



Incidence and recognition of peroneal tendon dislocation associated with calcaneal fractures



John Wong-Chung MCh, FRCSI^{a,*}, William Dominic Marley MRCS^a, Adam Tucker MRCS^a, Diarmaid S. O'Longain FRCR^b

^a Department of Trauma & Orthopaedics, Altnagelvin Hospital, Glenshane Road, Londonderry BT47 6SB, Northern Ireland, UK

^b Department of Radiology, Altnagelvin Hospital, Glenshane Road, Londonderry BT47 6SB, Northern Ireland, UK

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ABSTRACT

Background: Questions abound regarding natural history and medicolegal implications of untreated peroneal tendon dislocation (PTD) associated with calcaneal fractures.

Methods: We retrospectively analyzed CT scans and anteroposterior ankle radiographs of 79 consecutive calcaneal fractures presenting over 4 years at a single institution.

Results: Nineteen patients (24%) had associated PTD, which was initially missed in 10 (53%). Bony fleck was present in 11 (13.75%). Soft tissue swelling at lateral malleolar level, present on radiographs of 18 tendon dislocators (95%), raises likelihood of PTD with increasing specificity the greater the swelling. In 6 patients, surgeons failed to identify on CT spontaneously relocated tendons that then peeped around the posterolateral fibula, a finding not appreciable on 3-dimensional volume-rendering.

Conclusions: Despite a significant association of PTD with calcaneal fractures, it still passes unrecognized all too frequently. Anatomical fracture fixation does not guarantee stable tendon reposition. Further studies are required to elucidate functional outcome of untreated PTD.

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1. Introduction

Although dislocation of the peroneal tendons in association with calcaneal fractures has been described over 25 years ago, it frequently still passes unrecognized by both radiologists and orthopaedic surgeons [1,2]. Early investigators into this injury pattern utilized computed tomography and published their works in radiology journals. Thus, radiologists Rosenberg et al. [3] and Bradley and Davies [4] found a prevalence of 25% and 47.5% respectively of peroneal tendon dislocation (PTD) on CT scans of patients with calcaneal fractures.

In the orthopaedic literature, Ebraheim et al. [5] reported a series of 8 cases. However, Wright and Sangeorzan [6] later remarked that this injury combination was uncommon in their experience and believed it probably occurred in just 2–3% of calcaneal fractures. Further case reports have since appeared in both the orthopaedic and radiological literature [7–9]. More

recently, Toussaint et al. [10] reported a 28% prevalence rate of PTD in a retrospective multicentre study of 421 displaced intra-articular calcaneal fractures.

The present retrospective study aimed to (i) determine the incidence of peroneal tendon dislocation in association with calcaneal fractures at a single institution, (ii) describe systematic steps to avoid missed diagnosis at each stage of fracture management and (iii) discuss its natural history. Furthermore, we hypothesized that the presence of soft tissue swelling at the level of the lateral malleolus could serve as a predictor of associated peroneal tendon dislocation.

2. Methods

Plain radiographs and CT scans of all patients with calcaneal fractures were retrieved from the picture archiving and communications systems, which was installed in our hospital in June 2010. Over a 4-year period, 76 consecutive patients attended with intra-articular calcaneal fractures, 3 of whom had bilateral injuries.

The senior author and an orthopaedic senior resident independently reviewed anteroposterior plain radiographs of the ankle for evidence of an avulsed bony fleck off the lateral aspect of the distal

* Corresponding author at: 11 Waterstone Park, Londonderry BT47 2AG, Northern Ireland, UK. Tel.: +44 28 71342768.

E-mail address: johnwong@doctors.org.uk (J. Wong-Chung).

fibula. In addition, widths of the soft tissue shadows were measured both medially and laterally at a distance extending one-third of the way down from the top of the talus to the tips of the medial and lateral malleoli, respectively. Lateral malleolar swelling was deemed present when soft tissue width was greater laterally than medially (± 0.5 mm). Inter-rater agreement was calculated using Cohen's kappa coefficient (SPSS v.22 for Mac). To test the hypothesis that swelling at lateral malleolar level would indicate increased likelihood of injury to the superior peroneal retinaculum, Pearson's correlation coefficient and logistic regression analysis were utilized to correlate the presence of swelling at lateral malleolar level with, and calculate the odds ratio for incidence of associated PTD. For confirmed tendon dislocators, receiver operating characteristic (ROC) enabled assessment of specificity and sensitivity of lateral malleolar swelling as a predictor of associated PTD.

