Oxford City Publishers

Case Reports in Orthopaedic Surgery Journal

Case Report | Vol 3 Iss 2

Posterior Tibialis Tendon Rupture in Patient with Osteogenesis Imperfecta: A Case Report

Fredrik H Rovsing[1*], Jonas A Andersen[1,2], Henrik Wilbek[1] and Andreas B Knudsen[1]

[1]Orthopedic Department, North Zealand Hospital, Hillerød, Denmark

[2]Department of Clinical Medicine, University of Copenhagen, Copenhagen N, Denmark

[*]**Corresponding author:** Fredrik H Rovsing, Orthopedic Department North Zealand Hospital, Denmark.

E-mail: carl.fredrik.holm.rovsing@regionh.dk

Received: March 06, 2024; **Accepted:** March 23, 2024; **Published:** April 15, 2024

Abstract

In this case report we present a posterior tibialis tendon (PTT) rupture in a male patient with Osteogenesis Imperfecta (OI) in his mid-forties. The incidence of OI has been reported between 1/15000 to 1/20000. It is characterized by fragile bone structure and skeletal dysplasia. The clinical manifestations of OI can pose challenges when planning and performing surgical interventions for ailments like tendon ruptures.

We present a case from initial diagnosis through surgery and nine month clinical follow-up. Despite a complex medical history involving OI and an anamnestic record of PTT insufficiency a year before the acute injury, this case indicates the potential for successful surgery and healing following PTT rupture in patients with OI even with delayed treatment. To our knowledge, no prior reports on treatment of PTT rupture in patients with OI have been published.

Keywords: Osteogenesis imperfecta; Posterior tibialis tendon; Tibialis posterior tendon; Tendon reinsertion; Calcaneal osteotomy

Introduction

Osteogenesis Imperfecta (OI) is a rare skeletal disorder inherited through an autosomal dominant pattern and genetic heterogeneity, caused by mutations of collagen type 1 genes with an incidence between 1/15000 to 1/20000 [1,2]. Depending on the severity of OI, bone deformity, short stature and multiple fractures throughout the affected individuals life can be expected [1]. In addition, OI can affect connective tissue and have extra skeletal manifestations as; dental abnormalities, hearing loss, muscle weakness and cardiopulmonary complications among others [3]. The Sillence classification system (type I-VII) is frequently used to classify the severity and prognosis of OI and to determine appropriate treatment strategies [3]. Prior murine studies have suggested that OI may affect the mechanical properties of tendons [4]. However, these findings have not been translated to human studies and the effect of OI on human tendons remain unclear.

The posterior tibialis tendon (PTT) originates from the proximal posterior aspect of the tibia, fibula and interosseus membrane. It makes an acute turn behind the medial malleolus, passing through a fibrous tunnel. The distal insertion can present an anatomical variation, but most commonly includes the navicular bone (os naviculare), cuneiforms and second to fourth metatarsals [5]. The insertion on to the navicular bone is key to the PTTs function, as the navicular bone plays a key role in the biomechanics of the foot and the PTT is the main dynamic stabilizer of the longitudinal foot arch and a powerful inverter [6].

PTT dysfunction can have several causes i.e. inflammatory synovitis, degenerative rupture and acute trauma [7]. Regardless of the underlying pathology of PTT rupture, it is often preceded by mechanical weakening of the tendon [7].
In 1996 Myersen revised the original clinical classifications systems for PTT dysfunction proposed by Johnson and Storm in 1989. The classification ranges from stage I to IV depending on level of pain and degree of hindfoot deformity [8,9]. Stage I presents as tenosynovitis, while stage IV presents with complete dysfunction of the PTT and concurrent flatfoot deformity [8,9]. This system is widely accepted and used as a guide for appropriate treatment regimes. In mild cases the treatment regime will commonly consist of initial conservative treatment, with surgical treatment reserved for refractory and complex cases [10]. Both conservative and surgical treatment aim to restore the arch of the foot and correct hindfoot valgus [10]. Operative treatment aims to restore the function of the PTT and restore the normal anatomy through procedures such as osteotomies and arthrodesis [11-14].

