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ORIGINAL ARTICLE

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Posterior ankle impingement syndrome in athletes: surgical outcomes of a case series

Impacto posterior do tornozelo em atletas: resultados do tratamento cirúrgico em uma série de casos

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ABSTRACT

Objective: This study sought to evaluate the results of 10 athletes diagnosed with posterior ankle impingement syndrome (PAIS) treated with arthroscopy between 2016 and 2017 by the Sports Traumatology Center of our University.

Methods: Patients were evaluated with regard to the presence of associated lesions, the etiology of PAIS, and treatment outcomes using a visual analog scale (VAS) and the American Foot and Ankle Society (AOFAS) scores. All cases were treated using an arthroscopic approach to the posterior ankle.

Results: Six patients presented with ankle instability and were treated with Brostrom-Gould ligament repair as an adjuvant procedure. One patient had sinus tarsi syndrome, and this space was debrided. Injury of the peroneus brevis tendon was identified in two cases, and Achilles tendinopathy was identified in one individual. Only three patients did not receive adjuvant treatment. During surgery, five cases of trigonal processes, three cases of Stieda process, one case of hallux saltans, and one case of accessory ossicle of the fibula were identified as the causes of the impingement. The mean VAS score was 1.28 (0.6-2.5), and the mean AOFAS score was 88.6 (72-100). No complications were reported.

Conclusion: Arthroscopic resection of the cause of the impingement, alone or in combination with the treatment of secondary conditions, was used to effectively treat pain and reestablish function.

Level of Evidence IV; Therapeutic Studies; Case series.

Keywords: Arthroscopy; Ankle; Athletic injuries; Ankle injuries.

RESUMO

Objetivo: Avaliar os resultados de 10 pacientes (atletas) com diagnóstico de impacto posterior do tornozelo tratados cirurgicamente por via artroscópica entre os anos de 2016 e 2017 pelo Centro de Traumatologia do Esporte da nossa Universidade.

Métodos: Os pacientes foram avaliados em relação à presença de lesões associadas, etiologia do impacto e resultados do tratamento pelo escore VAS e AOFAS. Todos os casos foram conduzidos através da abordagem artroscópica posterior do tornozelo.

Resultados: Seis indivíduos apresentavam instabilidade do tornozelo e foram manejados com ligamentopastia de Brostrom-Gould, conjuntamente. Um paciente apresentava síndrome do seio do tarso, sendo esse espaço também desbridado. A lesão do tendão fibular curto foi identificada em 2 casos e tendinopatia do Aquiles em 1 indivíduo. Apenas três casos não receberam procedimentos adjuvantes. Durante a cirurgia, foram identificados como causas do impacto posterior a presença de 5 processos trigonais, 3 processos de Stieda, 1 Hallux Saltans e 1 ossículo acessório da fíbula. O resultado para o VAS foi de 1.28 (0.6-2.5) pontos com um escore AOFAS médio de 88,6 (72-100) pontos. Nenhuma complicação foi relatada.

Work performed at the Universidade Federal de São Paulo, São Paulo, SP, Brazil.

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Conclusão: A ressecção artroscópica da causa do impacto, isoladamente ou em conjunto com o tratamento das condições adjuvantes, mostrou-se eficaz no tratamento da dor e no reestabelecimento da função desses pacientes.
Nível de Evidência IV; Estudos Terapêuticos; Série de casos.

Descritores: Artroscopia; Tornozelo; Traumatismos em atletas; Traumatismos do tornozelo.

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INTRODUCTION

Posterior ankle impingement syndrome (PAIS) is a generic term attributed to a series of etiologies that present with the common complaint of pain in the posterior region of the ankle. The presence of pain in this region is even more common among athletes, which can lead to a decrease in performance and long periods away from the sport. Several authors have drawn attention to this syndrome and how it has affected several types of athletes[1–3].

PAIS is a condition that is summarized as a group of pathological changes that result from foot exposure to constant flexion or local recurrent trauma[3]. Several anatomical changes can cause PAIS, especially the occurrence of bony prominences, anomalous muscles, and ligament hypertrophies[2–5].

For example, bone changes include the *os trigonum* and Stieda process, both originating from the accessory ossicle posterior to the talus[2,3], as well as the fragmentation of the lateral tubule of the talus and local pseudarthrosis, which can irritate the posterior ankle when present. In particular, it can lead to the compression of the soft tissues adjacent to the distal tibia and the calcaneus during ankle flexion[3,6]. It can also rub against the flexor hallucis longus muscle and other local ligaments[7].

