Accessory Soleus Muscle and Persistent Posterior Ankle Pain: Report of Three Cases

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AIM: Posterior ankle pain is a nonspecific symptom that can result from various pathologies. Rare accessory muscle variants, including the accessory soleus muscle, may cause overlapping clinical conditions due to mass effect, dynamic impingement, chronic compartment syndrome, or tibial nerve compression. Limited familiarity with this anatomical variant often leads to diagnostic delay, misdiagnosis, or inappropriate treatment. The authors report three cases of chronic posterior ankle pain in athletes caused by the accessory soleus muscle with the aim to highlight the importance of considering the accessory soleus muscle (ASM) as a possible cause of this symptomatology. The diagnostic and therapeutic management, and clinical-functional outcomes are analysed.
CASE PRESENTATION: All patients reported posterior ankle pain for more than one year, exacerbated by sports activity and forced plantar flexion, with relief at rest. Magnetic Resonance Imaging (MRI) or Computed Tomography (CT) demonstrated the presence of ectopic muscle tissue compatible with an accessory soleus muscle. Clinical data, imaging findings, treatment modalities, and clinical-functional outcomes were retrospectively collected for each case. Preoperative, one year postoperative, and final follow-up assessments included the Visual Analog Scale (VAS) for pain evaluation, 17-Item Italian Foot Function Index (17-IFFI), and the American Orthopaedic Foot and Ankle Society (AOFAS) ankle–hindfoot score validated in Italian. All patients underwent surgical excision of the accessory soleus muscle through a posteromedial approach.
RESULTS: Surgical excision was the definitive treatment for each patient, resulting in pain relief, clinical and functional improvement, and return to sports activity. No complications or recurrences were observed.
CONCLUSIONS: The accessory soleus muscle is a potential cause of chronic posterior ankle pain and must be considered in the differential diagnosis to avoid diagnostic delays or misdiagnosis. Surgical excision has represented the effective and definitive treatment of the three reported cases.

Keywords: accessory soleus muscle; ankle; chronic pain; imaging; surgery; case report

Introduction

Chronic posterior ankle pain is a nonspecific clinical presentation that may result from a wide range of bone, tendon, muscle, and neurovascular pathologies. The most common diagnoses include Achilles tendinopathy, posterior impingement syndromes, flexor hallucis longus (FHL) tendinopathy, stress fractures of the posterior talar process, and expansive soft tissue tumours. However, less common conditions, such as the presence of an accessory soleus muscle (ASM), can cause similar symptoms and must be considered to avoid misdiagnosis or diagnostic delay [1–6].

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ASM is a congenital muscular variant with an estimated incidence of 0.5% to 6% [7,8], first described by Cruveilhier in 1843 [9]. Although most cases are asymptomatic and incidentally identified through imaging or surgical findings, its presence can generate this symptom at any age and especially in athletes engaged in running or endurance activities [5,6]. The anatomical variability is wide; the proximal origin may arise from the soleus or the posterior surface of the tibia, while the distal insertion can be muscular or tendinous directly on the medial or posteromedial surface of the calcaneus, or merging with the Achilles tendon [10]. This variability influences the clinical presentation, making the interpretation of the symptoms even more difficult.

The pathophysiology of this symptomatology is complex and multifactorial. One of the most documented causes is exertional compartment syndrome, caused by increased pressure within the posterior compartment following functional hypertrophy of the ASM during physical activity, leading to transient muscle ischemia due to insufficient arterial perfusion [4]. This condition, particularly described in endurance athletes and military recruits, may present with a wide clinical spectrum, ranging from muscle soreness to pain that worsens during exercise and resolves with rest [5,6].

A second recognized mechanism is compression of the tibial nerve or its terminal branches, resulting in clinical findings like tarsal tunnel syndrome. Several studies include ASM among the extrinsic causes of tibial nerve compression, with a presentation characterized by posteromedial pain, plantar paraesthesia, a positive Tinel sign, and symptom exacerbation during valgus movements of the foot, which increase tension in the tarsal tunnel and stretch the nerve [4,11,12].

Finally, other rare presentations include acute or subacute entities secondary to traumatic lesions of the ASM [13]. The presence of a posteromedial swelling that increases in consistency with plantar flexion is not constant [5].

