Bilateral Peroneus Longus Tendon Rupture Through a Bipartite Os Peroneum

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Peroneus longus rupture with associated involvement of the os peroneum is an uncommon injury, and a small number of cases have been reported. Several mechanisms of injury have been suggested, but the most accepted theory is due to an inversion force placed on a cavovarus foot type. The sesamoid often becomes the focal point of the mechanical stresses and may fracture. Although the purpose of the sesamoid is to protect the tendon from rupture, the os peroneum may actually encourage fatigue (tear/rupture) under certain circumstances. Because this injury occurs at the cuboid notch, primary repair is complicated because of the inability to access the tendon as it courses deep within the midfoot. We present a bilateral case of peroneus longus rupture with involvement of the os peroneum in a patient with a cavovarus foot type. The injuries were sustained from an identical mechanism and occurred almost 1 year apart. In both situations, a peroneus longus to peroneus brevis tendon transfer was performed above the ankle joint in conjunction with partial excision of the fractured os peroneum. To the authors’ knowledge, this is the only reported case of peroneus longus rupture associated with fracture of the os peroneum to occur bilaterally. (The Journal of Foot & Ankle Surgery 46(4):270–277, 2007)

Key words: peroneus longus, os peroneum, tendon rupture, fracture, bipartite

Fracture of an os peroneum or fracture through a partite os peroneum both result in discontinuity of the peroneus longus tendon and are uncommon injuries. Inversion of the ankle with forced plantarflexion of the first ray in the cavovarus foot type places the peroneus longus at risk for rupture. (1–17). The peroneus longus tendon is most susceptible to injury at the cuboid notch because of the sharp change in direction of the tendon as it courses toward its insertion on the first ray. As a result, an intratendinous, fibrocartilaginous thickening or sesamoid (os peroneum) forms at the cuboid notch to shield the peroneus longus from the increased force at this location.

When an os peroneum is present, the tendon may be more susceptible to injury and rupture through the sesamoid because the bone is less forgiving than fibrocartilaginous thickening of the tendon. A bipartite or multipartite os peroneum may fracture through the fibrocartilaginous interval (sychondrosis) between the fragments and result in similar discontinuity of the peroneus longus tendon.

The literature regarding peroneal tendon ruptures with involvement of the os peroneum is limited. In 1942, Hadley reported the first case of a fractured os peroneum with 5 mm of displacement of the fracture fragments (1). Mains and Sullivan reported on a patient with an os peroneum fracture and concomitant rupture of the peroneus longus tendon due to trauma (2). Peacock et al reported a case of peroneus longus rupture with os peroneum fracture due to a supination injury (3). Cachia et al described a single case of spontaneous rupture with fracture (4). Saxena and Cassidy reported on 4 patients with peroneus longus tears and os peroneum fracture, but did not define these as longitudinal tears or transverse ruptures of the tendon (5). We report a case of bilateral peroneus longus tendon rupture with a bipartite os peroneum fracture that occurred almost exactly 1 year apart. To the authors’ knowledge, there are no other cases of traumatic bilateral occurrence.
Case Presentation

A 37-year-old healthy man presented to the emergency room after sustaining an inversion injury of his right foot and ankle while running around first base during a baseball game. He recalled a popping sound and had pain, swelling, and bruising to the lateral aspect of his ankle and midfoot. He was able to bear weight with pain. Before this injury, he related a history of chronic lateral ankle pain with sporadic ankle sprains, but had never sought medical attention. His past medical history was otherwise unremarkable.

Physical examination of the right lower extremity revealed obvious swelling to the lateral aspect of the ankle and midfoot. Ecchymosis was present inferior to the lateral malleolus. Pinpoint tenderness was present over the peroneal tubercle and at the calcaneocuboid joint. The patient was able to evert his foot with full strength, which appeared to be through the muscular contraction of peroneus brevis. Peroneus longus function could not be isolated and elicited pain with testing. A weight-bearing examination was not performed because of the pain, but loading of the foot revealed a pes cavus foot type. The first ray was stable, and no forefoot callosities were present.

Injury radiographs revealed a displaced fractured right os peroneum (Fig 1). The proximal fragment of the os peroneum retracted proximally to the level of the peroneal tubercle (Fig 2). The larger distal fragment of os peroneum remained at the cuboid notch and appeared to have both smooth and rough edges. Small flecks of bone were present at the cuboid notch. A diagnosis of peroneus longus rupture with os peroneum fracture was made. The appearance of the bone fragments are suggestive that the os peroneum may have been partite and ruptured/fractured through the partite site. Because of the patient’s history of chronic lateral ankle pain and sprains, a magnetic resonance image (MRI) was obtained to evaluate the peroneal tendons for preexisting disease as well as to confirm the diagnosis of an os peroneum fracture (Fig 3).