Low implantation of the flexor hallucis longus muscle in patients who place high demands on or experience hypertrophy of this muscle is also a cause of impingement[3,5,8]. In addition, the presence of *os trigonum* or the Stieda process can exacerbate the pain in patients who require greater movement, especially dancers[5,9]. These conditions can also lead to the hallux saltans condition (Figure 1), which consists of pain and triggering when the flexor hallucis longus muscle passes through the tarsal tunnel[3,9].

The hypertrophy of the intermalleolar ligament, the posterior portion of the deltoid ligament, and the posterior subtalar ligaments are also painful sites in this region. These changes can occur after episodes of ankle trauma and persist for long periods until an appropriate diagnosis[1–3]. It is not uncommon for patients with the syndrome to have a history of ankle and subtalar sprains, and a large proportion presents with mechanical instability of these joints. Sequelae of fractures in this region can also cause local symptomatic impingement[1,2,7,8].

The conservative treatment of this condition is based on analgesia, muscle balance, and the prevention of situations that favor the collision and friction of the involved structures[1,2]. In the case that conservative treatment fails, a surgical approach is indicated in the literature[2,3]. The arthroscopic approach of these lesions has proven to be a viable option, with low invasiveness and long-lasting effects. A return to sports is usually quick, with full symptom resolution[1,2].

The aim of the present study was to evaluate the results of the arthroscopic treatment of PAIS among athletes undergoing surgery at a reference center.

METHODS

This study was approved by the Research Ethics Committee with registration in the Brazil Platform under CAAE number: 01505118.2.0000.5505. This retrospective,

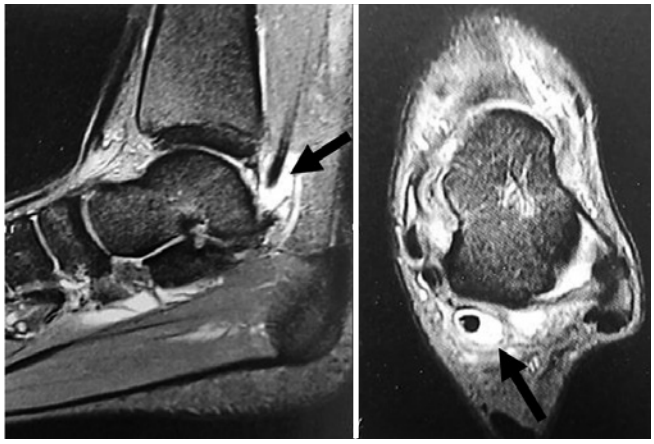

Figure 1. A 24-year-old female dancer diagnosed with hallux saltans; the flexor hallucis longus muscle synovitis on magnetic resonance imaging (arrows)
Source: Author's personal archive.

observational, descriptive, case-series study did not have a control group.

Patients who received surgery via an arthroscopic approach to the posterior ankle between January 2016 and December 2017 were included; these patients were diagnosed and treated at our institution. Only athletes with at least 30 days of pain symptoms in the posterior region of the ankle and an imaging diagnosis of PAIS were included in this study. These patients underwent the described procedure, postoperative periodical follow-up assessment, and agreed to participate in the study (Table 1). All patients diagnosed with PAIS who underwent the procedure but who were not actively practicing a sport, even if they were symptomatic, were excluded from the sample. After diagnosis, conservative treatment was initiated with analgesic and nonsteroidal anti-inflammatory drugs as well as physical therapy for pain targeting the posterior region of the ankle. In the absence of improvement or symptom worsening after 1 month, surgery was indicated and scheduled. Local infiltration with corticosteroids was not performed for any patient.

The patients were evaluated with regard to their practiced sport, the etiology of their posterior ankle pain, the presence of associated injuries, pain according to a visual analog scale (VAS)[13], function according to the American Foot and Ankle Society Score (AOFAS)[14], and the presence of postoperative complications.

Surgical technique

Patients underwent surgery using the same technique as described by van Djick in 2006[11]. Individuals were positioned in ventral decubitus after a peripheral blockade and general anesthesia. The foot was positioned on the edge of the table with a bump in the anterior region of the ankle, and the portals were marked according to the posterior arthroscopy technique (Figure 2). After making the portals, the cavity was debrided, the inventory was performed, and the lesions were treated. At the end of this step, the adjuvant procedures were performed, in which a bump was placed under the hip on the side during treatment to help with the external rotation of the ankle and foot. The associated ankle instability was treated with the Brostrom-Gould ligament repair procedure, using the open technique with a lateral approach as an adjuvant, without the need to change the decubitus. Sinus tarsi syndrome, when identified, was treated with the debridement of this space during surgery. Lesions in the peroneus brevis tendon were treated with resection if less than 50% of the tendon structure was affected. In the presence of noninsertional Achilles tendinopathy, debridement of the scar tissue and the arthroscopic release of the tendon were performed. If arthroscopy was needed in the anterior compartment (anterior impingement) after the end of the procedure in the posterior region and closure of the portals, then the patient was positioned in dorsal decubitus, which required that all surgical fields be replaced. In these cases, the ad-