The diagnosis relies on careful clinical evaluation combined with imaging. Magnetic Resonance Imaging (MRI) is the technique that allows for the most precise assessment of the morphology of the ASM, its course, insertion, and relationship with the Achilles tendon and neurovascular bundle [14]. Computed Tomography (CT) with dedicated soft-tissue scans, if evaluated by an experienced radiologist, may also be equally useful and, in addition, allows for a better analysis of any associated bone alterations [15].

The definitive treatment for chronic posterior ankle pain caused by ASM is generally surgical. Conservative management, such as weight-bearing modifications, physical therapy, and orthotic supports, is generally ineffective, especially in cases with severe pain, tibial neuropathy, or significant functional impairment. In these cases, surgical excision of the muscle represents an effective solution [1,7,16,17].

The three clinical cases reported in this study highlight the importance of considering ASM as a possible cause of posterior chronic ankle pain and of performing a careful clinical examination, dedicated imaging, and a critical assessment of the possible underlying pathophysiological mechanisms.

Case Presentation

This study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided written informed consent to participate in the study.

The study population consisted of three patients (2 runners and 1 high-level football player) presenting with chronic posterior ankle pain lasting at least 12 months, who had previously undergone multiple conservative treatments at other institutions without clinical improvement.

All patients were subsequently referred to our institution for further evaluation. At presentation, a detailed clinical assessment was performed, focusing on pain localization, relationship with physical activity, and symptom modulation with rest.

Ultrasound and advanced imaging investigations were always performed. MRI (2 cases) or CT (1 case) with soft tissue scans were used to assess the presence, morphology, and anatomical relationships of the ectopic muscle tissue, particularly its insertion on the calcaneus and its relationship with the Achilles tendon and surrounding soft tissues. Experienced musculoskeletal radiologists reviewed imaging findings.

Pain intensity was assessed using the Visual Analog Scale (VAS) (range 0–10, 0 absence of pain and 10 worst imaginable pain) [18]. Functional status was evaluated using the ankle–hindfoot score of the American Orthopaedic Foot and Ankle Society (AOFAS) in its Italian validated version [19] (0–100 point clinical scale used to assess function, pain, and alignment of the foot and ankle; higher scores indicate better outcomes–100 points represent an asymptomatic and perfectly functional foot/ankle), and the Foot Function Index (FFI), using the 17-Item Italian Foot Function Index (17-IFFI) that is a patient-reported questionnaire, self-compiled by the patient and evaluates the impact that foot pathologies have on the patient's perceived health status in terms of pain, disability and limitation of activities.

The final score can thus vary from a minimum of 0%, which corresponds to no pain or difficulty and limitation, to a maximum of 100%, which corresponds to the worst pain and extreme difficulty requiring assistance [20]. An independent assessor (FQ) collected all clinical scores retrospectively. Data were extracted from old records reconstructed later preoperatively and at 1 year after surgery. The long-term follow-up was obtained following a phone interview performed by the same assessor.

Given the persistence of symptoms despite prolonged conservative management, all patients were considered candidates for surgical treatment that consisted of complete surgical excision of the accessory soleus muscle through a posteromedial approach.

Surgery was performed with the patient in the prone position, with the affected lower limb free and with a support placed under the ankle to facilitate exposure of the posterior region. A longitudinal posteromedial skin incision was performed, centred on the area of maximal clinical tenderness and on the projection of the accessory muscle as identified on preoperative imaging.

After blunt dissection, the accessory soleus muscle belly was identified and particular care was taken to spot and secure the posteromedial neurovascular structures (tibial nerve and artery). The accessory muscle was isolated along its course and then completely excised up to its calcaneal insertion.

The same experienced foot and ankle surgeon (FCe) performed all procedures. Postoperative follow-up focused on pain resolution, functional recovery, and return to physical activity. The specific characteristics of the three patients are summarized in Table 1.

Table 1. Specific characteristics of the 3 patients.