The existing literature has described cases of tendon ruptures in individuals with OI. The published literature on the matter consists of case reports on quadriceps-, patellar- and Achilles tendon ruptures. These case reports speculate that tendon rupture associated with OI often occurs at the insertion point of the tendon [15-22].
In this case report we present a patient with OI and a traumatic ipsilateral PTT rupture – we present the case from diagnosis through surgical treatment, with tendon transfer and calcaneal osteotomy and nine month clinical follow up.

Case Presentation

A male patient in the mid-forties presented in the emergency department (ED) with pain at the medial aspect of the left foot. The patient had suffered a trauma to the left foot four days prior to initial contact. The trauma consisted of a distortion of the foot during play with his child. The patient felt a snap in the ankle and acute onset of pain on the medial side of the foot, leaving him unable to weight bear on the foot. Initially interpreted as a distortion in the ED he was treated with a walker boot and allowed to weight bearing within pain tolerance.

At follow up, 16 days after the injury, the clinical presentation was consistent with a lesion of the PTT, due to medially localized pain and accentuated pes planus. At day 21 the diagnosis was confirmed by ultrasound, showing an intact tibialis posterior muscle and tendon with an osseus tear at the insertion site of the PTT. The findings were further supported by x-ray and Computerized Tomography-scan (CT-scan) (Figure 1).

