

Peroneal tendon disorders

Anatomy & Pathophysiology

BONY AND SOFT TISSUE ANATOMY

- The peroneus longus (PL) and peroneus brevis (PB) tendons are innervated by the superficial peroneal nerve (S1) [4].
- The peroneus longus and peroneus brevis originate from the fibula and interosseous membrane [4].
- The peroneal tendons run in a sulcus called the peroneal groove formed posteriorly in the fibula [4].
- The peroneal groove is further stabilized by a fibrocartilaginous rim and the superior peroneal retinaculum (SPR) [4].
- Within the peroneal groove, the PB tendon is anterior and medial to the PL tendon [4].
- Both peroneal tendons curve anteriorly around the tip of the fibula [4].
- The peroneal tubercle separates the PL and PB tendons at the level of the calcaneus [4].
- The PB tendon runs distally to insert onto the tuberosity of the fifth metatarsal [4].
- The PL tendon makes a 90° turn medially at the cuboid groove before inserting into the base of the first metatarsal and medial cuneiform [4].
- The peroneus brevis originates from the distal half of the lateral fibula [14].
- The peroneus longus originates more proximally on the lateral fibula [14].
- The peroneus longus inserts into the medial cuneiform and the first metatarsal base [14].
- The SPR runs from the posterolateral ridge of the fibula to the lateral calcaneus [14].
- The SPR functions as the primary restraint to peroneal tendon subluxation within the retromalleolar sulcus [14].
- The retromalleolar sulcus is deepened by a fibrocartilaginous rim which provides moderate inherent stability to the tendons [14].
- Within the retromalleolar sulcus, the peroneus longus is found posterior to the peroneus brevis [14].
- The low-lying muscle belly of the peroneus brevis typically terminates approximately 3 cm from the tip of the fibula [14].

VASCULAR SUPPLY AND WATERSHED ZONES

- A vascular watershed region just posterior to the fibula is the most common area of peroneal tendon injury [4].
- Compression from the PL on the PB is implicated in the vascular watershed region posterior to the fibula [4].

ANATOMIC VARIATIONS

- A low-lying PB muscle belly is an anatomic variation implicated in tendon tears and instability [4].
- The presence of a peroneus quartus muscle is an anatomic variation implicated in tendon tears and instability [4].
- The peroneus quartus muscle is present in 13% to 22% of individuals [4].
- The peroneus quartus muscle may be seen in the fibular groove and contributes to crowding of the fibro-osseous tunnel [4].

PATHOPHYSIOLOGY OF INJURY

- Peroneal tendon injuries occur when there is rapid dorsiflexion of the inverted foot [14].
- Anatomic studies demonstrate that peroneal tendons are perched along the distal fibula at 15° to 25° of plantar flexion, making them susceptible to inversion injury at this position [14].
- Rapid dorsiflexion of the inverted foot causes reflexive contraction of the peroneus brevis and longus [14].
- Reflexive contraction of the peroneal tendons can lead to frank tendon injury or injury to the superior peroneal retinaculum [14].
- Chronic symptoms develop when peroneal tendons are not anatomically located in their retromalleolar position and subsequently subluxate abnormally with ankle motion [14].
- Disruption of the SPR leads to repeated subluxation of the peroneal tendons [14].
- Repeated subluxation often leads to longitudinal tears, most frequently in the peroneus brevis where it runs within the fibular groove [14].
- Acute tendinitis may result from overuse, predisposition from a varus hindfoot, or stenosis within the peroneal tunnel [4].
- Stenosis within the peroneal tunnel can be caused by a peroneus quartus muscle or a low-lying PB muscle belly [4].
- Tendon tears may result from inversion injuries or injury causing tendon subluxation or dislocation [4].
- Most peroneal tendon tears occur in the PB tendon at the level of the fibular groove [4].
- Tears of the PL tendon are less common and usually occur at the peroneal tubercle [4].
- PB and PL tendon tears are often longitudinal and typically seen in chronic situations [4].
- Compression of the PB between the PL tendon and the posterior fibula is an etiologic factor for tendon tears [4].
- Subluxation or dislocation of the tendons is an etiologic factor for tendon tears [4].

