All 21 patients in our cohort had EDB CMAP amplitudes below 3.6 mV, yet none had evidence of L5 radiculopathy or polyneuropathy. Therefore, in populations where prayer-related or traditional floor-sitting postures are common, isolated EDB abnormalities should be interpreted with caution, and focal entrapment at the anterior tarsal tunnel should be considered. Systematic TA recording, needle EMG evaluation, and, when available, deep peroneal sensory nerve studies may help improve diagnostic accuracy and prevent misattribution of low EDB CMAP amplitudes to proximal lesions.^{5,6}

Additionally, one patient reported long-term tailoring work requiring repetitive use of a sewing machine pedal. Although tailoring has not been specifically reported as a risk factor for ATTS, repetitive ankle movements and chronic microtrauma associated with pedal use may contribute to deep peroneal nerve compression, consistent with the proposed pathophysiology of ATTS.²³

Study Limitations

This study has several limitations. First, its retrospective design may have introduced selection bias and limited the availability of clinical data. Second, because the cohort was derived from an EMG laboratory population, the reported prevalence reflects a referral-based setting and may not represent the general population. Third, deep peroneal sensory NCS could only be performed in a subset of patients, primarily because of technical difficulties in older patients, which may have led to under-recognition of sensory involvement. Fourth, imaging studies were not routinely available; therefore, structural causes of nerve compression such as osteophytes, ganglia, or soft tissue lesions could not be completely excluded. Finally, no longitudinal follow-up was performed, and the long-term clinical course of asymptomatic ATTS remains uncertain.

CONCLUSION

Asymptomatic ATTS may be encountered more frequently in EMG practice than is generally expected. In societies where prayer-related and ground-sitting postures are culturally common, these habits represent important risk factors for ATTS. Routine inquiry into such postural habits, combined with bilateral systematic electrophysiological evaluation, including TA recordings, needle EMG, and deep peroneal sensory nerve studies, where feasible, may improve diagnostic accuracy and reduce the risk of misdiagnosis of polyneuropathy or lumbosacral radiculopathy.

MAIN POINTS

- Asymptomatic anterior tarsal tunnel syndrome is more common than previously recognized, with a prevalence of 0.58% in an electromyography laboratory setting.
- Prayer-related and ground-sitting postures are the most frequent identifiable risk factors.
- Electrophysiological abnormalities were confined to the extensor digitorum brevis (EDB) muscle, confirming a focal lesion at the anterior tarsal tunnel.

- Low EDB compound muscle action potential amplitudes in populations with habitual floor-sitting should not be misattributed to L5 radiculopathy or polyneuropathy.
- Systematic electrophysiological evaluation and routine inquiry into postural habits may reduce misdiagnosis in daily practice.

ETHICS

Ethics Committee Approval: Ethical approval was obtained from the University of Health Sciences Türkiye, Başakşehir Çam and Sakura City Hospital Clinical Research Ethical Committee (approval number: 237, date: 22.04.2026).

Informed Consent: Patient consent was not obtained because the study was retrospective.

Footnotes

Authorship Contributions

Surgical and Medical Practices: F.A.-İ., B.S.Ö., Concept: F.A.-İ., Design: F.A.-İ., B.S.Ö., Data Collection and/or Processing: F.A.-İ., B.S.Ö., Analysis and/or Interpretation: F.A.-İ., B.S.Ö., Literature Search: B.S.Ö., Writing: F.A.-İ.

DISCLOSURES

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