Trauma Case Reports 35 (2021) 100524

Contents lists available at ScienceDirect

Trauma Case Reports

journal homepage: www.elsevier.com/locate/tcr

Case Report

Peroneus brevis tendon injuries: Report of two cases and review of literature

Stamatios A. Papadakis [a,*], Dimitrios Pallis [a], Margarita-Michaela Ampadiotaki [a], Konstantinos Tsivelekas [a], Nicholaos Trygonis [a], Dimitrios Artsitas [a], Evangelos Triantafyllou [a], Thanos Badekas [b]

[a] B' Department of Orthopaedics, KAT General Hospital of Attica, Greece
[b] Hellenic Police Orthopaedic Department, Greece

ARTICLE INFO

Keywords:
Peroneal tendon
Tear
Ankle
MRI

ABSTRACT

The incidence of peroneal tendon disorders in the population is unknown and they are usually overlooked. We report two cases of peroneus brevis injuries and a comprehensive literature review was performed. The first case was a 53-year-old man presented with persistent pain on the lateral aspect on the left ankle during the last four years and difficulty to bear weight during the last year. MRI showed longitudinal tear of peroneus brevis tendon and the patient underwent surgical treatment. The second case was a 46-year-old woman with persistent pain on the lateral aspect of the ankle with a history of a road traffic accident two years ago. Although MRI showed a peroneus brevis tendon tear, this was a false positive finding. Surgical treatment revealed no tear and symphysiolysis managed to relieve patient's symptoms. Even though MRI is the most effective diagnostic tool in depicting peroneal tendon injuries, there are false positive findings. In cases when symptoms persist, surgical exploration is indicated.

Introduction

The incidence of peroneal tendon disorders in the population is unknown, but cadaveric studies suggest that peroneal tendon tears are relatively common and occur in 11.3% to 37.5% of specimens [1,2]. Due to low incidence, they are usually overlooked and undertreated [3,4]. These lesions are the result of acute injury or chronic pathology such as tendinopathy, tendon instability and chronic tendon tears [5].

There are four main areas of anatomical variance that may contribute to peroneal tendon pathology [6,7]. The musculotendinous junction of peroneus brevis (PB) is usually proximal to the superior peroneal retinaculum. When the junction occurs distally, within the retinaculum, the increased volume may contribute to stenosis within the tendon sheath.

Peroneal brevis tears most commonly occur in the region of the peroneal sulcus in the posterior and distal region of the fibula. Situated between the peroneus longus and the posterolateral fibula, the PB is under significant stress and longitudinal tearing of the PB can result from mechanical abrasion against the peroneus longus or against the posterolateral lip of the fibula as the superior peroneal retinaculum (SPR), becomes incompetent [8–10].

A longitudinal tear is the most common finding in the PB, but occasionally a “bucket handle” tear is rare and associated with a

* Corresponding author at: KAT Hospital, 2 Nikis Street, Kifisia 14561, Greece.
E-mail address: sanpapadakis@gmail.com (S.A. Papadakis).

https://doi.org/10.1016/j.tcr.2021.100524
Accepted 20 August 2021
Available online 24 August 2021

tendon split where the peroneus longus acts as a wedge. Other predisposing factors for PB tears are the presence of a peroneus quartus muscle or a low-lying PB muscle belly due to the increased mechanical stress from the overcrowding muscle presence [11]. Only 60% of peroneal tendon injuries are diagnosed at the initial visit to an orthopaedic surgeon, whereas for the remaining 40% the median time to the correct diagnosis is 7 months [12]. It is associated with persistent pain and lateral ankle instability resulting to a high degree of disability for the patient [13,14]. We report two cases of PB tendon injuries one with a positive and one with a false positive MRI findings. Both were treated surgically either by suturing or symphysiolysis with an excellent final outcome. A comprehensive literature review in PubMed database was also performed.

Case presentation 1

Patient information

We present a case of a 53-year-old man with a unilateral longitudinal tear of the PB tendon without a prominent history of injury. He was working as an electrician; his weight was 93 kg and his height 1.80 m. His past medical history was non-contributory and he did not take any medication. The patient presented at our outpatient clinic with a history of persistent dorsolateral ankle pain and difficulty bearing weight on the left foot during the past four years. He reported that the pain was worse at night and after prolonged exercise. During the past year, the symptoms had become permanent independent of activity, although he did not have the sensation of instability or 'giving out'. He had visited our department again in the past and he had received some NSAIDS, ice and rest without relief of the symptoms. The patient remembered a lot of sprains in the past, but nothing specifically related to the injury.

During examination the ankle had no swelling or ecchymosis on the lateral aspect and the alignment was normal, but he had tenderness in palpation along the course of peroneus tendons. The drawer and talar test were negative and the ankle was stable. Range of motion was also normal, but both active and passive hindfoot eversion was painful.

