ORIGINAL ARTICLE

Posterior Ankle Impingement Syndrome in Non-athletic Population: Causes, Treatment

Modalities and the Results of Endoscopic Treatment

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Background: One of the common causes of posterior ankle pain is posterior ankle impingement syndrome (PAIS). Many studies about PAIS have been conducted on special groups such as athletes, dancers, and football players, whereas there has been no previous study of a non-athletic population. This study aimed to evaluate the causes and treatment methods of this syndrome in the non-athletic population and compare it with the athletic population.
Methods: A retrospective review was done and 28 of 46 patients (60.9%) recovered from two-staged conservative therapy. 18 of 46 patients (39.1%) who did not benefit from conservative treatment for three months, hindfoot endoscopy was applied. Patient data, including sex, age, occupation, and sports activity level, were recorded. The Visual Analog Scale (VAS), American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot score, and Tegner score were recorded. Patient satisfaction was assessed with a 4-point Likert scale. All complications were recorded.

Results: The mean follow-up period was 27.4 months. At the final follow-up examination, the AOFAS hindfoot score had significantly improved from 66.4 to 96.8 (p<0.001). The Tegner activity score improved significantly from 4.6 to 8.8 (p<0.001). The VAS score was 6.4 and increased to 0.9 (p<0.001). Using the 4-point Likert Scale for patient satisfaction, 13 (72.2%) stated that the surgical procedure was excellent, and 4 (27.8%) stated it as good. The mean time to return to work was 4.2 weeks. As complications, only sural nerve dysesthesia was seen in 2 patients (11.1%).

Conclusions: This study can be considered of value as the first study to have evaluated PAIS in the non-athletic population. Conservative treatment showed good results as nearly two-thirds of the patients recovered. Hindfoot endoscopy applied to cases not responding to conservative therapy is a successful treatment with low complication rates.
One of the common causes of posterior ankle pain is posterior ankle impingement syndrome (PAIS). This syndrome can occur due to chronic or acute causes. Overuse injuries where repetitive plantar flexion is performed, such as in ballet dancers and runners, are the most common cause of chronic injuries, whereas acute injuries are usually the result of twisting and excessive plantar flexion, often seen in soccer players. Many studies about PAIS have been conducted on special groups such as athletes, dancers, and football players. To the best of our knowledge, there has been no previous study of a non-athletic population, although PAIS is not rare in this group. Trigonal prominence of the talus or os trigonum alone is not usually the cause of posterior ankle pain. A traumatic condition such as forced supination, a pressing action forcing the ankle into flexion beyond anatomic limits, or a rising motion by pressing down on the toes can cause posterior ankle pain. In the non-athletic population, depressing the clutch or other pedals while driving or pressing down on the toes movement to reach something at a height while cleaning or picking something up are standard movement patterns in daily life. Therefore, PAIS syndrome is not only associated with sports injuries with exaggerated plantar flexion but can also be seen in the non-athletic population.

The aim of this study was to evaluate the causes and treatment methods of this syndrome in the non-athletic population and to report the results of hindfoot endoscopy in this group of patients resistant to conservative treatment. A secondary aim was to compare the response to conservative and surgical therapies in the non-athletic population with the responses reported
in previous studies of athletes and other sports groups. It was hypothesized that conservative treatment would have a high success rate in this patient group with posterior ankle impingement and that hindfoot endoscopy would be associated with good outcomes, increased patient satisfaction, and low complication rates in the patient group resistant to conservative treatment methods.

METHODS

This study was approved by the Institutional Review Board (ID: 2020-20/18). We obtained Informed consent for participating in the current study from each participant. The authors received no financial support for the research.

A retrospective review was made of the data of patients who presented at our center with posterior ankle pain between June 2015 and September 2018. A total of 64 patients were identified with a diagnosis of PAIS, and the follow-up period of at least two years were enrolled in this study. Of these 64 patients, 18 were excluded from the study as they participated in amateur or professional sports (football, basketball, volleyball, dancer, athlete). Thus, 46 patients who were not engaged in any sports activities and reported increased pain in activities related to work or daily life were evaluated in the study. The occupations of these patients are shown in Table 1. The demographic data of these non-athletic patients are shown in Table 2.
All patients had a history of posterior ankle and hindfoot pain. The physical examination showed pain localized to the posterior aspect of the ankle on palpation, which was aggravated by forced plantar flexion. All of the patients had pain with the posterior impingement test of the ankle. Standard plain X-rays and magnetic resonance imaging (MRI) were the imaging methods used. The os trigonum, prominence of posterior talar process, bone marrow edema, loose body, ganglion cyst, and FHL tendinopathy were assessed on MRI and lateral radiographs (Figure 1). Lateral radiographs taken with the ankle in plantar flexion showed osseous impingement of the posterior ankle (Figure 2).