Multiplanar reformatted (MPR) and 3-dimensional volume rendered images were reconstructed from CT scans. The senior author and a musculoskeletal radiologist jointly analyzed the MPR images utilizing criteria as defined by Ho et al. [7] and 3-dimensional volume rendered images as described by Ohashi et al. [11], for concomitant dislocation of the peroneal tendons. According to Ho et al., peroneal tendons on axial CT images should lie within the confines of the triangle formed by the posterolateral margin of the distal fibula, the superior peroneal retinaculum and the calcaneofibular ligament. Normally located tendons thus lie medial and posterior to the posterolateral distal fibular margin. When dislocated, the tendons lie lateral and anterior to the posterolateral margin of the distal fibula.

3. Results

Nineteen of the 79 calcaneal fractures had associated subluxation or dislocation of the peroneal tendons, identified either on CT scan or at surgery (24%). The cohort of tendon dislocators comprised 15 men and 4 women, aged 21–66 (average, 49.5) years. Nine patients sustained left-sided, 7 right-sided and 3 bilateral calcaneal

fractures. Mechanism of injury was mostly fall from a height. Other causes included snowboarding, horse-riding, motor vehicle accident, attempted suicide, fall downstairs and tripping on a hole in the road. Other concomitant ipsilateral foot injuries included dislocation of tibialis posterior tendon, fractures of the talar neck, cuboid, medial malleolus and metatarsals.

Peroneal tendon dislocation was diagnosed at initial presentation either in the Emergency Room, during admission, on pre-operative CT scan or per-operatively. It was recognized pre-operatively on CT in 5 patients, both pre-operatively on CT and at surgery in 4, and at surgery in 9 patients. The tendon dislocators were subdivided into two groups, according to whether peroneal tendon dislocation was recognized and/or treated at time of initial presentation (Group 1) or not (Group 2) (Table 1).

In Group 1, associated peroneal tendon dislocation was diagnosed at initial fracture presentation in 9 patients, either on CT or by probing at surgery. The superior peroneal retinaculum was repaired at the time of ORIF in Patients 1–4 and of primary subtalar arthrodesis in Patient 5. In Patient 6, the peroneal tendons had dislocated into the bed of a large bony avulsion fracture off the posterolateral distal fibula. The superior peroneal retinaculum was left undisturbed. The peroneal tendons were reduced and retracted out of the fracture site using a probe inserted into the tendon sheath from below. The bony fleck was then fixed with a screw (Fig. 1). Although recognized at the time of ORIF, concurrent peroneal tendon dislocation was not addressed in Patients 7 and 8, because skin condition was deemed too precarious to justify proximal wound extension or additional incision. Peroneal tendon dislocation was identified on CT scan of Patient 9, but he opted to return to his home country for further management.

In Group 2, peroneal tendon dislocation was not recognized in Patient 10 at time of ORIF of a 2-part fracture dislocation of the calcaneum. At over 4 years post-ORIF, he has no complaints in relation to the persistently dislocated tendons as confirmed on follow-up CT and MRI scans. In Patient 11, both the intra-articular calcaneal fracture and peroneal tendon dislocation were missed in

Table 1
Peroneal tendon dislocators in association with calcaneal fractures.

Patient	Age	Sex	Side	Surgery	Peroneal tendons on CT scan	Bony fleck
<i>Group 1: Peroneal tendon dislocation recognized and/or treated at initial presentation</i>						
1	48	M	Bilateral	ORIF+SPR repair	Relocated tendons peep around posterolateral corner of fibula	
2	26	M	R	ORIF+SPR repair	Relocated tendons peep around posterolateral corner of fibula	
3	43	M	R	ORIF+SPR repair	Dislocated on CT	Small fleck
4	55	M	R	ORIF+SPR repair	Dislocated on CT	
5	60	F	L	Primary subtalar arthrodesis+SPR repair	Dislocated on CT	Big fleck
6	57	M	Bilateral	ORIF+screw fixation of bony fleck	Dislocated on CT	Big fleck
7	58	M	L	ORIF (SPR not repaired)	Dislocated on CT	
8	45	M	R	ORIF (SPR not repaired)	Relocated tendons peep around posterolateral corner of fibula	
9	52	M	L	No surgery	Dislocated on CT	Big fleck
<i>Group 2: Peroneal tendon dislocation not recognized at initial presentation</i>						
10	56	M	L	ORIF	Dislocated on CT	Small fleck
11	62	F	R	Subtalar arthrodesis+SPR repair	Dislocated on CT	Small fleck
12	66	M	L		Relocated tendons peep around posterolateral corner of fibula	Small fleck
13	21	M	L		Dislocated on CT	Small fleck
14	33	M	L		Relocated tendons peep around posterolateral corner of fibula	Small fleck
15	39	M	L		Dislocated on CT	Big fleck
16	54	F	R		Dislocated on CT	
17	48	M	L		Dislocated on CT	
18	56	M	Bilateral		Dislocated on CT	Big fleck
19	62	F	R		Relocated tendons peep around posterolateral corner of fibula	

ORIF, Open reduction and internal fixation; SPR, superior peroneal retinaculum

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