The patient underwent radiographs with anteroposterior and lateral views of foot and ankle, which revealed no pathology. The patient underwent an MRI examination, which showed longitudinal tear of PB tendon and bone edema of the cyboid bone.

The surgical exploration was necessary in order to relieve the symptoms. During surgery a longitudinal tear of PB tendon without dislocation was identified (Fig. 1). The rupture was longitudinal approximately 4 cm and repaired with continuous suture interlocking technique (Fig. 2).

The patient maintained a cast for four weeks postoperatively, with progressive weight bearing after three weeks. Subsequently, the patient had full ROM and reported relief of the symptoms. Moreover, physical therapy was prescribed. During the follow-up, three months post-operatively, the patient had full ROM, without pain, he was able to bear full weight and had returned to his daily activities.

Case presentation 2

The second patient was a 46-year-old woman. Her past medical history was non-contributory and she was a smoker. Her height was 1.65 m and her weight 57 kg, and she was an office worker. She visited our hospital due to persistent pain on the lateral aspect of the ankle. The patient reported that these symptoms began 2 years ago, after a car accident. Due to pain on the lateral aspect of the ankle, a cast was placed for two weeks. The patient reports persistent pain since the accident. She had taken painkillers and NSAIDs without relief of symptoms.

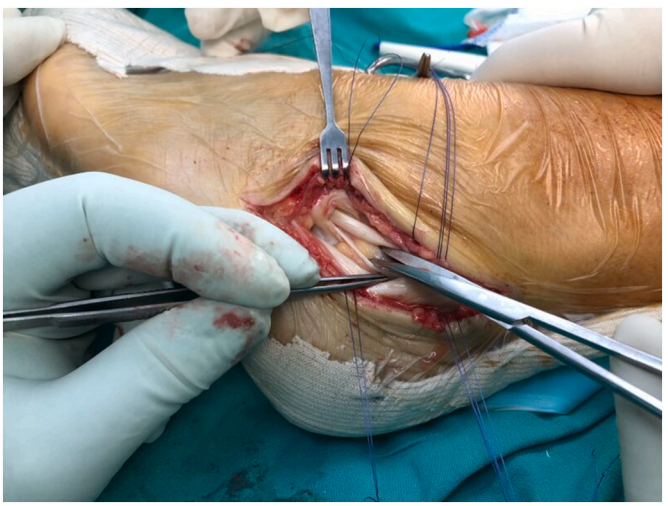

Fig. 1. Case 1. Intraoperative photo showing the longitudinal split of peroneus brevis tendon.

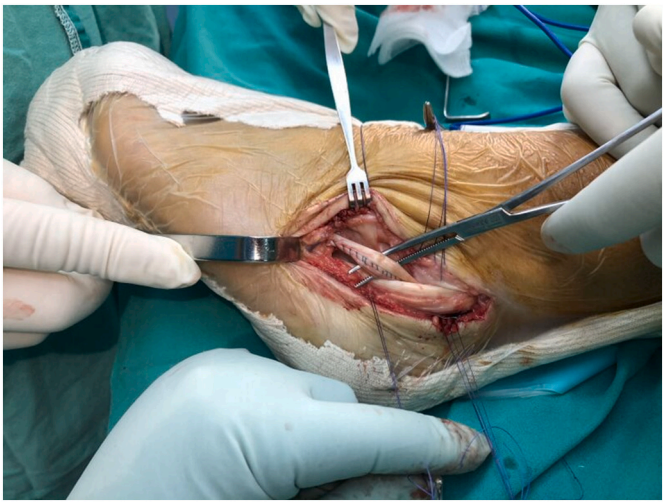

Fig. 2. Case 1. Intraoperative photo showing the continuous interlocking suture of peroneus brevis tendon.

During clinical examination, she had swelling on the lateral aspect of the ankle and pain along the course of peroneus tendons. Although the ankle was stable, ROM was normal but the hindfoot eversion was painful. The patient underwent both ankle and foot radiographs. These were normal without fracture or subluxation, neither abnormality nor pathology of the bones and soft tissues. The MRI examination showed a split of PB tendon (Fig. 3). She underwent surgical treatment. A curved incision was made behind the lateral malleolus. The PB tendon was identified and the sheath of the tendon was released. No ruptures of the tendon or tear were revealed and only a symphysiolysis was performed. Peroneus longus tendon was also intact.

A cast was applied for two weeks and instructions were given for partial bearing weight and physical therapy. Two weeks post-operatively, the patient had normal ROM and she was very satisfied of the final outcome. Her ankle was not painful and she had returned to her daily activities. Despite that the MRI was false-positive, symphysiolysis managed to relieve the symptoms.