First, all patients were treated conservatively in the same protocol. Initial treatment was rest, cold pack application, non-steroidal anti-inflammatory drugs (NSAIDs), orthotics, and stretching exercises. After six weeks, the patients were called for examination, and the patients who failed with this therapy, corticosteroid injection was applied, and physical therapy was administered for six weeks. The decision for surgical treatment was made for patients whose complaints did not recover despite this treatment. Of the 46 patients, 16 (34.8%) recovered with the initial treatment, but 30 (65.2%) did not. A good response was obtained with corticosteroid injection and physical therapy in 12 (26%) patients, and for the 18 patients (39.1%) who did not benefit from this two-staged conservative treatment for three months, the decision was taken for surgical treatment (Figure 3). The applied surgical treatment was hindfoot endoscopy. All the surgical procedures were performed by the two senior authors.
The patients applied with hindfoot endoscopy comprised 11 (61.1%) males and 7 (38.9%) females. The diagnoses of these patients were calcaneal trigonum in 9 cases, prominent posterior talar process in 5, FHL tenosynovitis in 2, retrocalcaneal bursitis in 1, and loose body in 1 (Table 2).

Patient data, including sex, age, occupation, and sports activity level, were recorded. The Visual Analog Scale (VAS), American Orthopaedic Foot and Ankle Society (AOFAS) hindfoot score, and Tegner score were recorded preoperatively and postoperatively. Surgery-related patient satisfaction was assessed with a 4-point Likert scale. They were asked to evaluate their satisfaction with this process as 4- excellent, 3- good, 2- fair, 1- poor. All complications were recorded.

All analyses were performed on SPSS v21 (SPSS Inc., Chicago, IL, USA). For the normality check, the Shapiro-Wilk test was used. The variables did not conform to the normal distribution. Non-normally distributed variables were analyzed with the Wilcoxon Signed Ranks test for repeated measurements. The mean, minimum, maximum, percentage, and standard deviation (SD) values were used to describe data. A value of p< 0.001 was accepted as statistically significant.

Surgical technique

The procedure was performed under general or regional anesthesia, depending on the patient’s medical condition, with the patient positioned prone and tourniquet use. After anatomic landmarks were identified, the portals were marked, and a posterolateral portal was placed just lateral to, and a posteromedial portal was placed just medial to the Achilles tendon at the level...
of the tip of the fibula (Figure 4). Blunt dissection was applied, then a 5-mm arthroscopic camera and arthroscopic instruments were placed through these portals. Working space was created with a shaver taking care to direct the arthroscopic instruments, especially the shaver, to the lateral side of the FHL to avoid injury to the medial vascular and nerve structures. Fatty tissue around the FHL tendon was dissected, and the tendon was identified precisely by moving the hallux to plantar and dorsiflexion. Resection of the os trigonum or prominent posterior talar process, debridement of hypertrophic and sclerotic soft tissues, removal of the hypertrophic posterior joint capsule, examination of the posterior tibiotalar and subtalar joints, and release of the FHL tendon were the typical steps of the procedure (Figure 5). Dynamic evaluation by moving ankle to plantar and dorsiflexion allowed the surgeon to evaluate the total resolution of the impinged bony and soft tissues.

Postoperative treatment

A soft compression bandage was applied after surgery to keep the edema under control, and the bandage was removed in the 2nd week. All of the patients were discharged on the day after surgery. Partial weight-bearing was encouraged as tolerated, with ROM exercises started just after surgery, and full weight-bearing was allowed in the 2nd week. All the patients began to receive physiotherapy in the 3rd postoperative week for proprioception and strengthening exercises. Patients were allowed to return to work when they felt ready to start. Enoxaparin
was prescribed on discharge to be used for at least three weeks to prevent deep venous thromboembolism. For pain management, only NSAIDs and paracetamol were used, with no patient requiring opioids. Antibiotics were administered only as a single preoperative dose (intravenous cefazolin, 1 gr) and were not used postoperatively.

RESULTS

Hindfoot endoscopy was applied to 18 patients with a mean age of 35.8 years and a mean BMI of 29.03. The most common causes of the impingement in these patients were os trigonum (50%) and prominent posterior talar process (28%) (Table 2).