Case series	Case 1 (male, football player, age 21)	Case 2 (male, runner, age 26)	Case 3 (female, runner, age 33)
Duration of symptoms before our evaluation (months)	12	20	12
Conservative treatments before our evaluation	Insole with heel riser Ultrasound Stretching of the posterior muscles of the leg Decontracting massage Mesotherapy with NSAID's Functional rest	Insole with heel riser Ultrasound Stretching of the posterior muscles of the leg Decontracting massage Functional rest	Heel riser Stretching of the posterior muscles of the leg Functional rest
Duration of symptoms before surgery (months)	15	24	17
Physical exam findings	No palpable swelling No sign of tarsal tunnel syndrome (negative Tinel) Absence of pain on palpation	Palpable swelling in the posteromedial region of the ankle No sign of tarsal tunnel syndrome (negative Tinel) Absence of pain on palpation	No palpable swelling No sign of tarsal tunnel syndrome (negative Tinel) Absence of pain on palpation
Imaging executed	Ultrasound CT with soft tissues windows Electromyography	Ultrasound MRI Electromyography	Ultrasound MRI Electromyography
Intraoperative findings	Presence of ASM in the postero-medial region of the ankle		
Insertion type	Direct muscular insertion on the postero-medial aspect of the calcaneus		
Rehabilitation protocol	Day 0–15: no weight-bearing and rest Day 15–30: no weight and assisted passive rehabilitation After day 30 progressive weight- bearing and assisted active rehabilitation until return to sport		

MRI, Magnetic Resonance Imaging; CT, Computed Tomography; ASM, accessory soleus muscle; NSAID, non-steroidal anti-inflammatory drugs.

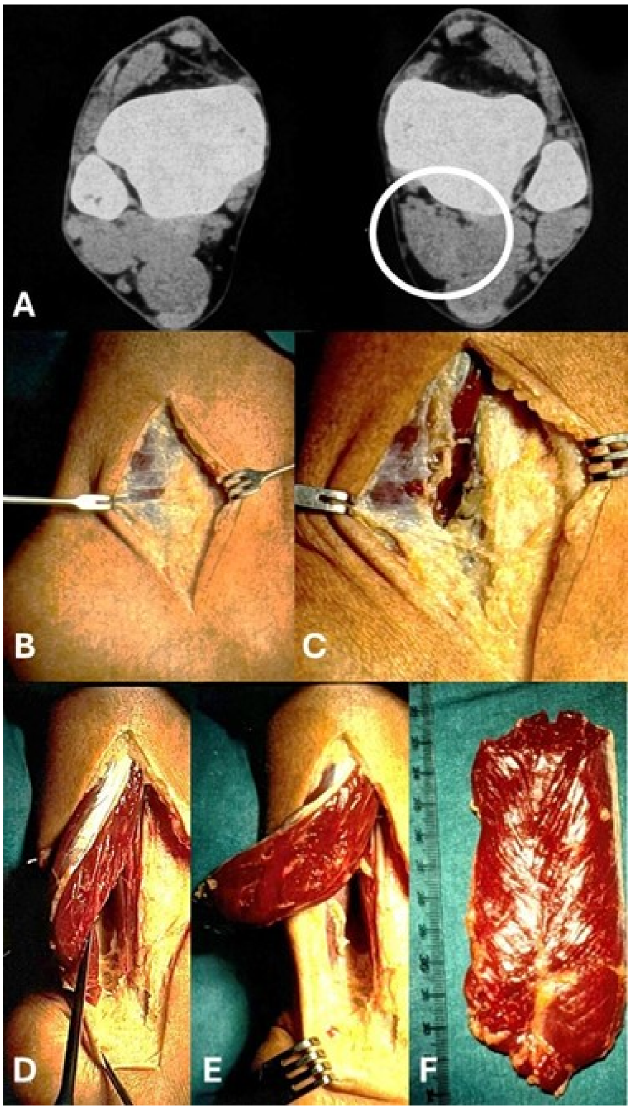

Fig. 1. Case 1 with left accessory soleus muscle (ASM) and chronic posterior ankle pain. (A) CT with soft tissue windows (axial views) and visualization of the ASM (white circle). (B) Posteromedial approach and incision. (C) Blunt dissection. (D) ASM identification and isolation. (E) ASM excision. (F) Muscle belly after excision.