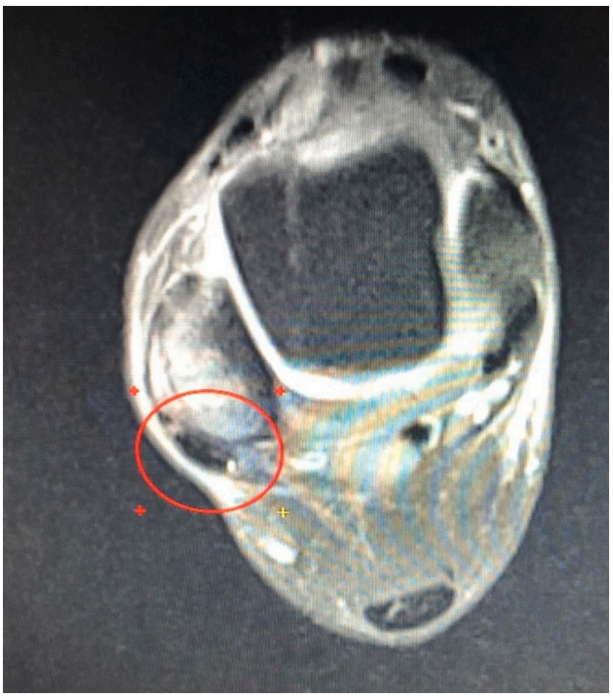

Fig. 3. Case 2. Proton density – weighted axial magnetic resonance image showing the flattened PB and a small longitudinal split right under the lateral malleolus.

Table 1
Published cases in PubMed database of isolated PB tear or concomitant with peroneus longus tendon.

Author	Cases/ sex	Age	Mechanism	Diagnosis	Treatment	Outcome
Scheidegger et al. [36]	M	57	Atraumatic	MRI, U/S	Open reconstruction of the PB through transfer on the PL	Good outcome 3 m post-op
Morimoto et al. [37]	F	40	Injured the ankle while dancing	MRI	Graft of ipsilateral semitendinosus and gracilis tendons	Was able to stand on a single leg in equinus 3 m post-op
Jockel et al. [38]	4 M, 4 F	Mean age 54	Ankle sprain/chronic pain	MRI		Excellent outcome in 5 pts/eversion weakness in 2 pts/1 pt did not return to preoperative activities and developed the single postoperative complication of a transient peroneal palsy
Clement et al. [39]	F	58	History of recurrent inversion ankle sprains and lateral ankle instability	MRI	End-to-end implantation of cadaver graft	At 2y follow-up had full function without pain or weakness
Radice et al. [40]	M	37	Rupture of the PL and PB tendons secondary to tophaceous gout i	MRI	PL to PB tenodesis	Excellent outcome 1y post-op
J Leppilahti et al. [41]	2 F	Middle age & 53	Car accident/chronic pain	U/S	Single central PB split was repaired with side-to-side saturation in 1 case. The torn fragment of the PB tendon was excised and the ankle was mobilized early	Pts were satisfied, although they still had some exertion pain in their ankle/good outcome
Minoyama et al. [42]	2 M	17 & 22	Ankle sprain	MRI	Debridement/the torn tendon was sutured with 4-0 nylon	Returned to his full activity 3 m post-op
Nishikawa et al. [34]	2 M, 1 F	Mean age 46	Ankle sprain	MRI	Semitendinosus tendon autograft was sutured to the proximal stump of the native PB tendon using a Pulvertaft suture with a 1-0 Vicryl. Bone tunnel in 5th metatarsal in 1 case	Pts 3 m post-op were pain free
Ochoa et al. [43]	F	16	Chronic pain-hypertrophied tubercle	MRI and CT-scan	Resection of the hypertrophied tubercle and peroneal tendon repair	Returned to her daily activities 6 m post-op
Tiwary et al. [44]	F	40	Old trauma	MRI	Suture-tubularization of tendon with non-absorbable 4-0 nylon sutures	Returned to her daily activities with no pain 4 m post-op
Carlis et al. [45]	F	51		MRI	The peroneus quartus tendon was resected as distal as possible and was sutured to the peroneus brevis tendon using 2-0 FiberWire	Returned to her returned to her daily routine 3 m post-op
Chauhan et al. [28]	F	64	Old trauma-running-ankle sprain injury 20y	MRI	Surgical treatment was suggested but the patient denied. Conservative treatment: physical therapy, heel pads and ankle support with a lace-up ankle brace, NSAIDS	
Diaz et al. [46]	M	56	2w of progressive pain and swelling of his left ankle. Burning feeling along the lateral aspect of his ankle	X-ray, U/S	Debridement and repair of longitudinal splits of the PL and PB tendons	Fully recovered 12 m post-op
De Yoe et al. [47]	M	30	10 y history of progressive left lateral ankle pain. Gout. History of multiple ankle sprains	MRI	Debridement/the longitudinal tear of the tendon was repaired by a running 4-0 polydiaxanone (PDS) suture. PB tubularization with 2-o PDS	Pain free at any activity after 1y
Saxena et al. [30]	19 M, 12 F	Mean age 43	24 pts had an isolated PB tear/ 7 pts had combined PB and PL tears		Debridement/tubularization-reconstruction using monofilament nylon sutures in 23 cases of PB tear (1 combined with TD) and 3 cases of combined	Isolated PB tear had excellent outcome, return to activity in 3.6 m ± 1.2 m. Combined tears had good outcome, return to activity in 3.7 m ± 1.4 m