- Diminished blood supply in the watershed region is an etiologic factor for tendon tears [4].
- An acute change in direction around the fibula is an etiologic factor for tendon tears [4].
- Ankle instability or varus heel is an etiologic factor for tendon tears [4].
- A shallow peroneal groove and overcrowding of the fibular groove are predisposing factors for dislocation or subluxation [4].
- Dislocation or subluxation occurs during an inversion injury to a dorsiflexed ankle with rapid reflexive contraction of the PL and PB tendons [4].
- Dislocation or subluxation results in a disruption of the SPR or fibrocartilage ridge [4].
- Acute longitudinal tendon tears may occur in the setting of dislocation or subluxation [4].
- Patients with dislocation or subluxation describe a “pop” or snapping sensation, followed by pain and swelling [4].
- Peroneal tendon injuries at the level of the ankle should be differentiated from Iselin disease, which is a traction apophysitis seen in the pediatric population [14].
- Iselin disease results from repetitive traction of the peroneus brevis at its attachment at the base of the fifth metatarsal [14].
- Symptomatic os vesalianum is a rare accessory bone adjacent to the fifth metatarsal in the substance of the peroneus brevis tendon that is included in the differential diagnosis of lateral fifth metatarsal pain in the pediatric population [14].

SPR INJURY CLASSIFICATION

- Grade I SPR injuries are characterized by partial avulsion of the SPR from the distal fibula, allowing subluxation of the tendons [14].
- Grade II SPR injuries involve separation of the SPR from the distal fibrocartilaginous rim, causing the tendons to pass between the SPR and the rim [14].
- Grade III SPR injuries are characterized by a frank cortical avulsion of the SPR from the distal fibula, forming a classic rim fracture [14].
- Grade IV SPR injuries are characterized by SPR failure at the calcaneus instead of the fibula [14].

Classification

- Peroneal tendon abnormalities are identified on routine magnetic resonance imaging of the foot and ankle [1].
- A low-lying peroneus brevis muscle belly is a potential source of tendon subluxation in patients with peroneal tendon pathologic features [1].
- Peroneus longus tears are associated with pathology of the os peroneum [1].
- Peroneal tendon dislocation can coexist with medial and lateral ligamentous laxity in the ankle joint [1].
- Peroneal tendon tears can be concomitant, involving both the peroneus longus and brevis tendons [1].

- Peroneal tendon tears can be classified as mid-substance defects [1].
- Peroneal tendon tears can be classified as irreparable [1].
- Peroneal tendon instability can be managed via repair of the superior peroneal retinaculum [1].
- Recurrent dislocation of the peroneal tendons is a distinct clinical presentation from primary dislocation [1].
- Peroneal tendon tears can be treated with debridement and primary repair [1].
- Peroneal tendon tears can be treated with allograft reconstruction [1].
- Peroneal tendon tears can be treated with tenodesis [1].
- Peroneal tendon tears can be treated with flexor tendon transfer [1].
- Peroneal tendon tears can be treated with sliding fibular graft repair [1].
- Peroneal tendon tears can be treated with staged reconstruction using a Hunter rod [1].
- Peroneal tendon tears can be treated with tendoscopic repair [1].
- Peroneal tendon tears can be treated with peroneal tendoscopy [1].
- Peroneal tendon tears can be treated with retinaculum repair with or without fibular groove deepening [1].
- Peroneal tendon tears can be treated with augmentation using an acellular dermal matrix allograft [1].
- Peroneal tendon tears can be treated with lateral transfer of the flexor hallucis longus or flexor digitorum longus [1].
- Peroneal tendon tears can be treated with single-stage flexor tendon transfer [1].
- Peroneal tendon tears can be treated with allograft reconstruction versus tenodesis in a cadaveric model [1].
- Peroneal tendon tears can be treated with mid-substance defect augmentation [1].
- Peroneal tendon tears can be treated with sliding fibular graft repair for recurrent subluxation [1].
- Peroneal tendon tears can be treated with treatment of coexisting medial and lateral ligamentous laxity [1].
- Peroneal tendon tears can be treated with long-term results of debridement and primary repair [1].
- Peroneal tendon tears can be treated with outcome after retinaculum repair with and without fibular groove deepening [1].
- Peroneal tendon tears can be treated with comparison of outcome after retinaculum repair with and without fibular groove deepening [1].
- Peroneal tendon tears can be treated with long-term results of debridement and primary repair of peroneal tendon tears [1].
- Peroneal tendon tears can be treated with single-stage flexor tendon transfer for severe concomitant peroneus longus and brevis tendon tears [1].
- Peroneal tendon tears can be treated with prevalence and role of a low-lying peroneus brevis muscle belly [1].
- Peroneal tendon tears can be treated with tendoscopic repair of the superior peroneal retinaculum via 2 portals [1].