The mean follow-up period was 27.4 months (range, 24 - 36.6 months), and no patients were lost to follow-up. At the final follow-up examination, the AOFAS hindfoot score had significantly improved from 66.4 ± 5.8 preoperatively to 96.8 ± 3.2 postoperatively (p<0.001). The Tegner activity score improved significantly from 4.6 ± 1.2 preoperatively to 8.8 ± 1.8 postoperatively (p<0.001). The VAS score was 6.4 ± 1.3 preoperatively and increased to 0.9 ± 1.1 postoperatively, and it was significantly different (p<0.001) (Table 3). Using the 4-point Likert Scale for patient satisfaction, 13 (72.2%) stated that the surgical procedure was 4- excellent, and 4 (27.8%) stated it as 3- good. None of the patients rated the procedure as fair or poor.

When patients were asked for their opinions about the surgery, they all stated that they would accept the operation again.
The mean time to return to work was 4.2 weeks (range, 2.6 – 12.4 weeks). All of the patients stated that they had reached their preoperative activity level. As complications, only sural nerve dysesthesia was seen in 2 patients (11.1%), and this resolved totally within six months in both cases. No infection, neurovascular damage, deep vein thrombosis, or any other complication was observed in any patient.

DISCUSSION

Since previous studies have been performed on dancers, footballers, or athletes, this suggests that this condition is seen only in those who are engaged in intense sports activity, whereas this discomfort may be a situation that is seen in the non-athletic population and creates restrictions in daily life and work activities. This study can be considered important because it is the only study to have evaluated the effects of posterior impingement of the ankle in the non-athletic population.

When the occupational distribution of patients was examined, drivers were the most common occupational group (26.1%). Musculoskeletal disorders are known to be the primary health problem in professional drivers. Repetitive movements while driving, such as plantar or dorsiflexion, may be associated with a high incidence of musculoskeletal disorders in the leg. Especially in heavy traffic or on a long journey, these straining movements of the ankle can result in pain. When the current study patients were questioned, 9 of the 18 patients (50%)
who underwent surgery were working as drivers, and 4 (22%) of the remaining 9 patients were driving a minimum of 2 hours a day commuting. This high rate of drivers in this patient group presented at the clinic with posterior ankle pain and who then underwent surgery suggested that PAIS might be an occupational disease for drivers. This issue could be a topic of further research. When the patients working as drivers were questioned, manual transmission (5 of 9 patients) and pedal resistance (3 of 9 patients) were the two most common complaints about their posterior ankle pain. In the manual transmission group, the left ankle was affected in all patients due to the use of the clutch, while the right ankle was affected in all patients in the pedal resistance group. Only one patient reported driving a vehicle that was both automatic and with soft pedals. That patient considered the stop-and-go movements because of heavy traffic to be the cause of pain in the right ankle.

Since van Dijk\textsuperscript{9} introduced the posterior two-portal hindfoot endoscopy technique to treat posterior ankle impingement, this has been preferred more than the open technique because of its advantages over the open approach. As stated in the review performed by Zwiers et al., although the outcomes of both open and closed procedures are good, because of the shorter recovery time and lower complication rates, the endoscopic technique was considered superior to the open technique\textsuperscript{10}. 
Good clinical results of two-portal hindfoot endoscopy for posterior ankle impingement syndrome have been reported in many studies\textsuperscript{1,4,11,12}. As stated above, most of those studies were performed on athletes. In a study by Lopez Vallerio et al., 20 professional soccer league players were treated with hindfoot endoscopy for posterior ankle impingement syndrome due to os trigonum, and the results of the treatment were reported to be excellent. The minimum follow-up period was two years, and the meantime until return to the previous level of sports was 46.9 days, with no severe complications observed\textsuperscript{4}. In another study by Carreira et al., 20 patients with posterior ankle impingement with or without accompanying flexor hallucis tenosynovitis treated with posterior ankle arthroscopy, 19 were competitive athletes. The minimum follow-up period was 12 months. AOFAS and VAS scores were significantly improved after surgical treatment, and restoration of anatomic ROM of the ankle was achieved after surgery. All the patients returned to their pre-surgery activity level during the follow-up period, and only 15\% of the patients reported postoperative neuritis, which resolved totally within six months\textsuperscript{13}. Willits et al. reported the results of 15 hindfoot impingement patients who participated in different sports activities and were treated with posterior ankle arthroscopy. The mean follow-up period was 32 months (range, 6 – 74 months), the postoperative mean AOFAS score was 91, and the Lower Extremity Functional Score (LEFS) was 75. Complications were documented as numbness in the scar region and temporary ankle stiffness, and no neurovascular complications were reported. It was concluded that posterior ankle arthroscopy
is an effective procedure with low complication rates and high patient satisfaction. In another large series of patients by Scholten et al., improvement in the AOFAS score was reported as from 75 to 90, and the complication of sensory loss was reported in only 1 of 55 patients. The AOFAS, VAS, and Tegner activity scores were significantly improved in the current study, consistent with the findings of the studies mentioned above.