Eleven days after the injury, the patient was brought to the operating room. A curvilinear incision was made directly over the peroneal tendons from the fibular malleolus to the fifth metatarsal base. A subcutaneous hematoma was encountered consistent with the injury. The peroneal sheath and inferior peroneal retinaculum were incised. The peroneus longus rupture with fractured os peroneum was immediately identified at the peroneal tubercle. The large ossicle encompassed the entire width of the tendon. A 1-cm segment of tendinosis with the peroneus longus tendon was identified just proximal to the fracture. The peroneus brevis tendon was intact without rupture, longitudinal tear, or tendinosis. The distal fragment of the fractured os peroneum was identified at the cuboid notch. Because of the size of fracture fragments, tendinosis of the peroneus longus tendon, and inability to access the distal tendon stump, the prospects of performing a primary repair were abandoned. Rather, a peroneus longus to peroneus brevis tendon transfer...
was performed above the ankle joint. The distal tendon and fragment of os peroneum were left untouched. The incision was extended proximally, and the peroneus longus tendon was sutured to the posterior aspect of the peroneus brevis tendon. The peroneus longus tendon was debulked, and the adjoining paratenons were stripped as the tendons were secured together with an absorbable 2-0 suture. The tendon transfer was positioned with the foot at 90° to the leg. The peroneal tendon sheath was reapproximated. Subcutaneous tissue and skin closure was performed in the standard technique.

A Jones splint was placed on the operative extremity in the operating room. The patient would be non-weightbearing for 8 weeks total. At the first postoperative visit (2 weeks after the operation), sutures were removed. The extremity was placed into a removable cast boot for the remaining 6 weeks of non-weightbearing. The patient began a gentle range-of-motion program twice daily. Weightbearing was initiated after 8 weeks as well as a physical therapy program targeting peroneal muscle strength and proprioception. The patient was transitioned into stable shoes after 10 weeks postoperatively.

Although the postoperative course was uneventful regarding the operative right side, the patient was complaining of persistent lateral ankle pain in the peroneal tendon region of the contralateral side. He related a sporadic history of lateral ankle pain in the past, but this episode was exacerbated by the non-weightbearing status of the contralateral extremity. Physical examination of the left lower extremity revealed minimal pain along the peroneus longus tendon from the fibular malleolus to the peroneal tubercle. Peroneus longus strength was slightly diminished (grade 4+/5) and elicited pain with resistance. A weightbearing examination demonstrated a high arch foot with slight heel varus of 2° inverted. Radiographs were not obtained. Magnetic resonance imaging demonstrated a partite os peroneum extending the entire width of the tendon (Fig 4), minimal intratendinous signal of the peroneus longus tendon proximal to the ossicle, and thickening of the tendon at the peroneal tubercle region—suggestive of a tendinosis and a longitudinal split of the tendon. Surgery was offered to the patient, but he declined, and a conservative treatment program of physical therapy, antiinflammatories, and an ankle brace was implemented.

![MRI (fat saturation sequence) of right foot clearly visualizes the retracted fractured os peroneum (black arrow) retained within the peroneus longus tendon. Note the fusiform thickening of the peroneus longus tendon just proximal to fracture fragment, indicative of tendinosis. Peroneus brevis tendon is visualized and intact (white arrow).](image-url)
Almost exactly 1 year from the previous injury and from similar activity, the patient injured his left ankle while sliding into a base during a baseball game. The patient recalled a popping sound within the ankle. He related a history of pain and discomfort involving the peroneal area for 1 week before this injury.

Physical examination of the left lower extremity revealed localized swelling to the lateral aspect of the ankle and mid-foot. There was ecchymosis over the peroneal tubercle. Pinpoint tenderness was present over the peroneal tubercle and at the calcaneocuboid joint. The patient was able to evert his foot with full strength, which appeared to be through the muscular contraction of peroneus brevis. Peroneus longus function could not be isolated and elicited pain with testing.