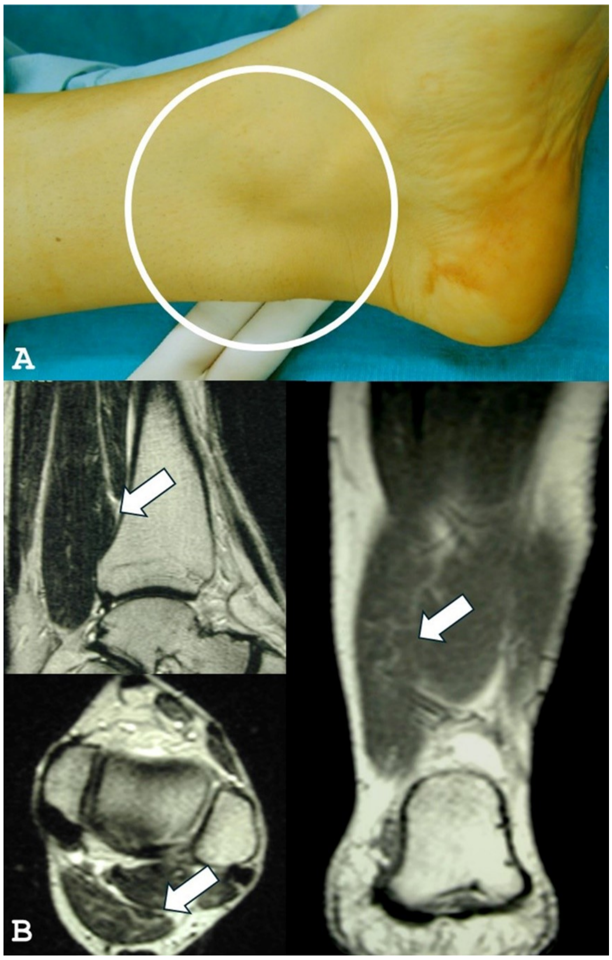

Fig. 2. Case 2 with left ASM and chronic posterior ankle pain. (A) Palpable and visible mass in the postero-medial aspect of the ankle (white circle). (B) T1 weighted MRI scans with visualization of ASM (white arrows) in sagittal, axial and coronal planes.

Results

The three patients in this case series underwent surgery in 2000, 2010, and 2013. The mean age at surgery was 26.7 years (range 21–33). All cases were unilateral, with involvement of the right limb in one patient and the left limb in two.

All patients reported chronic posterior ankle pain lasting more than one year, which progressively worsened during sports activities, especially with forced plantar flexion movements; the symptoms improved or regressed at rest. Symptoms suggestive of tibial nerve compression were referred to by all patients during physical activity. Clinically palpable swelling in the posteromedial region was noted only in one case. No objective signs and symptoms of tarsal tunnel syndrome, including sensory deficits or a positive Tinel sign along the tarsal tunnel, were detected at rest during physical examination.

Initial ultrasound suggested the presence of abnormal muscular tissue in the posterior ankle region. Patients were subsequently evaluated with CT in 1 case (Case 1/Fig. 1) or MRI in Case 2 (Figs. 2,3) and in Case 3. Ectopic muscular tissue was localized in the posteromedial region of the ankle in all cases. Imaging excluded Achilles tendinopathy, posterior impingement syndrome, FHL tendinopathy, stress fractures of the posterior talar process, and expansive soft tissue tumours. Electromyography performed at rest did not reveal signs of tarsal tunnel syndrome.

The ASM always had a distal muscular insertion on the medial aspect of the calcaneus and close anatomical relationships with the Achilles tendon and deep soft tissues. All patients underwent complete surgical excision of the accessory soleus muscle. No perioperative complications were observed. In the postoperative period, progressive clinical improvement was observed in all patients, with complete