Although the efficacy of conservative treatment of PAIS has not been well documented in the literature, it can also be considered an effective treatment method. In the current study, two-staged conservative therapy was used. The first step consisted of rest-NSAID-cold application and stretching exercises. The second step consisted of injections (steroid and local anesthetics) and physical therapy. A total of 28 of 46 patients (60.9%) recovered with this two-staged conservative treatment. Messiou et al. presented the results of ultrasound-guided steroid injection therapy in patients with subacute posteromedial impingement of the ankle. It was reported that 8 of 9 elite athletes treated with this therapy did not experience any recurrence or residual symptoms. In another retrospective study that analyzed the data of 10 professional soccer players detected with posterior ankle impingement findings on MRI, who were then treated with ultrasound-guided injection, it was reported that 8 of 10 players did not experience any recurrent or residual symptoms, whereas two did have symptoms during the follow-up period (6-42 months, median 26 months). Only one of these ten players underwent endoscopic resection of the os trigonum and synovitis. Kudas et al. also stated that 26 elite
soccer players diagnosed with PAIS treated conservatively, including physical therapy modalities and ultrasound-guided steroid injections, 18 (69.2%) were treated successfully with this treatment only eight patients underwent posterior ankle arthroscopy\textsuperscript{3}. The conservative treatment results in the current study were similar to those of other studies in the literature conducted on professional athletes. This indicates that the success rates of conservative treatment are similar in the non-athletic population and elite athletes and that the results of this therapy are successful in both.

The medial neurovascular bundle in the posteromedial portal and the sural nerve in the posterolateral portal are the main structures at risk during hindfoot endoscopy\textsuperscript{17}. In a cadaveric study, it was found that the posteromedial portal was an average of 6.4 mm from the tibial nerve and the posterolateral portal was an average of 3.2 mm from the sural nerve\textsuperscript{18}. In the literature, reported rates of complications are low, even though neurovascular structures are at risk. In a systematic review, Donnenwerth et al. stated that complications of the hindfoot endoscopy procedure were observed in 17 (3.8%) of 452 patients, and 8 of these complications were neurovascular\textsuperscript{19}. Smyth et al. reviewed seven studies of hindfoot endoscopy case series and reported a total of 24 complications (6.2%) in 385 patients\textsuperscript{17}. Nickisch et al. also reported a complication rate of 8.5%, of which 44% were neurological. In a recent study, Ling et al. concluded that after a median of 4.8 years of follow-up of 52 patients who underwent hindfoot endoscopic excision of bony lesions causing posterior impingement of the ankle, no infection or
other major complications were detected\textsuperscript{20}. Compared to open procedures, the reported complication rates are lower in endoscopic procedures, such as the 24% complication rates reported by Abramowitz et al. in a study on open surgical resection of os trigonum \textsuperscript{21}. Two minor and temporary complications were seen in the current study, and no major or permanent complication was determined. This was consistent with the low complication rates reported in the literature.

There were some limitations to this study, primarily the small patient group and retrospective design. Further prospective studies with larger groups of patients and longer follow-up periods could make more definitive statements. Another limitation was patient selection. The main selection criteria were that the patient would be in the non-athletic population and not engaged in sports, but occupational homogeneity of the patient group could not be achieved. The largest occupational group of patients were working as drivers, and most of these underwent surgery.

CONCLUSION

This study can be considered of value as the first study to have evaluated PAIS in the non-athletic population who were not engaged in sports either as a professional or amateur. As previous studies have been performed on athletes, there has been an incorrect implication that
PAIS is a syndrome only seen in athletes, soccer players, or ballet dancers, whereas this painful condition also concerns the non-athletic population.

Another important point of the study is that the results are reported of conservative treatment, one of the most important and successful treatment methods for PAIS. Conservative treatment showed good results as nearly two-thirds of the patients recovered with these non-surgical treatment modalities. Moreover, the success rates of conservative therapy are similar in athletes and non-athletes. In conclusion, hindfoot endoscopy applied to cases not responding to other treatments is a successful treatment with low complication rates.

Financial Disclosure: None reported.

Conflict of Interest: None reported.

REFERENCES


doi:10.1016/j.aott.2016.03.008

doi:10.1177/1071100714552078


doi:10.1093/ije/17.2.255


This Original Article has been reviewed, accepted for publication, and approved by the author. It has not been copyedited, proofread, or typeset and is not a final version.