(*continued on next page*)

Table 1 (*continued*)

Author	Cases/ sex	Age	Mechanism	Diagnosis	Treatment	Outcome
					tears/5 cases of TD (1 isolated and 4 combined tears)	
Fischetti et al. [48]	M	27	No history of recent trauma	MRI,U/S	A lateral side-to-side suture of PB was done. Moderate milling of the retro-malleolar groove. Inferior and superior peroneal retinaculum were also sutured	No symptoms during sport activity after 6 m
Wind et al. [49]	M	21	Ankle injury during football 1y	X-ray, physical examination	Debridement/tubularization of the remaining peroneal sheath. Both tendons were tenodesed together, augmented with a peroneus tertius tendon graft	Returned to football after 11 m
Lagoutaris et al. [50]	M	35	4y history of episodic pain, medical history was significant for gout	MRI	Debridement. Both tendons were entubulated using absorbable suture	At 1y follow-up the pt was back at work at full activity
Borton et al. [51]	2 M	60 & 61	Old trauma (7 m/3y)	MRI/clinical diagnosis	Transfer FDL to PB. The peroneal sheath was closed with 2/0 Vicryl suture	No symptoms at 6y follow-up. Mild discomfort under the base of the fifth metatarsal after long walking
Bojanic et al. [52]	2 M, 1 F	Mean age 36	Old ankle inversion or contusion/no previous injury in 1 pt		Endoscopic treatment with debridement of the tears/mini-open repair with tubularization of the tendon in 1 case.	No pain or clicking at 1y follow up
Krause & Brodsky [25]	10 M, 10 F	Mean age 44	11 pts had specific injury (sport injuries, falls, etc.), 9 pts had unknown traumatic history	Clinical examination (5 cases), MRI (15 cases)	Tendon debridement and repair by tubularization in 11 pts. Tubularization and excision of damaged PB in 9 pts.	Good outcome in an average of 39 m follow up. Mean post-op AOFA score was 85
Larson, E [53]	2 M	Mean age 37	Old ankle sprain	Clinical examination and stress radiographs	Modified Evans procedure using the ruptured part of PB/tendon resection	Return to activities after 18 m and 24 m follow-up
Sammarco &. DiRaimondo [11]	7 M, 6 F	Mean age 34	Old trauma (8 m/20y)	Intraoperative finding during ankle instability reconstruction surgery/2 cases of preoperative clinical diagnosis	Debridement/11 defects were incorporated into the tendon graft for ankle reconstruction. The remaining defects were closed with a buried nonabsorbable suture/direct tendon suturation repair in 2 cases	Follow-up (8 m to 49 m) showed significant relief of pain in 12 cases
Seybold et al. [35]	6 M,3 F	Mean age 56	Old trauma (5 m/37 m)		Single-stage reconstruction of concomitant peroneal tendon tears by transferring the FHL (5 cases) and FDL (4 cases) tendons grafts	Mean follow-up was 35.7 m (12-94). All pts were satisfied with the results of the procedure
Redfern & Myerson [27]	19 M, 9 F	Mean age 36		MRI in 22 pts	Debridement/tendon tear repair and tubularization using 4-0 nylon sutures/tendon graft or transfer using FDL	Post-op 21 pts were satisfied, 3 pts were partially satisfied, 4 pts were dissatisfied with the final outcome
Munk & Davis [23]	M	27	Old trauma (2y)	X-ray, clinical examination	Extraction of damaged PB and attachment of the remaining tendon to PL	Pain free and full joint function 10w post-op

Abbreviations: Pts: patients, PB: peroneus brevis, PL: peroneus longus, FDL: flexor digitorum longus, FHL: flexor hallucis longus, U/S: ultrasound, post-op: post-operatively, w: week/s, m: month/s, y: year/s.

Discussion

Peroneus tendon disorders are not restricted to the elderly and can occur in young athletes. They can be the outcome of an incompetence of the SPR with the subluxation of the tendon following an injury along with the contribution of many predisposing factors. They are often underdiagnosed by orthopaedic surgeons and are correlated with a high incidence of lateral ankle instability and chronic pain. It is important that they remain a part of the differential diagnosis and should not escape the clinical evaluation. There exist controversial data on the right operative technique, which is mostly based on the surgeons experience and the intra-operative findings.