Injury radiographs revealed a fractured right os peroneum (Fig 5). The bone fragments were significantly displaced, with a large fragment retracted proximally to the level of the peroneal tubercle and a smaller waferlike fragment as well as a bone fleck of the os peroneum remaining at the cuboid notch. A diagnosis of peroneus longus rupture with os peroneum fracture was made. An MRI was obtained to evaluate any further intratendinous damage to the peroneus longus compared with the patient’s study 1 year before on the same extremity (Fig 6). The radiographic appearance of the fracture fragments and MRI suggest that os peroneum was partite and fractured/ruptured through the partite site.

The patient was brought to the operating room, and a peroneus longus to peroneus brevis tendon transfer above the level of the ankle joint was performed on the left lower extremity. A curvilinear incision was made directly over the peroneal tendons, beginning proximal and posterior to the fibular malleolus extending past the peroneal tubercle. The peroneal sheath and inferior peroneal retinaculum were incised. The peroneus longus rupture with fractured os peroneum was located at the peroneal tubercle (Fig 7). The large osseous encompassed the entire width of the tendon. In addition, a 1-cm segment of tendinosis within the peroneus longus tendon was identified just proximal to the fracture. The peroneus brevis tendon was intact without rupture, longitudinal tear, or tendinosis. Because of the size of the proximal fracture fragments, tendinosis of the
peroneus longus tendon and inability to access the distal tendon stump, the prospects of performing a primary repair were abandoned. A peroneus longus to peroneus brevis tendon transfer was performed above the ankle joint. The distal tendon and fracture fragment of the os peroneum were left untouched. The peroneus longus tendon was sutured to the posterior aspect of the peroneus brevis tendon. The peroneus longus tendon was debulked, and the adjoining paratenons were stripped as the tendons were secured together with an absorbable 2-0 suture. The tendon transfer was positioned with the foot at 90° to the leg. The peroneal tendon sheath was reapproximated with 3-0 absorbable suture. Subcutaneous tissue and skin closure was performed in the standard technique.

At follow-up 1 year after surgery on the patient’s left side and 2 years after surgery on the patient’s right side, he was satisfied with his outcome. Clinically, the incisions were well healed, and there was no pain at the surgical sites. As expected, the patient is unable to plantarflex the first ray bilaterally. The first ray remained stable, and first ray elevatus did not develop. In addition, his chronic lateral ankle pain has been resolved as a result of this injury and reconstruction.

Discussion

Several etiologic factors have been associated with peroneus longus injuries. Forced inversion may place the peroneus longus at risk for injury. Advanced age, inflammatory arthritis, obesity, and metabolic disease may be contributing factors (6, 7, 19–23). Previous steroid injection(s) or oral agents known to elicit tendon rupture (for example, Ciprofloxacin) should not be overlooked (8, 24). Some of the anatomic and mechanical factors that play a role in peroneus brevis injuries are also suggested to occur with peroneus longus injuries. These include a flat fibular groove, hypertrophic peroneal tubercle, giant lateral malleolus, peroneal subluxation, and lateral ankle instability (8–14, 19, 20, 25–27). Although mechanical lateral ankle instability has long been linked to peroneal tendon pathology, Bassett and Speer state that ankle instability is not a requirement for either peroneus brevis or longus tendon injury (9–12, 25–28). It is thought that a cavovarus foot type places increased stress on the peroneal tendons, which may predispose the tendons to injury and/or degeneration (6–10, 13, 14, 16–19). A watershed area (hypovasular zone) has been suggested to predispose the tendon to rupture as well (29–31).

The presence of an os peroneum, especially an enlarged ossicle, is associated with peroneus longus tendon ruptures (8, 17, 32). Although the purpose of the sesamoid is to protect the tendon from rupture, the os peroneum may actually encourage fatigue (tear/rupture) under certain circumstances. The presence of an os peroneum has been reported to occur in 5% to 26% of individuals. (3, 4, 6, 7, 13, 17, 26, 33–45). Grant identified an os peroneum in 26% of 92 cadaveric dissections (41). Burman and Lapidus reviewed 1000 radiographs and found a 14% incidence of the os peroneum (39). A collective effort by the Anatomical Society identified that the os peroneum was present in 20% of 225 feet (37). They also identified that fibrocartilaginous thickening within the tendon occurs at the cuboid notch in 55% of feet (37). Sarrafian reported that fibrocartilaginous thickening is always present and is fully ossified in 20% of cases (13, 17, 19, 34, 42). Edwards also reported ossification of the os peroneum in 20% of cases (46). The os peroneum may also demonstrate partism. In a radiographic review, Burman and Lapidus found that when the os peroneum is present, 19% were bipartite and 1% were multipartite (39). Bianchi indicated that 25% of patients with an os peroneum may be partite (47).