Table 1. Patient characteristics and diagnoses

Patient	Age (years)	Sex	Side	Diagnosis	Sports
1	21	Fem	Right	Posterior impingement (Stieda process) Ankle instability	Dance
2	40	Fem	Left	Posterior ankle impingement (*os trigonum*) Anterolateral impingement; Ankle instability Injury of the peroneus brevis muscle	Dance
3	27	Male	Left	Posterior ankle impingement (*os trigonum*) Anterior ankle impingement; Ankle instability, insertional Achilles tendinopathy	Soccer
4	40	Male	Left	Posterior ankle impingement (*os trigonum*) ankle instability, sinus tarsi syndrome	Soccer
5	33	Male	Right	Posterior impingement (Stieda process), anterior ankle impingement; Ankle instability	Soccer
6	24	Fem	Left	Posterior ankle impingement hallux saltans	Dance
7	14	Fem	Right	Posterior impingement, ankle instability	Dance
8	44	Male	Right	Posterior impingement (Stieda process)	Soccer
9	37	Male	Left	Posterior ankle impingement (*os trigonum*), Injury of the peroneus brevis tendon, fibular ossicle	Soccer
10	28	Fem	Left	Posterior ankle impingement (*os trigonum*)	Dance

Fem: Female.
Source: Prepared by the author based on the results of the research.

juvant procedures (ligament repair and injury of the peroneal tendons) were performed after the end of the anterior ankle arthroscopy.

The postoperative recovery protocol consisted of immobilization with a rigid short leg cast for 2 weeks, followed by immobilization with a semirigid ankle brace for 4 weeks, physical therapy for pain, adjuvant stimulus of mobilization, and the use of crutches. After 4 weeks, gradual weight bearing began as tolerated, and physical therapy was initiated to increase range of motion and gait training. The return to physical activity was only authorized in the absence of pain symptoms and after at least 3 months of physical therapy.

Statistical analyses

A paired Student's t-test was used to evaluate the changes between the preoperative and postoperative AOFAS and VAS scores. P<0.05 was defined as significant. Data were analyzed using SPSS 21.0.

RESULTS

Patients diagnosed with PAIS were divided into groups of dancers and soccer players, totaling 10 procedures. The mean age was 30.8 years old (14 to 44 years old) (Table 1). Six also presented with ankle instability and were treated with the Brostrom-Gould procedure. One patient presented with sinus tarsi syndrome, and this space was also debrided during surgery. Peroneus brevis tendon injury was identified in two cases, and the presence of Achilles tendinopathy was found in one individual. All cases were treated using an arthroscopic approach to the posterior ankle. Only three cases did not undergo adjuvant procedures.

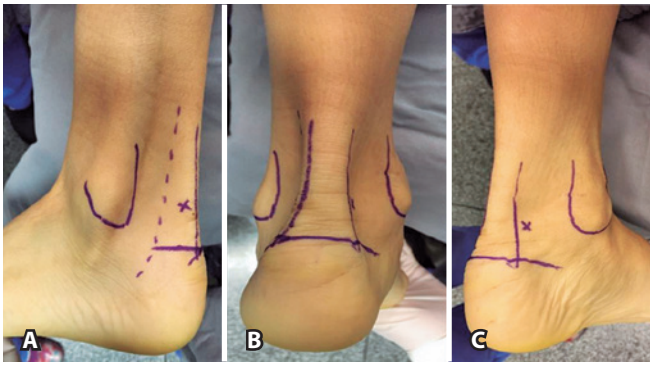

Figure 2. Position in ventral decubitus; marking of the arthroscopic portals: posterolateral portal (A), posterior view (B), posterolateral portal (C), in posterior ankle arthroscopy
Source: Author's personal archive.