In patients with chronic lateral ankle pain, a determination must again be made between lateral ankle ligament insufficiency and peroneal tendon pathology. A thorough history often shows that patients with lateral ankle ligament pain secondary to recurrent sprains relate instability, especially on uneven terrain. In contrast, peroneal tendon pathology often presents as chronic disability and pain [15]. With recurrent subluxation, patients sometimes describe a snapping or popping sensation. In these cases, effusion of the tendon sheath with crepitation may be observed. Hutchinson relates that the presence of effusion usually indicates significant damage to the tendons [16].

Imaging workup of a patient with lateral ankle pain and a suspected peroneal tendon injury should begin with radiographs. Weight-bearing radiographs of the symptomatic foot and ankle should be acquired. Abnormal findings specific to peroneal tendon pathology may include an avulsion of the base of the fifth metatarsal, a fleck avulsion off the distal fibula, indicating traumatic subluxation or dislocation of the peroneal tendons out of the fibular groove because of injury to the SPR hypertrophy of the peroneal tubercle, or the presence of an osperoneum. A Harris heel view helps with assessing hindfoot alignment and is best for evaluating peroneal tubercle hypertrophy as well as the retromalleolar groove [17,18].

Ultrasound imaging offers the advantage of 'dynamic' real-time imaging of the peronei, and may identify subluxation [19]. Grant et al. reported 90% accuracy in diagnosing peroneal tendon tears [20]. Injection of local anaesthetic into the tendon sheath may help localise pain to the peronei. In our two cases we did not advocate the use of steroids which carry a potential risk of subsequent tendon rupture.

MRI is the most effective diagnostic tool in depicting peroneal tendon tears. Findings suggestive of pathology of the peroneal tendons include oedema and thickening within the tendon or synovium, flattened or C-shaped tendon, irregularities of the surrounding tissue, and excessive fluid within the tendon sheath [7,21]. MRI has a relatively high sensitivity and specificity of 83% to 90% and 72% to 75%, respectively. However, its use is often disputable as it is often associated with many both false positive and false negative results [22]. In our reported cases, MRI findings showed PB splits and it was difficult to distinguish an evident split (case 1) from a false positive split (case 2) preoperatively. In case 2, MRI findings showed a flattened PB and a small longitudinal split right under the lateral malleolus and high signal in proton density – weighted axial magnetic resonance image (Fig. 3). These findings probably were due to forming symphysis of PB, following the injury 2 years ago. However, this was a false positive finding as it was demonstrated under surgical exploration. In cases when symptoms persist, surgical exploration and symphysiolysis is necessary to set the right diagnosis and to relief the patient from symptoms.

Regarding the mechanism, according to Munk and Davis, the split of PB may occur either after a subluxation or due to compression between fibula and peroneus longus muscle [23]. Dombenk et al., found that the PB tendon is most commonly affected [24]. Furthermore, Krause and Brodsky, reported on 20 patients with PB tear and suggested a classification system where grade 1 lesions (cross-sectional area tendon involvement<50%) require debridement and grade 2 lesions (>50%) require tenodesis on peroneus longus [25]. Bassett et al., reported that the surgeon may be alert that chronic ankle pain with "on and off" periods means peroneus tendon tear and needs surgical treatment [26]. Redfern and Myerson reported on 28 patients with chronic ankle pain, eight of them had instability too and 38% of them had both longus and brevis tendons tears. They suggested that the surgical treatment of peroneus brevis and longus tears is adequate [27]. A classification of PB tendon splits has been proposed by Sobel et al., based on the length of the split [8]. Furthermore, Chauhan et al., added MRI findings and suggested treatment options [28].

Treatment should only be applied to symptomatic patients. According to the ESSKA-AFAS international consensus conservative treatment of 8 weeks comprised of rest, NSAIDs and physiotherapy should be the initial approach [18,29]. When conservative treatment fails, the surgical technique is based on the extent and nature of the tear. There is a consensus for a threshold of a 50% tear and in that case any part of the tendon can be debrided and tubularized [25,29]. However, according to recent data this threshold is quite arbitrary. In the literature, treatment of peroneal tendon tears with primary debridement and repair has been associated with excellent return to full activity and patient-reported outcome scores [30]. For any tear over 50% usually a tenodesis with the healthy muscle or a single-stage grafting is advised. The single-stage grafting with an autograft is preferred because tenodesis is associated with a poorer outcome affecting the biomechanical balance of the foot often resulting in lateral ankle instability [31]. The use of an autograft, gracilis or semitendinosus tendons are usually the preferred choice [7,10,32–34]. Even though in our case 1 the split of the PB was Grade IV according to Sobel et al. classification system [8], we decided not to proceed in tenodesis as the tendon was healthy and viable without intraoperative subluxation and intact SPR and the final clinical outcome was excellent.