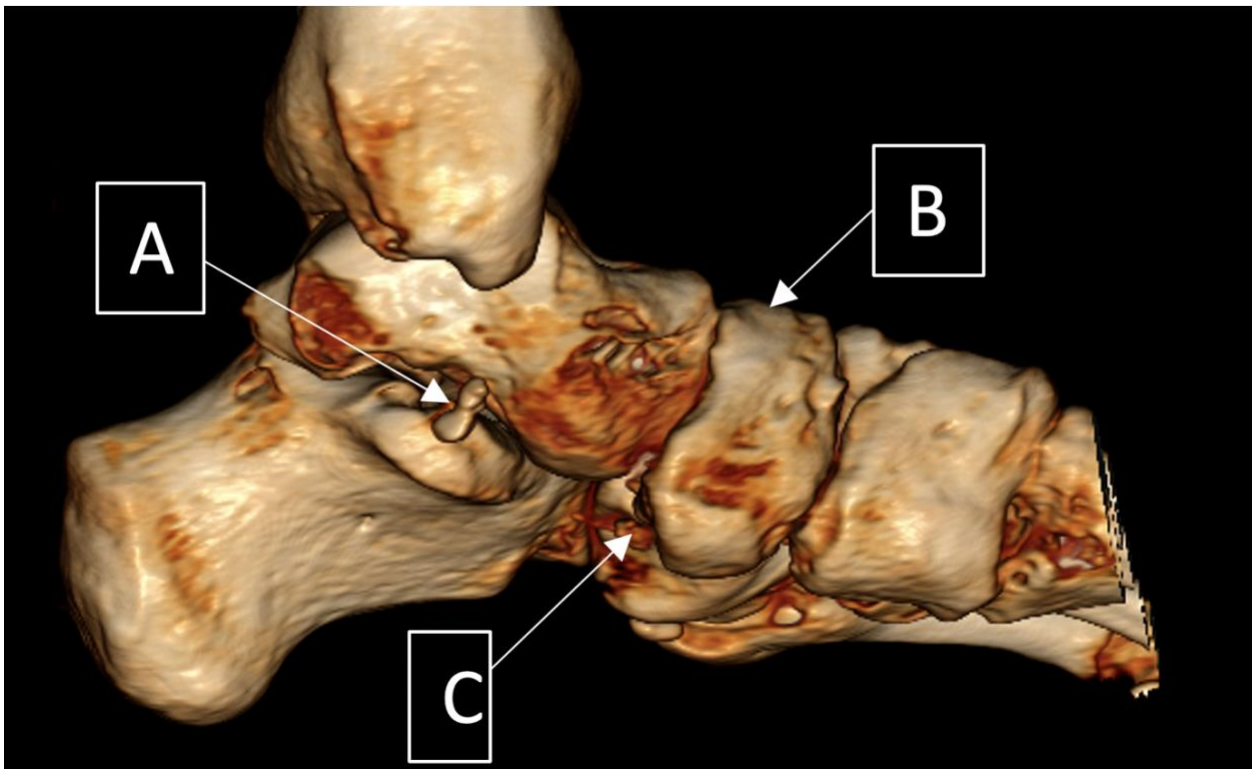

Figure 1: Preoperative CT scan with 3D reconstruction at day 21.

A: Retracted avulsion fracture from the os navicular attached to the posterior tibialis tendon

B: Os naviculare

C: Avulsion at the insertion site of the posterior tibialis tendon on the os naviculare.

At day 22 after the accident the patient was seen by a foot surgeon. The patient informed that he had experienced increasing pain on the medial side of the left foot during the past year leading up to the trauma, resulting in reduced walking distance from two kilometers (normal walking distance for the patient) to less than half a kilometer with crutches. In addition, the patient's OI had resulted in approximately 30 fractures during his lifetime, including fractures in the left foot many years ago. However, these prior fractures did not limit the patient's physical performance. Treatment of the patients OI was maintained by endocrinology outpatient clinic, with yearly follow-ups, including bone density scanning (DEXA-scan). At time of injury no medical treatment of the OI was prescribed to the patient. In addition, the patient suffered from gout which was treated with Allopurinol and Colchicin. The patient was a non-smoker and the blood supply to the affected foot was found to be within normal range.

A Magnetic Resonance Imaging scan (MRI-scan), at day 25, confirmed the PTT rupture with a bony fragment, which was retracted 2.7 cm from its insertion point. The posterior tibial muscle was seen with signs of atrophy and fat degeneration.

Based on the clinical findings and supported by the imaging diagnostic, a surgical approach was chosen. The patient was prepared for surgery at day 33 after the injury.

Operation

The surgery was performed by three foot and ankle surgeons (two senior surgeons and one senior registrar). The surgery was performed with the patient in general anesthesia, in a supine position. Preoperatively 2g of Cloxacillin was given prophylactically, with an additional 1g administered after two hours of surgery. Time of surgery was two and half hours.

1. Incision was placed in accordance with the PTT posterior to the medial malleolus and carried to the insertion on the navicular bone. The rupture was visualized distal to the medial malleolus with a bony fragment attached to the distal part (Figure 2).

