



Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

M. Peroneus Quartus Causing Chronic Peroneal Compartment Syndrome in a Runner Treated by Endoscopic Fasciotomy: A Case Report

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ARTICLE INFO

Level of Clinical Evidence: 4

Keywords:

accessory peroneal muscle
chronic ankle pain
chronic exertional compartment syndrome
peroneal fasciotomy

ABSTRACT

We present the rare case of a 47-year-old male long-distance runner who was referred to our hospital with a long-standing pain in his left calf. Clinical history, as well as ultrasound and magnetic resonance imaging scans, showed an accessory peroneal muscle. This muscle was identified as a peroneus quartus muscle. On ultrasound, controlled intracompartmental pressure measurement, a chronic peroneal compartment syndrome, was diagnosed. We performed an endoscopic-assisted fasciotomy of the peroneal compartment. This resolved the patient's symptoms completely and allowed the runner to return to competition shortly after the surgery.

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The peroneus quartus muscle is 1 of the accessory peroneal muscles with a prevalence of 6.6% to 21.7% (1,2). The terminology for accessory peroneal muscles is still inconsistent. There are few anatomic studies that report different origins for a peroneus quartus muscle, with the majority originating from peroneus brevis muscle belly. In addition, several different sites of insertion have been described, ranging from a prominent peroneal tubercle of the calcaneus to the base of the fifth metatarsal (1–3). More recent studies demonstrated a higher prevalence, with a growing focus on the clinical relevance. Most of the literature published to date proposed a complete excision of this muscle if it becomes symptomatic (2,4,5). In an earlier case, Mick and Lynch (6) reported a reconstruction of the peroneal retinaculum using a peroneus quartus tendon. Another group of authors described the case of chronic ankle pain with effusion in the peroneal compartment and, while performing an exploratory surgery, discovered a peroneus quartus muscle (7). It has been previously described that this accessory muscle is overlooked many times in magnetic resonance imaging (MRI) diagnostics and can also mislead to a diagnosis of peroneal tendon splits (8). It has also been linked to other peroneal tendon disorders, such as an insufficient peroneal retinaculum with possible tendon subluxation or peroneal groove overcrowding causing chronic lateral ankle pain (3–5).

Sonographic imaging can differentiate well between peroneal tendon disorders and a possible peroneus quartus muscle. For further investigation, peroneal compartment pressure measuring by ultrasound-guided positioning of the probe exactly in the muscle belly can be used. This is especially important in cases in which a chronic exertional compartment syndrome (CECS) must be suspected (9,10).

Case Report

A 47-year-old male athlete who had finished several marathons and had been competing in long-distance running for years was referred to our hospital. The athlete reported no relevant medical history. For 2 years, he had been suffering from lateral calf and ankle pain that had first started in his left leg about 2 to 6 hours after long-distance running and then worsened over time. Before the first visit to our hospital, he had already had to reduce his weekly running amount to a maximum of 15 km. In addition, he reported that he experienced pain when standing up for longer than 30 minutes. He had already received injection therapy with cortisone and local anesthetic that had not led to any improvement of the symptoms. Balance training, stretching, and fascial release treatment had shown no relevant effect.

During clinical examination, the maximum pain was in the lower peroneal group of the left leg. In the distal peroneal muscles, there was a tender, diffuse swelling compared to the contralateral leg. The right leg and ankle were asymptomatic. To exclude superficial peroneal nerve compression or fascial impingement, an additional neurologic examination was performed. The external rotation and eversion of the left

Financial Disclosure: None reported.

Conflict of Interest: None reported.

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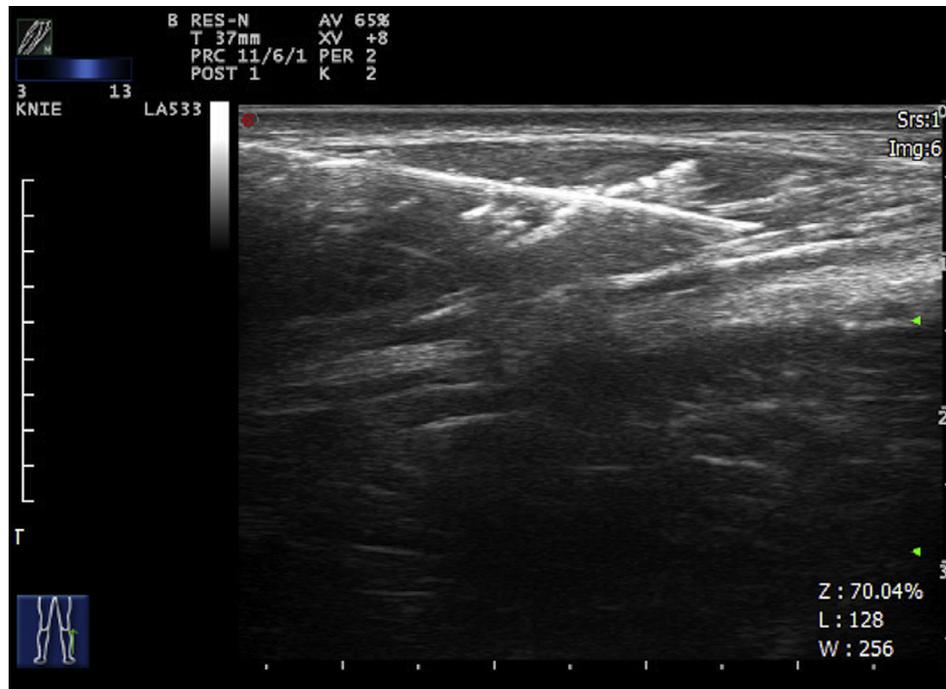