In cases of complete irreparable tears, including insufficient tendon excursion significant scarring, abnormal muscle atrophy, fatty infiltration, and/or frank rupture with large gap defects, no evidence exists to provide good treatment recommendations. The use of autologous flexor hallucis longus (FHL) or flexor digitorum longus (FDL) transfer has been proposed without considerable good outcomes [35].

The comprehensive literature review that was performed in PubMed database revealed 137 published cases of isolated PB tear or concomitant with peroneus longus tendon (Table 1). The majority of cases were misdiagnosed initially and the delayed diagnosis was the result of persistent pain in the ankle. The mean average age was 41.3 years old and the ratio between men and women was 3:2. The

most frequent definitive treatment options were debridement, repair of longitudinal split of the peroneus brevis, longus to brevis tenodesis and flexor tendon transfer of the FHL or of the FDL. The final outcome in most of the cases was excellent in three months follow up and all patients were returned to their daily activities.

Finally suggested rehabilitation protocols play a pivotal role in deciding how soon and if the patient can return to previous activity [32,54]. When surgery includes repair of the SPR, rehabilitation should consist of two-week non-weight bearing in a lower leg cast, followed by four weeks of weight bearing in a cast or a walker boot. When SPR is not repaired rehabilitation with early ROM is advisable [22,29].

Conclusion

The orthopaedic surgeon must be alert with the chronic lateral ankle pain and have always in mind a PB injury, if the symptoms remain. Our patients, despite the initial conservative therapy, complained about lateral ankle pain. Surgical treatment either by exploring and suturing the tear (case 1) or by symphysiolysis alone (case 2) led to patients' satisfaction and a good clinical outcome. Although MRI is the most effective diagnostic tool in depicting peroneal tendon tears, a false positive finding was present in our case 2. Further imaging investigation (U/S) should be always performed. When symptoms persist, surgical exploration is necessary to relief patients' symptoms.