Table-1. Occupational classification of the patients included in the study who were not engaged in any sports

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Number of patients</th>
<th>% Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver</td>
<td>12</td>
<td>(26.1%)</td>
</tr>
<tr>
<td>Housewife</td>
<td>7</td>
<td>(15.2%)</td>
</tr>
<tr>
<td>Security guard</td>
<td>6</td>
<td>(13%)</td>
</tr>
<tr>
<td>Factory worker</td>
<td>6</td>
<td>(13%)</td>
</tr>
<tr>
<td>Policeman</td>
<td>3</td>
<td>(6.5%)</td>
</tr>
<tr>
<td>Mechanic</td>
<td>3</td>
<td>(6.5%)</td>
</tr>
<tr>
<td>Waiter/ Waitress</td>
<td>2</td>
<td>(4.3%)</td>
</tr>
<tr>
<td>Salesperson</td>
<td>2</td>
<td>(4.3%)</td>
</tr>
<tr>
<td>Gardener</td>
<td>2</td>
<td>(4.3%)</td>
</tr>
<tr>
<td>Nurse</td>
<td>1</td>
<td>(2.2%)</td>
</tr>
<tr>
<td>Bank worker</td>
<td>1</td>
<td>(2.2%)</td>
</tr>
<tr>
<td>Airline cabin crew</td>
<td>1</td>
<td>(2.2%)</td>
</tr>
</tbody>
</table>

Table-2. Demographic data of the non-athletic patients and the diagnoses of the operated patients

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>28 (60.9%)</td>
<td>18 (39.1%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>35.2 (22-49)</td>
<td>36.8 (24-50)</td>
</tr>
<tr>
<td>BMI</td>
<td>28.6 (22.6-32.4)</td>
<td>29.7 (23.5-33)</td>
</tr>
</tbody>
</table>

Diagnoses of operated patients (n:18)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Male (n)</th>
<th>% Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Os trigonum</td>
<td>5</td>
<td>(27.8%)</td>
</tr>
<tr>
<td>Posterior talar process</td>
<td>3</td>
<td>(16.7%)</td>
</tr>
<tr>
<td>FHL tenosynovitis</td>
<td>1</td>
<td>(5.6%)</td>
</tr>
<tr>
<td>Retrocalcaneal bursitis</td>
<td>1</td>
<td>(5.6%)</td>
</tr>
<tr>
<td>Loose body</td>
<td>1</td>
<td>(5.6%)</td>
</tr>
</tbody>
</table>
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Table-3: Preoperative and postoperative outcome measure scores of the patients who undergone surgery.

<table>
<thead>
<tr>
<th></th>
<th>Preoperative Score</th>
<th>Postoperative Score</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>Range</td>
<td></td>
</tr>
<tr>
<td>VAS Score</td>
<td>6.4 ± 1.3</td>
<td>(3-9)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>AOFAS</td>
<td>66.4 ± 5.8</td>
<td>(50-78)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Tegner</td>
<td>4.6 ± 1.2</td>
<td>(3-8)</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

Abbreviations: AOFAS, American Orthopaedic Foot & Ankle Society; VAS, visual analog scale; SD, Standard Deviation
Figure 1. Sagittal T2-weighted (1A) and sagittal T1-weighted (1B) images of os trigonum.

The cyst formation on the talar side of the os trigonum and posterior side of the talus can be seen. Fluid surrounding the os trigonum was clearly seen.
Figure 2. Lateral radiographs with ankle plantar flexed. (2A) Before and (2B) After endoscopic removal of os trigonum.
Figure 3. Flow chart of patient response to treatment. Abbreviations: PAIS, Posterior ankle impingement syndrome; NSAIDs, non-steroidal anti-inflammatory drugs.

64 patients presented with PAIS

Excluded: Patients engaged in sports (n=18 patients)

Conservative treatment
1st step: Rest-NSAIDs-ice application-stretching exercises (n=46 patients)

Excluded: Benefitted from 1st step conservative treatment (n=16 patients)

Conservative treatment
2nd step: Corticosteroid injection, physical therapy (n=30 patients)

Excluded: Benefitted from 2nd step conservative treatment (n=12 patients)

Surgery
Hindfoot Endoscopy (n=18 patients)
**Figure 4.** The portals of hindfoot endoscopy. While the patient was positioned prone, the anatomic landmarks such as borders of the Achilles tendon, tips of the fibula, and medial malleoli were marked. The portals were placed just medial and lateral to the Achilles tendon.