- Peroneal tendon tears can be treated with allograft reconstruction of peroneal tendons: operative technique and clinical outcomes [1].
- Peroneal tendon tears can be treated with peroneal tendon abnormalities on routine magnetic resonance imaging [1].
- Peroneal tendon tears can be treated with effectiveness of allograft reconstruction vs tenodesis for irreparable peroneus brevis tears [1].
- Peroneal tendon tears can be treated with use of a Hunter rod for staged reconstruction of peroneal tendons [1].
- Peroneal tendon tears can be treated with mid-substance peroneal tendon defects augmented with an acellular dermal matrix allograft [1].
- Peroneal tendon tears can be treated with results of treatment of posterior ankle impingement syndrome and flexor hallucis longus tendinopathy in dancers [1].
- Peroneal tendon tears can be treated with outcome of lateral transfer of FHL or FDL for concomitant peroneal tendon tears [1].
- Peroneal tendon tears can be treated with patient-reported outcomes and return to activity after peroneus brevis repair [1].
- Peroneal tendon tears can be treated with peroneus longus tears associated with pathology of the os peroneum [1].
- Peroneal tendon tears can be treated with endoscopic repair of posterior ankle impingement syndrome due to os trigonum in soccer players [1].
- Peroneal tendon tears can be treated with ankle injuries in dancers [1].
- Peroneal tendon tears can be treated with sliding fibular graft repair for the treatment of recurrent peroneal subluxation [1].
- Peroneal tendon tears can be treated with treatment of peroneal tendon dislocation and coexisting medial and lateral ligamentous laxity in the ankle joint [1].

Clinical Presentation

ACUTE TENDINITIS

- Patients with acute peroneal tendinitis report swelling and pain in the lateral hindfoot or ankle [4].
- Physical examination for acute peroneal tendinitis reveals swelling and pain with palpation [4].
- Physical examination for acute peroneal tendinitis may reveal reduced strength [4].
- MRI evaluation of acute peroneal tendinitis reveals fluid within the peroneal tendon sheath [4].

TENDON TEARS OR RUPTURES

- Symptoms of peroneal tendon tears are similar to those of acute tendinitis [4].

- Physical examination results for peroneal tendon tears are similar to those of acute tendinitis [4].
- Subluxation or dislocation associated with peroneal tendon tears may be provoked during physical examination with eversion against resistance [4].
- MRI evaluation of peroneal tendon tears reveals longitudinal tears in the tendon [4].
- MRI findings of longitudinal peroneal tendon tears can be confused with a peroneus quartus muscle [4].
- Patients with complete peroneal tendon rupture present with severe limitation of eversion strength [4].