References

[1] K. Yammine, The accessory peroneal (fibular) muscles: peroneus quartus and peroneus digitiquinti. A systematic review and meta-analysis, Surg. Radiol. Anat. 37 (2015) 617–627.
[2] M. Sobel, W.H. Bohne, M.E. Levy, Longitudinal attrition of the peroneus brevis tendon in the fibular groove: an anatomic study, Foot Ankle 11 (3) (1990) 124–128.
[3] K. Klos, M. Knobe, T. Randt, P. Simons, T. Mückley, Injuries of the peroneal tendons: often overlooked, Unfallchirurg 120 (12) (2017) 1020–1030.
[4] M. Philbin, S. Landis, B. Smith, Peroneal tendon injuries, J. Am. Acad. Orthop. Surg. 17 (5) (2009) 306–317.
[5] B. Di Giovanni, C. Fraga, B. Cohen, M. Shereff, Associated injuries found in chronic lateral ankle instability, Foot Ankle Int. 21 (2000) 809–815.
[6] R. Scanlan, R. Gehl, Peroneal tendon injuries, Clin. Podiatr. Med. Surg. 19 (2002) 419–431.
[7] S. Mihra, ?. Taljanovic, N. Jennifer, J. Alcala, L. Gimber, D. Joshua, J. Rieke, ?. Chilvers, L. Daniel, High-resolution US and MR imaging of peroneal tendon injuries, Radiographics 35 (1) (2015) 179–199.
[8] M. Sobel, M. Geppert, W. Bohne, S. Arnoczky, The dynamics of peroneus brevis tendon spits: a proposed mechanism, technique of diagnosis, and classification of injury, Foot Ankle 13 (7) (1992) 413–422.
[9] M. Geppert, M. Sobel, W. Bohne, Lateral ankle instability as a cause of periorperoneal retinacular laxity: an anatomic and biomechanical study of cadaver feet, Foot Ankle 14 (1993) 330–334.
[10] N. Squires, M. Myerson, C. Gamba, Surgical treatment of peroneal tendon tears, Foot Ankle Clin. N. Am. 12 (2007) 675–695.
[11] G. Sammarco, C. Di Raimondo, Chronic peroneus brevis tendon lesions, Foot Ankle 9 (1989) 163–170.
[12] B. Steginsky, A. Riley, L. Douglas, T. Philbin, G. Berlet, Patient-reported outcomes and return to activity after peroneus Brevis repair, Foot Ankle Int. (2015) 1–8.
[13] M. Bonnin, T. Tavernier, M. Bouysset, Split lesions of the peroneus brevis tendon in chronic ankle laxity, Am. J. Sports Med. 25 (1997) 699–703.
[14] K. Dadva, ?. Malhotra, P. Donnel, D. Singh, N. Cullen, Peroneal tendon disorders, in: EFORT Open Review EOR Vol 2, 2017. No 6.
[15] M. Safran, D. O'Malley, F. Fu, Peroneal tendon subluxation in athletes: new exam technique, cases reports, and review, Med. Sci. Sports Exerc. 31 (7) (1999), S487-92. Supplement.
[16] J. Karlsson, P. Wiger, Longitudinal Split of the peroneus brevis tendon and lateral ankle instability: treatment of concomitant lesions, J. Athl. Train. 37 (4) (2002) 463–466.
[17] D. Heckman, G. Gluck, S. Parekh, Tendon disorders of the foot and ankle, part1: peroneal tendon disorders, Am. J. Sports Med. 37 (3) (2009) 614–625.
[18] B. Roster, P. Michelier, E. Giza, Peroneal tendon disorders, Clin. Sports Med. 34 (4) (2015 Oct) 625–641.
[19] J. Neustadter, S. Raikin, L. Nazarian, Dynamic sonographic evaluation of peroneal tendon subluxation, AJR Am. J. Roentgenol. 183 (2004) 985–988.
[20] T. Grant, A. Kelikian, S. Jereb, R. McCarthy, Ultrasound diagnosis of peroneal tendon tears. A surgical correlation, J. Bone Joint Surg. Am. 87- A (2005) 1788–1794.
[21] J. Kennedy, P. van Dijk, C. Murawski, G. Duke, H. Newman, W. Christopher, C. DiGiovanni, Y. Yasui, Functional outcomes after peroneal tendoscopy in the treatment of peroneal tendon disorders, Knee Surg. Sports Traumatol. Arthrosc. 24 (2016) 1148–1154.
[22] Pim A.D. van Dijk, M. Gino, M. Kerkhoffs, C. Chiodo, W. Christopher, C. DiGiovanni, Chronic disorders of the peroneal tendons: current concepts review of the literature, J. Am. Acad. Orthop. Surg. 27 (2) (2019) 590–598.
[23] R.L. Munk, P.H. Davis, Longitudinal rupture of the peroneus brevis tendon, J. Trauma 16 (1976) 803–806.
[24] M. Dombek, B. Lamm, K. Saltrick, R. Mendicino, A. Catanzariti, Peroneal tendon tears: a retrospective review, J. Foot Ankle Surg. 42 (2003) 250–258.
[25] J. Krause, J. Brodsky, Peroneus Brevis tendon tears: pathophysiology, surgical reconstruction, and clinical results, Foot Ankle Int. 19 (1998) 271–279.
[26] F.H. Bassett 3rd, K.P. Speer, Longitudinal rupture of the peroneal tendons, Am. J. Sports Med. 21 (3) (1993) 354–357.
[27] D. Redfern, M. Myerson, The management of concomitant tears of the peroneus longus and brevis tendons, Foot Ankle Int 25 (2004) 695–707.
[28] B. Chauhan, P. Panchal, E. Szabo, T. Wilkins, Split peroneus brevis tendon: an unusual cause of ankle pain and instability, JABFM 27 (2014) 297–302.
[29] P. van Dijk, D. Miller, J. Calde, C. DiGiovanni, J. Kennedy, G. Kerkhoffs, D. Havercamp, S. Guillo, X. Oliva, C. Pearce, H. Pereira, P. Spennacchio, J. Stephen, N. van Dijk, The ESSKA-AFAS international consensus statement on peroneal tendon pathologies, Knee Surg. Sports Traumatol. Arthrosc. 26 (10) (Oct 2018) 3096–3107.
[30] A. Saxena, A. Cassidy, Peroneal tendon injuries: an evaluation of 49 tears in 41 patients, J. Foot Ankle Surg. 42 (2003) 215–220.
[31] T. Philbin, G. Landis, B. Smith, Peroneal tendon injuries, J. Am. Acad. Orthop. Surg. 17 (5) (2009) 306–317.
[32] M. Pellegrini, R. Glisson, T. Matsumoto, A. Schiff, L. Laver, M. Easley, A. James, J. Nunley, Effectiveness of allograft treconstruction tenodesis for irreparable peroneus Brevis tears: a cadaveric model, Foot Ankle Int. 37 (2016) 803–808.
[33] W. Mook, S. Parekh, J. Nunley, Allograft reconstruction of peroneal tendons: operative technique and clinical outcomes, Foot Ankle Int. 34 (2013) 1212–1220.
[34] D.R. Nishikawa, F.A. Duarte, G.H. Saito, C. Cesar Netto, A.C. Monteiro, M.P. Prado, I.F. Grava de Sousa, Reconstruction of the Peroneus Brevis Tendon Tears with Semitendinosus Tendon Autograft, Case Rep. Orthop. 2019 (Jun 11 2019), 5014687, https://doi.org/10.1155/2019/5014687, 6 pages.
[35] J. Seybold, J. Campbell, C. Jeng, K. Short, M. Myerson, Outcome of lateral transfer of the FHL or FDL for concomitant peroneal tendon tears, Foot Ankle Int. 37 (2016) 576–581.
[36] P. Scheidegger, L. Weisskopf, A. Hirschmüller, Atraumatic bilateral rupture of the peroneus brevis tendon in recreational sport: a case report, SAGE Open Med. Case Rep. 5 (Dec 11 2017), 2050313X17745225.
[37] Y. Morimoto, Y. Tokuhashi, Reconstruction of complete peroneus longus and brevis tendon ruptures using a semitendinosus and gracilis tendon graft, Acta Med. Okayama 73 (6) (2019 Dec) 533–536.