Fig. 1. Peroneal compartment showing needle placement for intracompartmental pressure measurement.

hindfoot showed a reduced force when compared to the healthy contralateral side. Range of motion as well as stability of the ankle and entire lower extremity were adequate. The clinical and radiologic hindfoot alignment were straight. The foot type and shoe gear were both neutral.

When performing further diagnostics using ultrasound, an accessory peroneal muscle reaching down to the height of the lateral malleolus was observed. Because of its anatomic position, the muscle was identified as a peroneus quartus muscle. According to the clinical history and examination, the suspicion of a CECS was raised; therefore, sonographically guided intracompartmental pressure measurement was performed (Fig. 1).

The results confirmed the diagnosis: pathological values were found only in the peroneal compartment (Table). Already at rest and before exercising, we found the intracompartmental pressure to be elevated with an average of 69 mmHg, whereas the expected maximum should not exceed 25 mmHg (11). Postexercise, a maximum of 87 mmHg, with an increased average of 83 mmHg was found. Radiologic reports from a bilateral MRI scan of the lower leg had mentioned a peroneus quartus as well as the suspicion of a peroneus brevis tendon split (Fig. 2). In addition, a flexor digitorum longus accessorius muscle was identified.

Table

Results of the ultrasound-guided intracompartmental peroneal pressure measurement before and after exercising

Time (minutes)	Intracompartmental Pressure (mmHg)	Comment
0	75	At rest, supine
2	68	At rest, supine
4	64	At rest, supine
Average	69	At rest
Treadmill		
8 minutes, 11 km/hour, 6% incline		
0	69	Postexercise, supine
4	87	Postexercise, supine
8	83	Postexercise, supine
12	87	Postexercise, supine
16	88	Postexercise, supine
Average	83	Postexercise

In our case, the insertion of the M. peroneus quartus was just posterior to the peroneal tubercle of the calcaneus.

It was concluded that the sole pathology was the CECS in the peroneal compartment resulting from an overcrowding caused by the existence of a peroneus quartus muscle. We therefore proposed an endoscopically guided fasciotomy of the peroneal compartment under regional anesthesia. In our hospital, this is a standardized procedure in long-distance runners with chronic lower leg compartment syndromes (9,11). It has been shown that fasciotomy as a treatment of CECS has a good outcome in the hands of an experienced surgeon (9,12).

During the preoperative and anesthesiologic preparation, a pathological bleeding time was noticed, and the patient was further referred to hematologic examination. In another blood sample taken, a low-normal von Willebrand's factor was observed; however, this was judged not to be a contraindication for an operative treatment. Because of an anamnesis of a prolonged time of bleeding after extraction of the patient's tooth a few years earlier, it was decided to perform the operation in an optimized in-house setting with a 2-night stance. It was proposed that Cyklokapron be administered for 7 days after the operation to obviate excessive postoperative hematoma.

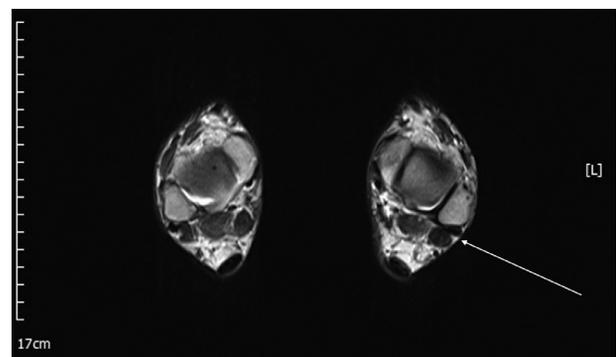


Fig. 2. Bilateral, transversal plane magnetic resonance imaging of both ankles showing the accessory peroneal muscle (arrow).



Fig. 3. Stab incision and placing of a speculum on top of the peroneal fascia. Upper ankle joint line and lateral malleolus are marked.