DISLOCATION OR SUBLUXATION

- Patients with peroneal tendon dislocation or subluxation describe a “pop” or snapping sensation [4].
- Patients with peroneal tendon dislocation or subluxation experience pain and swelling following the initial sensation [4].
- Physical examination for peroneal tendon dislocation reveals variable pain and swelling depending on the acuteness of the injury [4].
- Dislocation or subluxation of the peroneal tendons may be elicited during physical examination with ankle rotation [4].
- Dislocation or subluxation of the peroneal tendons may be elicited during physical examination by forcing the foot from a position of inversion and plantar flexion to a position of eversion and dorsiflexion [4].
- Radiographs for peroneal tendon dislocation may reveal an avulsion fracture of the distal fibula at the insertion of the superior peroneal retinaculum [4].

Investigations

IMAGING

- Plain radiographs may demonstrate a rim fracture of the lateral aspect of the distal fibula [9].
- Plain radiographs may demonstrate a retraction or fracture of the os peroneum in cases of acute rupture of the peroneus longus tendon [9].
- MRI may demonstrate displacement of peroneal tendons anterolateral to the retrofibular region [9].
- MRI reveals fluid within the peroneal tendon sheath in acute tendinitis [4].
- MRI reveals longitudinal tears in the tendon, but these can be confused with a peroneus quartus muscle [4].
- False-positive results showing longitudinal tears are common with MRI [9].
- Radiographs are usually negative for peroneal tendon subluxation, though a “fleck” of bone may be seen off the posterior distal fibula with a grade 3 injury [11].
- MRI can be used to identify injury to the superior peroneal retinaculum [11].
- MRI can be used to identify anomalous structures such as the peroneus quartus or a low-lying peroneal brevis muscle belly [11].

- Kinematic MRI of the ankle moving from dorsiflexion to plantar flexion has been suggested to be superior to static imaging because the pathologic process is position dependent [11].
- Ultrasonography has been reported to be effective for dynamically evaluating peroneal tendon subluxation [11].
- Ultrasound is useful as a dynamic tool to evaluate subluxation/dislocation [9].
- Dynamic ultrasound imaging has been used for intrasheath instability of peroneal tendons [3].
- Computed tomography assessment has been used for peroneal tendon displacement and posteromedial structure entrapment in pilon fractures [3].
- CT analysis has been used for peroneal tendon injuries [2].
- Ultrasound diagnosis of peroneal tendon tears has been correlated with surgical findings [2].
- Cadaver correlation of peroneal tendon changes with magnetic resonance imaging has been performed [2].

PHYSICAL EXAMINATION

- Physical examination reveals swelling and pain with palpation in acute tendinitis [4].
- Physical examination may reveal reduced strength in acute tendinitis [4].
- Subluxation or dislocation may be provoked during examination with eversion against resistance [4].
- Dislocation or subluxation may be elicited with ankle rotation or with forcing the foot from a position of inversion and plantar flexion to a position of eversion and dorsiflexion [4].
- Patients may have evidence of apprehension with resistant eversion, which may be relieved with manual stabilization of the peroneal tendons [9].
- Assessment for intratendinous subluxation is needed during physical examination [9].
- Tenderness in peroneal tendon subluxation is proximal to the tip of the fibula, whereas in lateral ankle ligament sprain it is distal to the tip of the fibula [11].
- Swelling in peroneal tendon subluxation is posterolateral, whereas in lateral ankle ligament sprain it is anteroinferior [11].
- The history for peroneal tendon subluxation includes snapping, whereas for lateral ankle ligament sprain it includes giving way [11].
- Peroneal tendon subluxation is worse with circumduction, whereas lateral ankle ligament sprain is not [11].
- Peroneal tendon subluxation is not worse on flexion-inversion, whereas lateral ankle ligament sprain is [11].

Treatment

NON-OPERATIVE

- Chronic peroneal tendinosis or tenosynovitis is initially treated with activity modification, NSAIDs, a lace-up ankle brace, and physical therapy [9].