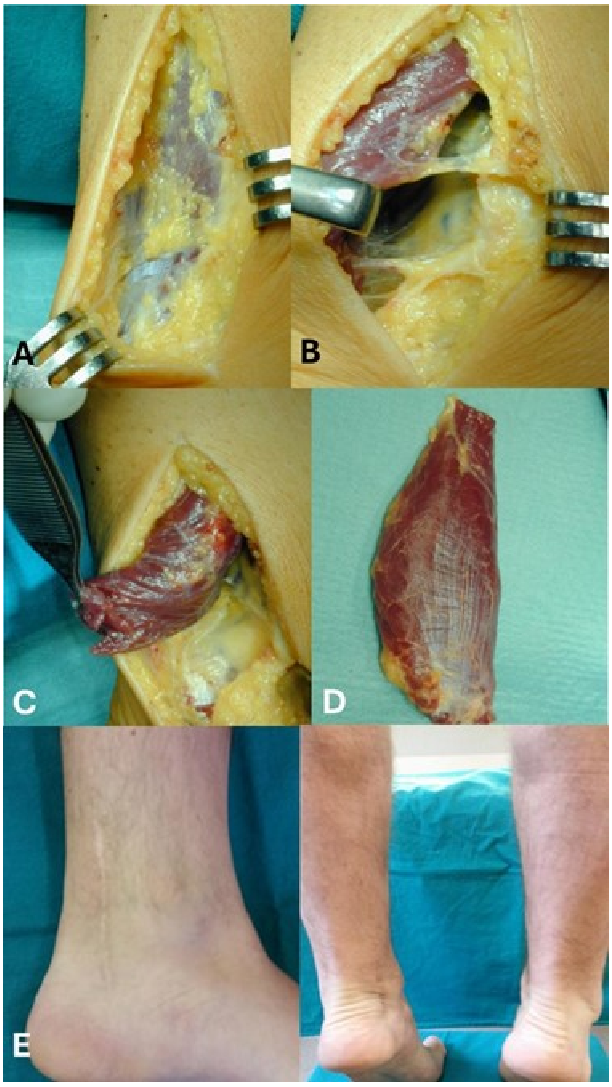

Fig. 3. Case 2 with left ASM and chronic posterior ankle pain. (A) Posteromedial approach and incision. (B) Blunt dissection. (C) ASM identification, isolation and detachment. (D) Muscle belly after excision. (E) Clinical images at final follow-up.

resolution of posterior ankle pain. All patients achieved a VAS score of 0 at 12 months and at the remote follow-up, which occurred at a mean time of 17 years and 4 months (range 12–25). Weight bearing on the operated limb was allowed one month after surgery. For all patients, the rehabilitation protocol consisted of assisted passive rehabilitation from postoperative day 15 to day 30, followed by assisted active rehabilitation until return to sport. The aim of this program was to restore adequate muscle trophism, as well as full ankle and knee range of motion. Return to sports activity occurred three months after surgery in all patients. No symptomatic recurrences, neurological deficits, or late complications were reported. The pain and clinical-functional results are summarized in Tables 2,3,4.

This case series has been reported in accordance with the Case Report (CARE) Guidelines to ensure the accuracy and completeness of the report (**Supplementary Material**).

Table 2. Case 1. VAS, 17-IFFI, AOFAS before and 1 year after surgery and at final follow-up.

Case 1 (male, football player)	VAS during training	17-IFFI	AOFAS
Pre-op	6	27%	75
1 year post-op	0	14.1%	95
Follow-up (25 years)	0	12.7%	95

VAS, Visual Analog Scale; 17-IFFI, 17-Item Italian Foot Function Index; AOFAS, American Orthopaedic Foot and Ankle Society.

Table 3. Case 2. VAS, 17-IFFI, AOFAS before and 1 year after surgery and at final follow-up.

Case 2 (Male, runner)	VAS during training	17-IFFI	AOFAS
Pre-op	5	21.7%	72
1 year post-op	0	12.9%	95
Follow-up (15 years)	0	11.3%	95

Table 4. Case 3. VAS, 17-IFFI, AOFAS before and 1 year after surgery and at final follow-up.

Case 3 (Female, runner)	VAS during training	17-IFFI	AOFAS
Pre-op	6	25.3%	65
1 year post-op	0	13.5%	93
Follow-up (12 years)	0	12.1%	95

Discussion

Chronic posterior ankle pain is a nonspecific but very common symptom, especially among endurance athletes, and may result from various tendon, bone, muscle, and neurovascular disorders. For this reason, and the frequent absence of other specific pathognomonic signs and symptoms, diagnosis of the underlying condition is difficult. Among the possible causes of chronic posterior ankle pain, the presence of an accessory soleus muscle should not be overlooked [1–6].

The literature describes the accessory soleus muscle as a relatively rare congenital variant that is frequently asymptomatic [5,10,17]. Its true clinical relevance lies in symptomatic presentation that is often nonspecific and easily associable to more common conditions (Achilles tendinopathy, posterior impingement syndromes, or flexor hallucis longus pathology) [2,3].

The cases presented in this study perfectly reflect this diagnostic grey area. All patients were athletes and presented with pain triggered primarily by physical activity and forced plantar flexion, with improvement at rest. Only one of the three patients presented with clinically palpable swelling in the posteromedial region, while in the other two the symptoms were exclusively functional. This finding confirms what has already been reported in the literature: the presence of a visible mass is not constant and depends on the morphology of the accessory muscle belly, its distal extension, and its insertion onto the calcaneus [5,10,16]. In cases with a more proximal muscle belly or predominantly tendinous insertion, the absence of clinical swelling significantly contributes to the diagnostic delay.