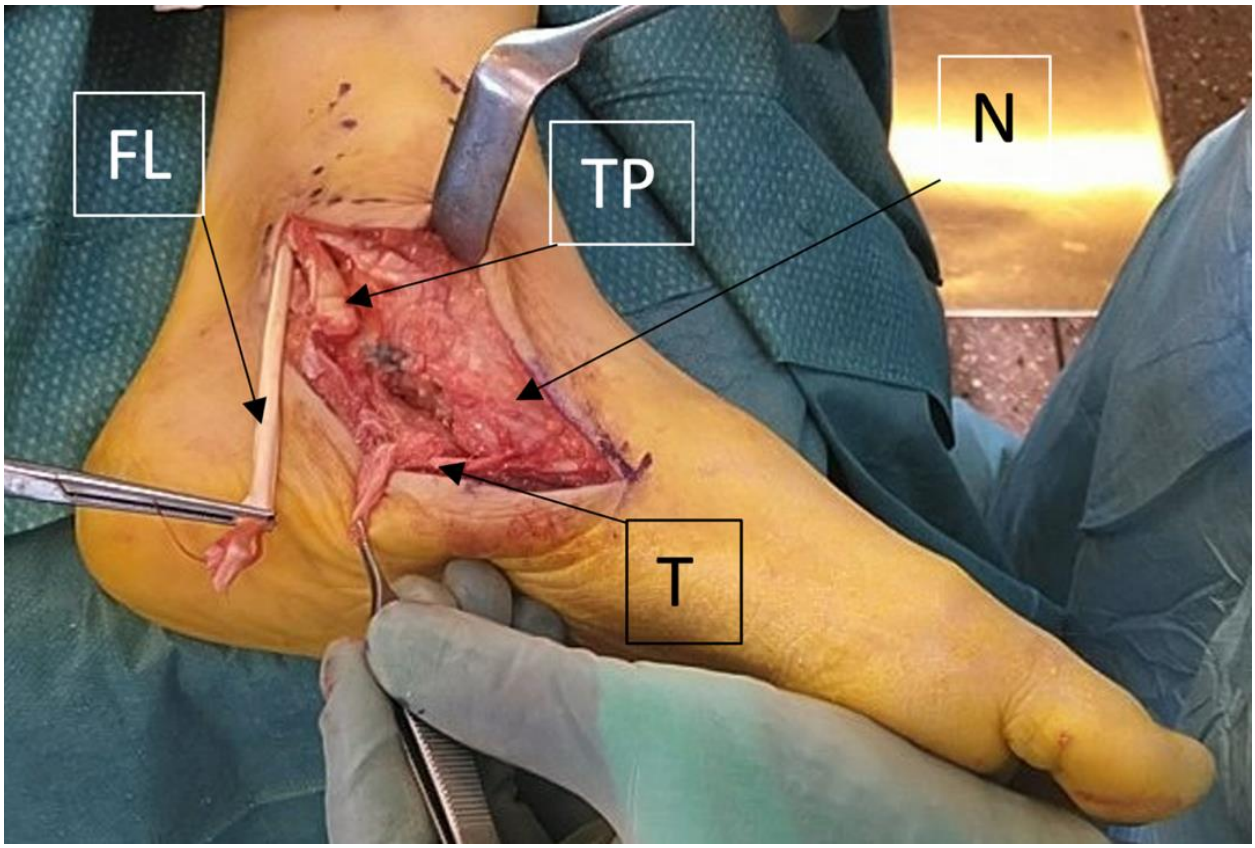

Figure 2: Perioperative image.

FL = Flexor hallucis longus tendon

TP = Tibialis posterior tendon

N = Os naviculare

T = Original insertion of the tibialis posterior tendon.

2. The spring ligament was visualized and found to be lax. With the foot in maximum inversion the spring ligament was repaired and tightened with a composite suture, Orthocord 2-0.
3. The flexor hallucis longus (FHL) and flexor digitorum longus (FDL) were visualized plantar to the first metatarsal. Distal to Henrys knot the FHL and FDL were sutured together side to side, using an Orthocord, size 3-0. After this the FDL was cut proximal to the sutures and cannulated through the retinaculum of the medial malleoli.

4. The PTT and FDL were pulled forward and sutured side to side, using an Orthocord size 3-0. A drill hole was made in os naviculare in an inferior to superior orientation. The sutured FDL/PTT construct was then passed through the hole in the os naviculare and sutured to the proximal part of the PTT. An additional corkscrew anchor was placed in the os naviculare but failed to gain purchase resulting in pull-out of the anchor using low force by hand. No additional placement of anchors was attempted.
5. Following reconstruction of the spring ligament and PTT, a V-shaped calcaneal osteotomy was performed. The posterior part of the osteotomy was displaced approximately 1cm medially and stabilized with two fully threaded 7.0mm compression screws (Figure 3). The osteotomy was preformed through a lateral incision over the calcaneus and screws were introduced percutaneously through the posterior aspect of the calcaneus.