[38] J.R. Jockel, J.W. Brodsky, Single-stage flexor tendon transfer for the treatment of severe concomitant peroneus longus and brevis tendon tears, Foot Ankle Int. 34 (5) (2013) 666–672.
[39] C.P. Clement, R. Guberman, E. Lee, L.P. DeJesus, Use of cadaveric graft in reconstruction of peroneus brevis rupture and lateral ankle instability a case report, J. Am. Podiatr. Med. Assoc. 109 (1) (2019 Jan) 70–74.
[40] F. Radice, J.E. Monckeberg, G. Carcuro, Longitudinal tears of peroneus longus and brevis tendons: a gouty infiltration, J. Foot Ankle Surg. 50 (6) (Nov-Dec 2011) 751–753.
[41] J. Leppilahti, T. Flinkkilä, P. Hyvönen, M. Hämäläinen, Longitudinal split of peroneus brevis tendon. A report on two cases, Ann. Chir. Gynaecol. 89 (1) (2000) 61–64.
[42] O. Minoyama, E. Uchiyama, H. Iwaso, K. Hiranuma, Y. Takeda, Two cases of peroneus brevis tendon tear, Br. J. Sports Med. 36 (1) (Feb 2002) 65–66.
[43] L.M. Ochoa, R. Banerjee, Recurrent hypertrophic peroneal tubercle associated with peroneus brevis tendon tear, J. Foot Ankle Surg. 46 (5) (2007) 403–408.
[44] M. Tiwari, V. Singh, R. Bhargava, Peroneus brevis attrition & longitudinal split tear without subluxation and associated hypertrophy of peronal tubercle" - treatment of an uncommon lesion, J. Orthop. Case Rep. 5 (1) (Jan-Mar 2015) 34–36.
[45] Scott Carlis, Daniel Pollack, Shaylyn McTeague, Greg Khaimov, Peroneus Quartus Muscle Autograft, J. Am. Podiatr. Med. Assoc. 107 (1) (2017) 76–79.
[46] G.C. Diaz, M. van Holsbeeck, J.A. Jacobson, Longitudinal split of the peroneus longus and peroneus brevis tendons with disruption of the superior peroneal retinaculum, J. Ultrasound Med. 17 (8) (1998) 525–529.
[47] B.E. De Yoe, A. Ng, B. Miller, M.S. Rockett, Peroneus brevis tendon rupture with tophaceous gout infiltration, J. Foot Ankle Surg. 38 (5) (1999) 359–362.
[48] A. Fischetti, J.P. Zawaideh, D. Orlandi, S. Belfiore, E. SIlvestri, Traumatic peroneal split lesion with retinaculum avulsion: diagnosis and post-operative multymodality imaging, World J. Radiol. 10 (5) (May 28 2018) 46–51.
[49] W.M. Wind, B.J. Rohrbacher, Peroneus Longus and Brevis rupture in a collegiate athlete, Foot Ankle Int. 22 (2) (2001) 140–143.
[50] E.D. Lagoutaris, H.B. Adams, L.A. DiDomenico, R.J. Rothenberg, Longitudinal tears of both peroneal tendons associated with tophaceous gouty infiltration. A case report, J. Foot Ankle Surg. 44 (3) (2005) 222–224.
[51] D.C. Borton, P. Lucas, N.M. Jomha, M.J. Cross, K. Slater, Operative reconstruction after transverse rupture of the tendons of both peroneus longus and brevis. Surgical reconstruction by transfer of the flexor digitorum longus tendon, J. Bone Joint Surg. (Br.) 80 (5) (Sep 1998) 781–784.
[52] I. Bojanic, D. Dimnjakovic, I. Bohacek, T. Smoljanovic, Peronealtendoscopy – more than just a solitary procedure: case-series, Croat. Med. J. 56 (1) (2015) 57–62.
[53] E. Larson, Longitudinal rupture of the peroneus brevis tendon, J. Bone Joint Surg. 69B (1987) 340–341.
[54] P. VanDijk, B. Lubberts, C. Verheul, C. DiGiovanni, G. Kerkhoffs, Rehabilitation after surgical treatment of peroneal tendon tears and ruptures, Knee Surg. Sports Traumatol. Arthrosc. 24 (2016) 1165–1174.