During surgery, the presence of five trigonal processes (Figures 3 and 4), three Stieda processes, one hallux saltans, and one accessory ossicle of the distal fibula were identified as causes of the impingement. The patients were rehabilitated according to their injuries, with weight bearing and controlled range of motion initiated early in the treatment process. The mean preoperative VAS was 4.31 (1.8-6.6), with a mean postoperative VAS score of 1.28 (0.6-2.5, p<0.0001). The mean preoperative AOFAS score of the hindfoot was 72.2 (62-80) and that during the follow-up period was 88.6 (72-100, p=0.0005; Table 2). No compli-

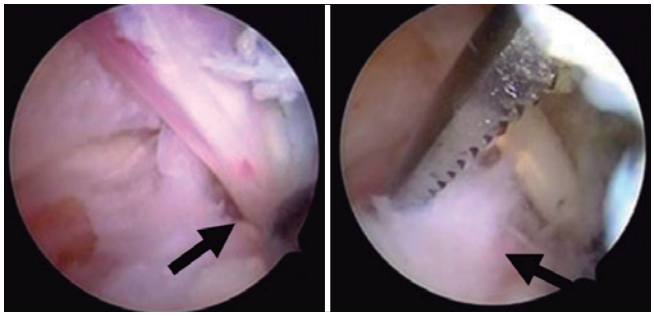

Figure 3. A 27-year-old soccer player diagnosed with PAIS due to *os trigonum*. Arthroscopic images of the posterior region of the ankle and hindfoot showing stenosis of the flexor longus hallux muscle canal (arrow A) and the resection of the ossicle with forceps (arrow B)
Source: Author's personal archive.

Figure 4. Profile radiograph of the left ankle showing *os trigonum* (arrow)
Source: Author's personal archive.

cations were reported during the procedure or follow-up period. The mean follow-up length was 13.6 months (03-28 months). All patients returned to sport activities after a minimum of 3 months of physical therapy. No athletes abandoned their sports or reported new local pain complaints during follow up.

DISCUSSION

Favorable conditions for the development of the posterior impingement syndrome are present in the general population; however, the symptoms are more common among physically active individuals. This syndrome is an important cause of sport abandonment. Dancers and soccer players were the populations that predominated this case series.

The diagnosis of PAIS consists of the presence of complaints regarding the posterior region of the ankle and investigation with imaging tests[1,3]. The delay in the identification of a single and clear etiological cause of this syndrome is common, with consequent delays in the establishment of targeted treatment[2,3]. This delay can lead to additional consequences for the athlete because the presence of pain while moving leads to suboptimal sports performance[1].

As Ribbans et al.[2] suggested in their review, PAIS can generally be divided into bone and soft tissue etiologies; this review found that surgeries for treating bone changes accounted for 81% of all cases and those for treating soft tissue accounted for 42% of all cases[2]. When assessing bone changes, the presence of elongation of the posterior tubercle of the talus (Stieda process) and trigonal processes were the most prevalent in our sample. Both the *os trigono* and Stieda process have been observed without clinical repercussions in the general population[15]. This finding is in line with that found by Zwiers et al.[16] in a tomographic evaluation of 1,256 ankles, which also found a prevalence of 30.3% of *os trigonum* in asymptomatic patients and that of 46.4% in individuals with posterior impingement; in general, this finding was present in 23.7% of all ankles[16]. In the absence of evidence of *os trigonum*, the Stieda process was identified in 34.9% of the ankles[16]. Repeated overload, repetitive microtraumas, and forced plantar flexion (to which the athlete population is more exposed) might be triggering factors for PAIS symptoms[3,7,9,15].

The presence of associated injuries was reported in almost all patients of this case series. Among them, the vast majority of participants reported lateral instability of the ankle. At the time, the concomitant treatment of these conditions was performed using the open Brostrom-Gould procedure. In the literature, frequent lesions primarily associated with anterior impingement and ligament injuries have been reported[1,2,17]. The laxity of the anterior talofibular ligament might allow the anterior excursion of the talus beneath the tibia, which theoretically brings the posterior elements close to the posterior tibial lip, thereby increasing the risk of PAIS onset[2,18]. The concomitant presence of anterior ankle impingement presents a challenge for treatment, especially regarding the position of the patient for performing a single procedure. Some authors have shown positive results with the simultaneous arthroscopic treatment of these lesions[8,17].

The identification in the case series of dancers, as well as the presence of changes in the flexor hallucis longus

Table 2. AOFAS and VAS results and adjuvant procedures.