Figure 3: Postoperative sagittal non-weight bearing X-ray (left, postoperative day 0). Postoperative non-weight bearing CT scan with 3D reconstruction (to the right, postoperative day 8).
A: Medializing calcaneus osteotomy fixed with 2 x FT Compressions screws
B: Avulsion fracture following pull out of corkscrew anchor placed in the os naviculare
C: Drill hole in os navicular where the flexor digitorum longus tendon and posterior tibialis tendon construct was pulled through.

6. The incisions were closed in layered fashion with absorbable sutures in the retinaculum and subcutis, size 0 and 2-0 respectively, and the dermis was closed with 3-0 non-absorbable sutures. A circular below the knee cast was applied with the ankle in 90 degrees and inverted position.

Postoperative treatment regime consisted of cast immobilization for six weeks without weight bearing, during this period anticoagulant therapy was prescribed. Sutures were removed three weeks after surgery. At six weeks postoperative follow up additional x-ray and CT-scans showed satisfactory results. Cast was replaced with a walker boot and the patient was allowed weight bearing for another six weeks.

At the 15 week follow up the patient showed continued clinical progress with satisfactory healing of skin and osteotomy (Figure 4). Activities of daily living were performed without medial foot pain, though still needing a single crutch occasionally.

Figure 4: Weight bearing sagittal X-ray of the left foot at 15 weeks follow up.

At nine months follow up the patient had regained function equivalent to the level he had two years prior to the PTT rupture. There was no remaining pain, only a discomfort and tightness in the Achilles tendon when descending stairs. The X-rays (Figure 5) showed satisfactory positioning of the screws and solid healing of the calcaneal osteotomy.

Figure 5: Sagittal and coronal x-rays of the calcaneus at 9 months follow up.

Discussion / Conclusion

We believe that this case of PTT rupture in a patient with OI adds important knowledge to an otherwise poorly described potentially debilitating complication to OI.

When dealing with an OI-patient with a trauma, one should show a high level of suspicion, not only of fractures but also of soft tissue injuries that are otherwise uncommon in the general population. Otherwise, atypical injuries can easily be misinterpreted or simply missed. Delay of diagnosis or missed diagnosis may lead to severe impairment of the individual with OI. In this case an otherwise minor trauma led to a PTT rupture, which was initially missed in the ER. Fortunately, the attending physician prescribed a follow-up visit in the out-patient clinic where the PTT rupture was diagnosed. It is therefore noted that obtaining a second opinion for patients of this nature can prove to be beneficial.

As highlighted by the perioperative findings, with brittle bone structure, preoperative planning is essential in these cases especially the need to include alternative plans if the primary plan fails. This further emphasizes the importance of a meticulous and careful approach when reinserting the PTT in general and especially in cases like this. We believe that reattachment of the ruptured tendon, through drill holes should be the preferred method in cases where bone structure may be impaired as in the case of OI, where anchors have a high risk of failing. The calcaneal osteotomy was performed as a supplementary realignment, according to general standards. The osteotomy of the calcaneus did not fail following full weight bearing, which shows that this can be a reliable procedure in OI patients with the correct approach.

As implied in many other case reports depicting tendon rupture in OI patients, the rupture occurred at the insertion point of the afflicted tendon. This leads us to believe that the tendon can be stronger than the bone in patients who suffer from OI.
Despite a complex medical history involving OI and an anamnestic record of PTT insufficiency a year before the acute injury, this case indicates the potential for successful surgery and healing even with delayed treatment.
We believe this case shows some of the pitfalls when dealing with OI patients. We also believe that this case report adds important knowledge on the surgical treatment of tendon ruptures of the patient with OI.

Abbreviations

OI: Osteogenesis Imperfecta; PTT: Posterior Tibialis tendon; ED: Emergency Department; FDL: Flexor Digitorum Longus; FHL: Flexor Hallucis Longus; CT: Computer Tomography; MRI: Magnetic Resonance Imaging

REFERENCES

1. Deguchi M, Tsuji S, Katsura D, et al. Current overview of osteogenesis imperfecta. Medicina (Kaunas) 2021; 57: 464.
2. Robinson ME, Rauch F. Mendelian bone fragility disorders. Bone (New York, NY) 2019; 126: 11-17.
3. Rossi V, Lee B, Marom R. Osteogenesis imperfecta: advancements in genetics and treatment. Curr Opin Pediatr. 2019; 31: 708-715.
4. Sinkam L, Boraschi-Diaz I, Svensson RB, et al. Tendon properties in a mouse model of severe osteogenesis imperfecta. Connect Tissue Res. 2023; 64: 285-293.