The most common injury to the peroneus longus tendon is a longitudinal split (19, 22). Complete transverse rupture is rare. The presence of an os peroneum has been listed as an etiologic factor to peroneus longus tendon rupture or tear (3, 5, 15, 17). Partite sesamoids may render the tendon more susceptible to rupture/fracture because of a potential innate area of weakness between the sesamoid fragments. A non-displaced fracture of the os peroneum is not always a straightforward diagnosis in the presence of partism. A
partite os peroneum may be mistaken for a fracture when there is a specific history of trauma. Displaced fragments of bone with ragged edges may be easily distinguished. Nonetheless, peroneus longus ruptures and discontinuity associated with an os peroneum fracture or fracture through a partite os peroneum is an uncommon event.

In this case report, the radiographic appearance of the fractured os peroneums is suggestive that the os peroneum may have been partite because the edges of the bone-displaced bone fragments had both smooth and rough edges. We were fortunate to have magnetic resonance imaging of the left side before and after the injury, confirming the presence of partism on the left side. It appears that the os peroneum fracture occurred through the partite region (Figs 4 and 6). This suggests that a partite os peroneum may be predisposed to fracture through the synchondrosis site. McMaster’s observations that tendon ruptures may occur at the insertion of tendon into bone further support the concept that the os peroneum may predispose the peroneus longus tendon to rupture (48).

Repairing peroneus longus ruptures at the cuboid notch with or without the presence of an os peroneum is a surgical dilemma because it may be difficult to access the distal stump of the tendon deep in the midfoot. Ruptures with a small os peroneum and little gapping of the tendon ends may be repaired with an end-to-end anastomosis, as long as the distal tendon end is accessible. In some situations, tendon grafting may be needed to augment the repair (15, 17, 21, 31, 29, 36, 49–53). Harvest sites for tendon grafting of the peroneus longus have included the plantaris tendon, peroneus tertius, half of the peroneus brevis, or deep fascia (15, 18, 29). Peroneus longus ruptures with a large os peroneum and a significantly displaced fragment is a more challenging situation. Cerclage wiring of the os peroneum fracture may be performed. Peacock et al reported primary repair of an os peroneum fracture by weaving nonabsorbable suture through the ossicle and tendon (3). Many would argue the purpose of fixating an os peroneum fracture altogether because it will remain a point of possible tendon weakness. Some advocate excising the fractured bone segments (3, 5, 6, 15, 17, 21, 36). However, if primary tendon repair is attempted after removing
Primary repair was precluded because of the large size of fractured bipartite os peroneum and associated tendinosis of the peroneus longus tendon. At the time of surgery, we considered performing a free tendon graft; however, this would require a lengthy graft that would be difficult to secure to the distal stump. Accessing the distal peroneus longus tendon stump after excision of the large distal os peroneum fracture fragment would be challenging and, most importantly, would likely not provide enough remaining peroneus longus tendon to anastomose to the peroneus brevis at the cuboid notch.

If the distal peroneus longus tendon stump is unable to be re-anastomosed to the peroneus brevis, then removal of the distal os peroneum fracture fragment is probably not necessary. We believe that the risks of removal are greater than simply leaving the fracture fragment undisturbed. Gaining access to the distal os peroneum fracture fragment at the cuboid notch potentially exposes the sural nerve to injury as well as increases the risk for deep complications such as hematoma, vascular injury, and/or scar tissue formation. If the retained distal fractured os peroneum becomes symptomatic, then it could be removed in the future. The greater concern is the loss of peroneus longus effect on the first ray, which may potentially result in first ray elevatus. Loss or dampening of peroneus longus in patients with pes cavovarus may be advantageous in certain circumstances. Because our patient had both lateral ankle instability and a cavovarus foot type, we performed a peroneus longus to peroneus brevis tendon transfer above the ankle joint and left the distal fracture fragment undisturbed. Because we were pleased with the clinical and functional result obtained with the right lower extremity surgery, the same procedure was performed on the left lower extremity.

Conclusion

The peroneus longus tendon may be susceptible to injury in the presence of an os peroneum. While the purpose of the sesamoid is to protect the tendon from rupture at the cuboid notch, the presence of a partite os peroneum may actually encourage fatigue (tear/rupture) under certain circumstances. We present a case of traumatic bilateral peroneus longus rupture with fracture of a partite os peroneum in a patient with a cavovarus foot type. A peroneus longus to peroneus brevis tendon transfer was performed above the ankle joint.

References

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