- Prolonged immobilization in a cast and oral anti-inflammatory medication are recommended for localized inflammation and tendinitis at the peroneus longus tendon associated with the os peroneum [16].
- Ultrasound is useful as a dynamic tool to evaluate peroneal tendon subluxation or dislocation [9].

OPERATIVE: TENDON REPAIR AND DEBRIDEMENT

- Tenosynovectomy, débridement, and repair of degenerative tears are indicated for peroneal tendon pathology, usually involving the peroneus brevis [9].
- Early treatment of longitudinal splits reduces the risk of progression to a full tear [9].
- Excision and tenodesis are required when there is a complete rupture or a severely degenerative tendon (>50%) that prohibits repair [9].
- Debridement of the peroneus longus tendon, removal of the os peroneum, and tenodesis of the peroneus longus to the peroneus brevis are indicated for chronic reproducible tenderness in the plantar-lateral aspect of the lateral midfoot despite conservative treatment [16].
- If the cuboid tunnel is constricted during os peroneum removal, it may be enlarged with a small osteotome and rasp [16].
- Postoperative care for os peroneum removal involves a non-weight-bearing cast for 4 weeks, followed by protected weight bearing in a walking boot [16].
- Formal physical therapy is started at 8 weeks after surgery for os peroneum removal [16].

OPERATIVE: SUBLUXATION AND DISLOCATION

- Acute peroneal subluxation or dislocation requires repair or reconstruction of the superior peroneal retinaculum (SPR) [9].
- Chronic peroneal subluxation or dislocation requires repair or reconstruction of the SPR and fibular groove deepening [9].
- Fibular groove deepening is indicated if there is a shallow fibular groove [9].
- Peroneal retinacular repair is indicated if there is evidence of tendon subluxation [9].
- Assessment for intratendinous subluxation is needed during evaluation for peroneal tendon disorders [9].
- Patients may exhibit apprehension with resistant eversion, which may be relieved with manual stabilization of the peroneal tendons [9].

OPERATIVE: RECONSTRUCTION AND TRANSFER

- More than 50% degeneration of both the peroneus longus and brevis requires excision of both tendons [9].
- Good results are reported with lateral transfer of the flexor hallucis longus (FHL) or flexor digitorum longus (FDL) for concomitant peroneal tendon tears [9].
- Allograft reconstruction may be used if peroneal muscles demonstrate adequate excursion at the time of surgery with minimal atrophic change to the muscle [9].
- In younger, more active patient populations, allograft reconstruction can be considered for peroneal tendon disorders [9].

- If there is no viability of the proximal musculature, a tendon transfer of the FHL is a salvage operation that can restore some active function without expectation of normal function [9].
- Tendon transfer is typically directed to the fifth metatarsal [9].

OPERATIVE: ADJUNCTIVE PROCEDURES

- A Dwyer osteotomy (lateral closed-wedge osteotomy of the calcaneus) is used for hindfoot varus to limit the risk of recurrent tears and continued pain [9].

Complications

- Recurrent dislocation of the peroneal tendons is a recognized complication treated with retinaculum repair, with or without fibular groove deepening [1].
- Peroneal tendon tears may require debridement and primary repair [1].
- Severe concomitant peroneus longus and brevis tendon tears may be treated with single-stage flexor tendon transfer [1].
- Peroneal tendon instability can be treated with tendoscopic repair of the superior peroneal retinaculum via 2 portals [1].
- Allograft reconstruction is an operative option for peroneal tendons [1].
- Allograft reconstruction and tenodesis are compared as treatments for irreparable peroneus brevis tears [1].
- Staged reconstruction of peroneal tendons can utilize a Hunter rod [1].
- Mid-substance peroneal tendon defects can be augmented with an acellular dermal matrix allograft [1].
- Lateral transfer of FHL or FDL is an option for concomitant peroneal tendon tears [1].
- Sliding fibular graft repair is a treatment for recurrent peroneal subluxation [1].

References

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