The operation was performed in April 2017 under regional anesthesia. A lateral mini-incision of 3 cm at the medium height of the lower leg was made and subtle preparation to the peroneal fascia was done. A speculum for endoscopic guidance was carefully placed between the fascia and subcutis (Fig. 3). A 4.0-mm scope was placed and fixed at the speculum with a specially adapted tool. A superficial stab incision of the fascia was made under vision (Fig. 4). On incision, the peroneus muscles protruded extensively out of the fascia, confirming the assumption of a hyperpression in the peroneal compartment. Further fasciotomy until the distal end of the fascia was done with a specifically adapted meniscus knife (Smilie Knife; Anklin AG, Reinach, Switzerland). The fasciotomy was completed toward the proximal end. It was documented how the muscle belly continued to protrude after fasciotomy (Fig. 5). Subtle hemostasis was done after opening the tourniquet because of the anamnesis of a possible bleeding disorder. Drainage was placed before subcutaneous and cutaneous suture.

Postoperatively, the patient was allowed full weightbearing. Immediate mobilization was begun. Sport-specific physical therapy was continued for 12 weeks according to our hospital's postoperative treatment protocol for fasciotomy. We recommended coordinative and stabilizing sensorimotor exercises for 4 weeks before allowing return to sports. After the successful return to sports, we advised the patient to avoid higher intensity running or hypertrophy training for another 2 weeks.



Fig. 4. Incision of the peroneal fascia from an endoscopic view.



Fig. 5. Complete fasciotomy shows the protrusion of the peroneal muscles.

Because the patient remained free of symptoms, we recommended increasing regular training distance by about 5 to 10 km per week. Three months after the surgery, the patient had already competed in a half marathon without any recurrence of symptoms. Ultrasound control showed an adequate fasciotomy and no further effusion. A bilateral symmetric range of motion was maintained. Biomechanical analysis including isometric and isokinetic force measurements showed no side-to-side deficit in eversion or inversion torque.

Four months after the surgery, the patient successfully completed a marathon race without any recurrence of symptoms. One year after the surgery, the patient is still performing long-distance running on a competitive level.

Discussion

In most cases, a peroneus quartus muscle, as 1 of the accessory peroneal muscles, is asymptomatic (2); however, in patients with ongoing symptoms in the lateral aspect of the ankle or shaft, the presence and possible role of an accessory peroneal muscle should be considered (2,7). In the literature, the number of reported pathological cases is limited (1,4–6). To our knowledge, this is the first case in which a peroneus quartus muscle caused a CECS. In other cases, a peroneus quartus muscle was linked to a locking phenomenon of the ankle combined with an intrasheath tendon subluxation of the peroneal tendons, which had been treated by a suture and the resection of a peroneus quartus muscle (5). The possible usefulness of a peroneus quartus tendon for reconstructive surgery, as proposed by Mick and Lynch (6), will be restrained to singular cases. Another case report of chronic lateral ankle pain reported alleviation of lateral ankle pain after dissection of a peroneus quartus muscle (4); furthermore, it was investigated whether a peroneus quartus muscle played a role in functional ankle instability (13). In our case, the patient reported no symptoms of functional ankle instability, and no peroneal dysfunction was observed. Additionally, there was no deficit in peak torque in eversion or inversion; thus, it may be hypothesized that the presence of a peroneus quartus muscle does not alter inversion or eversion force.

The diagnosis of a peroneus quartus muscle via ultrasound has been studied previously (8,13); however, because of its various anatomic appearances, a well-experienced sonographer is necessary for the correct identification of this muscle. In addition, the data published are based on retrospective interpretation of sonographic imaging, which remains controversial in its diagnostic quality (8). We argue that it is important to acknowledge the high prevalence of a peroneus quartus muscle. Although its possible etiologic causality to peroneal tendon

disorders is controversial, it might mislead to the diagnosis of a peroneal tendon split. In our case, this was also suspected by the MRI findings, but could neither be confirmed during sonography nor during surgery. There are a few case reports in which a peroneus quartus muscle was encountered while performing surgery on what was thought to be a peroneal split (5,8,14). Before performing surgery on a possible longitudinal split of peroneal tendons, the existence of a peroneus quartus muscle should be excluded via exact MRI investigation. In our view, additional evaluation using ultrasound should be sought; thus, the diagnosis of a peroneal tendon's split in cases in which a peroneus quartus muscle is present needs to be interpreted with caution (14).

In conclusion, we considered resection of the peroneus quartus muscle a very invasive solution and preferred to maintain the individual anatomy. Furthermore, considering the existence of a possible blood clotting disorder, we decided to restrain possible tissue damage to a minimum. Whether low von Willebrand's factor plays a role in triggering the development of a CECS remains unclear. To the best of our knowledge, there are no cases reported on a possible correlation. In our view, the primary cause of the excessive intracompartmental pressure was the accessory peroneal muscle; hence, our therapeutic approach was to address the pathology by solely performing an endoscopically guided fasciotomy. According to the literature, a mini-open or endoscopic fasciotomy was demonstrated to be a successful procedure if it is performed by an experienced surgeon (10). The recurrence rate of a CECS might be slightly elevated compared to total dissection; however, when performing an endoscopically guided fasciotomy of sufficient length, the advantages of this minimally invasive operative technique outweigh the possible risk of recurrence. The complete alleviation of symptoms and the successful return to competition further supported this approach.

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