Patient	Preoperative VAS	Postoperative VAS	Preoperative AOFAS	Postoperative AOFAS	Procedures adjuvants
1	5.2	0.6	67	100	Yes
2	4.3	1.8	77	90	Yes
3	4.5	2.1	77	85	Yes
4	5.5	1	67	72	Yes
5	3.0	2.5	62	72	Yes
6	4.1	0.8	77	100	No
7	1.8	0.5	69	100	Yes
8	6.6	1.2	80	90	No
9	4.9	1	69	90	Yes
10	3.2	1.3	77	87	No
Mean	4,31	1.28	72.2	88.6	

VAS: Visual Analog Scale; AOFAS: American Foot and Ankle Society Score.
Source: Prepared by the author based on the results of the research.

tendon and hallux saltans, draws attention to this etiology as a source of pain complaints regarding the posterior region of the ankle. The etiology is diverse and ranges from the distal insertion of muscle fibers, the oblique course of the tendon in the flexor tunnel in the hindfoot, and chronic local inflammation due to overload[9,10]. Hamilton et al.[19] called attention to the isolated tendonitis of the flexor hallucis longus tendon as a differential diagnosis of PAIS in dancers[9,19].

Pain in the posterior region of the ankle usually responds well to conservative treatments[3] such as rest, ice, anti-inflammatory medication, and even local infiltrations[2]. However, the effectiveness of conservative treatment cannot be accurately determined, and no long-term follow-up study has investigated this treatment with scientific validity[2]. Cases in which the anatomical changes associated with persistent complaints (failure of the conservative treatment) and reduced athletic performance are indications for surgery[2–4,6,15].

The open surgical approach consists of the incision and exploration of the posterior region of the ankle, the excision of bone lesions, and the debridement of local hypertrophic scar tissue. However, according to a review of 357 surgeries by Ribbans et al.[2], the posterolateral approach is associated with a greater number of complications (12.7%) than the posteromedial approach (3.9%) including sural nerve injury, infection, and a longer recovery period[2]. Abramowitz et al.[20] showed the presence of complications in 10 (24%) patients in their series of 41 patients, despite the positive results showing an AOFAS score greater than 90 and sural sensory loss in eight patients, superficial infection, and the development of reflex sympathetic dystrophy in one patient[20].

The advent of the arthroscopic technique with two posterior portals popularized by van Dijk[21] enables a minimally invasive approach to posterior impingement and associated local abnormalities. This technique is considered as valid and safe for the treatment of injuries in the posterior region of the ankle, and it leads to better outcomes by reducing the time to return to sports compared with open surgery[2–4,15]. Zwiers et al.[22] conducted a systematic review of 16 studies and 419 ankles and found that the complication rates are lower. The complication rates were 7.2% vs. 15.9%, and the mean time to return to activity was 11.3 weeks compared with 16 weeks using the open technique[22]. Ribbans et al.[2] reported an approximate 4.8% incidence of complications in their review of 521 arthroscopy procedures[2]. The present study found no complications in the surgical wound (e.g., infection or signs of local nerve injury).

In general, the surgical approach to PAIS improves the AOFAS functional score and is associated with an improvement in pain as shown by the decrease in the VAS score[2]. Both open and endoscopic surgeries had postoperative AOFAS scores above 86 and VAS scores below 2. We found satisfactory postoperative outcomes with a mean AOFAS score of 88.6 and a mean VAS score of 1.28, both of which were significant ($p<0.05$). However, the lack of standardization of the scores used across studies, as well as the lack of reports thereof, hinder a more comprehensive comparison and conclusion about this condition.

The present study has limitations with regard to its small number of patients; it is a case series predominated by soccer players and dancers evaluated in a reference center. Other conditions were concomitantly treated during the same surgical procedure, which might have contributed to the overall improvement in the functional and pain scores (AOFAS and VAS, respectively). Importantly, however, complications were absent, and the results of the endoscopic approach of this condition were positive.

CONCLUSIONS

Injuries associated with posterior impingement are common among athletes, which contributes to the abandonment of sport. Of the causes described in our sample, the presence of trigonal processes was the most prevalent. The arthroscopic resection of these conditions, combined with the use of adjuvant procedures or alone, effectively treated pain and reestablished the function of these patients.

Authors' contributions: Each author contributed individually and significantly to the development of this article: VFP *(https://orcid.org/0000-0002-1005-6089) conceived and planned the activities that led to the study, wrote the article, interpreted the results of the study, approved the final version; JPG *(https://orcid.org/0000-0001-6673-4136) wrote the article, participated in the review process, approved the final version; CMN *(https://orcid.org/0000-0002-1710-8187) participated in the review process, approved the final version; JDXS *(https://orcid.org/0000-0003-4807-7990) conceived and planned the activities that led to the study, participated in the review process, approved the final version; CASN *(https://orcid.org/0000-0002-9286-1750) conceived and planned the activities that led to the study, participated in the review process, approved the final version; NSBM *(https://orcid.org/0000-0003-1067-727X) conceived and planned the activities that led to the study, wrote the article, interpreted the results of the study, approved the final version. *ORCID (Open Researcher and Contributor ID).

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