5. Canata GL, d'Hooghe P, Hunt KJ. Muscle and Tendon Injuries Evaluation and Management. Berlin, Heidelberg: Springer Berlin Heidelberg; 2017.
6. Lhoste-Trouilloud A. The tibialis posterior tendon. J Ultrasound. 2012; 15: 2-6.
7. Trnka HJ. Dysfunction of the tendon of tibialis posterior. J Bone Joint Surg Br. 2004; 86: 939-946.
8. Johnson KA, Strom DE. Tibialis posterior tendon dysfunction. Clin Orthop Relat Res. 1989; 239: 196-206.
9. Myerson MS. Adult acquired flatfoot deformity: Treatment of dysfunction of the posterior tibial tendon. J Bone Joint Surg Am. 1996; 78: 780-792.
10. Beals TC, Pomeroy GC, Manoli A. Posterior Tibial Tendon Insufficiency: Diagnosis and Treatment. J Am Acad Orthop Surg. 1999; 7: 112-118.
11. Backus JD, McCormick JJ. Tendon Transfers in the Treatment of the Adult Flatfoot. Foot Ankle Clin. 2014; 19: 29-48.
12. Ling SK-K, Lui TH. Posterior Tibial Tendon Dysfunction: An Overview. Open Orthop J. 2017; 11: 714-723.
13. Ruffilli A, Traina F, Giannini S, et al. Surgical treatment of stage II posterior tibialis tendon dysfunction: ten-year clinical and radiographic results. Eur J Orthop Surg Traumatol. 2018; 28: 139-145.
14. Jahss MH. Spontaneous Rupture of the Tibialis Posterior Tendon: Clinical Findings, Tenographic Studies, and a New Technique of Repair. Foot Ankle 1982; 3: 158-166.
15. McKiernan FE. Musculoskeletal manifestations of mild osteogenesis imperfecta in the adult. Osteoporos Int 2005; 16: 1698-1702.
16. Mehta R, Mahajan U. Tibial-tubercle avulsion and patellar-tendon rupture in pre-pubertal child with osteogenesis imperfecta (OI): Case report and review of current treatment in OI. J Clin Orthop Trauma. 2020; 11: 339-343.
17. Park J-Y, Cho T-J, Lee MC. Successful anterior cruciate ligament reconstruction and meniscal repair in osteogenesis imperfecta. Knee Surg Sports Traumatol Arthrosc. 2018; 26: 2297-2301.
18. Cortes ZE, Maloney MD. Anterior Cruciate Ligament Reconstruction in Osteogenesis Imperfecta. Am J Sports Med. 2004; 32: 1317-1322.
19. Figueroa D, Calvo R, Vaisman A. Spontaneous and simultaneous bilateral rupture of the quadriceps tendon in a patient with osteogenesis imperfecta: A case report. Knee. 2006; 13: 158-160.
20. Nasra MH, Dijanic C, Sudah S, et al. Simultaneous Bilateral Patellar Tendon Rupture in a Patient with Osteogenesis Imperfecta. Curēus (Palo Alto, CA) 2021; 13.
21. Ogilvie-Harris DJ, Khazim R. Tendon and ligament injuries in adults with Osteogenesis imperfecta. J Bone Joint Surg Br. 1995; 77: 155-156.
22. ElGuindy A, Lustig S, Servien E, et al. Treatment of chronic disruption of the patellar tendon in Osteogenesis Imperfecta with allograft reconstruction. Knee. 2011; 18: 121-124.