From a pathophysiological perspective, the results of our study support the hypothesis that the symptomatic ASM predominantly causes dynamic functional limitation, rather than continuous pain at rest. This aspect clearly emerges from the analysis of outcomes measured through patient-reported questionnaires. The 17-IFFI [19], showed moderate preoperative functional impairment in all patients, with greater involvement of the subscales relating to stiffness and functional difficulty, while the painful component and social impact were relatively less affected. This distribution suggests a mechanism linked to functional conflict and increased local pressure during physical activity, consistent with the hypothesis of extrinsic compartment syndrome or dynamic conflict described in the literature [5,16].

Pain assessment further supports this interpretation. In all cases, pain was moderate during sports activity, but sufficient to limit or interrupt participation in training and competition, while it tended to reduce or resolve with rest. The complete resolution of pain (VAS 0) at 1 year and at long-term follow-up, associated with return to sport in all patients, confirms that pain was closely related to the presence and dynamic behaviour of the accessory muscle under load.

In this context, clinical-functional assessment using the AOFAS ankle-hindfoot scale, in its validated Italian version, provided objective confirmation of the observed functional improvement [20]. In all patients, the AOFAS score improved from preoperative values between 65 and 75, indicative of impaired function, to scores above 90 at 12 months and at the final follow-up. This improvement reflects not only pain resolution but also recovery of function and joint load-bearing capacity, consistent with a full return to sports activity. The combined use of Patient-Reported Outcome measures (PROMs) like 17-IFFI and a validated clinical score, such as the AOFAS, allows for a more comprehensive assessment of outcomes, integrating the patient's subjective perception with objective clinical and functional observation.

Imaging plays a key role in the diagnostic process [14,15]. MRI, performed in two patients of the present study, is generally considered the gold standard for assessing soft tissue abnormalities. CT with soft tissue scans has proven equally accurate in identifying the ASM, defining its morphology, and its anatomical relationships with the calcaneus, Achilles tendon, and deep soft tissues as seen in the first case (Fig. 1). This finding emphasizes how, with a targeted clinical suspicion and expert radiological interpretation, even more accessible methods can enable a correct diagnosis, reducing the risk of further delays, errors, or misinterpretations.

All patients were treated by complete surgical excision of the accessory soleus muscle, without associated procedures. In the absence of clinical signs and symptoms of tibial nerve compression at rest, tarsal tunnel decompression should not be indicated and should not be performed, as documented in this case series [21]. This observation reflects a precise pathophysiological vision; nerve compression, when present, is often extrinsic and dynamic, secondary to increased volume of the muscle belly during activity, mimicking a condition of chronic compartment syndrome. The complete resolution of symptoms and the absence of post-operative neurological deficits in this case series confirm that isolated excision of the accessory muscle was effective, avoiding additional unjustified procedures.

The observed clinical outcomes are fully consistent with those reported in the literature, which generally describe favourable and curative results after excision of the symptomatic accessory soleus muscle, with a return to sport, a low incidence of complications, and no recurrences [16,22]. The observation of satisfactory clinical and functional results at a mean follow-up of 17 years and 4 months and the absence of recurrences further confirm these assumptions.

This study has some limitations. The small number of patients studied due to the rarity of the condition precludes statistical analysis and limits generalizability. Nevertheless, the long-term follow-up and detailed clinical, imaging, and functional assessment strengthen the relevance of the observations reported. Finally, all clinical scores were retrospectively collected. Data were extracted from old records reconstructed later preoperatively and at 1 year after surgery. The long-term follow-up was obtained following a phone interview. This could be a limitation for the recall bias. However, the small sample size for such a rare disease allowed a single collector to analyze the clinical data and conduct the telephone interview; for this reason, the authors believe that the results observed are valid and realistic.

Conclusions

ASM should not be considered only a simple anatomical variant, but a potential cause of chronic posterior ankle pain. The absence of a palpable mass or objective signs of tibial nerve compression may not be present, but does not exclude the diagnosis. Weight bearing and sports activity generally worsen the symptomatology. MRI represents the most accurate imaging modality for confirming the presence of ASM and defining its anatomical characteristics. In symptomatic ASM refractory to conservative management, excision was effective in this small series, but larger studies are needed.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Author Contributions

FP and SB designed the study; FCe and FCa performed the surgeries; FQ collected the data. FP and SB wrote the manuscript All authors contributed to the critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

This case series study does not involve any personally identifiable data; the Ethics Committee of University Hospital of Parma has confirmed that approval is not necessary. This study was conducted in accordance with the principles of the Declaration of Helsinki. All participants provided informed consent before participating in the study, after an explanation of its anonymous nature.

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.62713/aic.4588.

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