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The isolated posterior malleolar fracture and syndesmotic instability: A case report and review of the literature

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ABSTRACT

INTRODUCTION: Ankle fractures are among the most common type of fractures in the lower extremity. A posterior malleolar fracture is frequently part of a more complex ankle fracture and only in rare cases it occurs as isolated injury. Posterior malleolar fractures often occur with associated injuries, such as a Maisonneuve fracture or with bi- or trimalleolar ligamentous injuries. Knowledge about these associated injuries is essential to prevent missed diagnoses. The aim of this article is to describe the isolated posterior malleolar fracture, the possible associated injuries, the diagnostic work-up and therapeutic consequences. **PRESENTATION OF CASE:** We present a case of a 26-year-old male patient who sustained an isolated posterior malleolar fracture with 4.5 years follow-up.

DISCUSSION: Isolated fractures of the posterior malleolus are uncommon injuries. Diagnosis, treatment and outcome can seldom be extracted from large series. However, several cases have been described in literature, which we have summarized.

CONCLUSION: This case report and literature review shows that isolated posterior malleolar fractures might occur as part of a more complex ankle injury, in combination with a fracture of the lower leg or after high energy trauma. Physicians should be aware of these associated injuries. Diagnostic work-up should include X-rays of the knee and lower leg and a CT scan of the ankle. If diagnosed and treated properly, isolated posterior malleolar fractures have a good long-term functional outcome.

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1. Introduction

Ankle fractures are among the most common type of fractures in lower extremity injuries [1]. A fracture of the posterior malleolus is frequently present in combination with other injuries such as pilon tibial fracture, spiral tibial shaft fracture, or as part of bi- or trimalleolar ankle fracture [2,3]. Posterior malleolar fractures and their treatment are frequently discussed [2,4]. However, an isolated posterior malleolar fracture is an uncommon injury as it occurs in about 1–4% of all ankle fractures [5,6]. Nonetheless, case reports of isolated posterior fractures have been published since 1828 [7]. An isolated posterior malleolar fracture is also known as a Volkman's fracture or an Earle's fracture [7,8]. This injury is easily missed on plain radiographs and requires awareness of the treating physician [9]. In the present study, we describe a patient

with an isolated posterior malleolar fracture including the long-term follow-up, which has been reported in line with the SCARE statement [10].

The aim of this article is to describe the isolated posterior malleolar fracture, possible associated injuries, diagnostic work-up and therapeutic consequences by presenting a case and summarizing current literature.

2. Case Report/Series

A 26-year-old male patient attended the emergency department in October 2010 because of pain in his left ankle. The pain had occurred after a backward fall while his left foot stayed fixed to the ground, while playing tennis. The ankle was immediately painful, swollen and the patient was unable to bear weight. He did not have any other complaints or signs of injury.

His medical history was limited to stomach pains for which he used omeprazole 40 mg capsules and he had hay fever. He smoked and had a body mass index of 29.1.

On physical examination swelling and tenderness was present at the left medial malleolus. Significant tenderness was present

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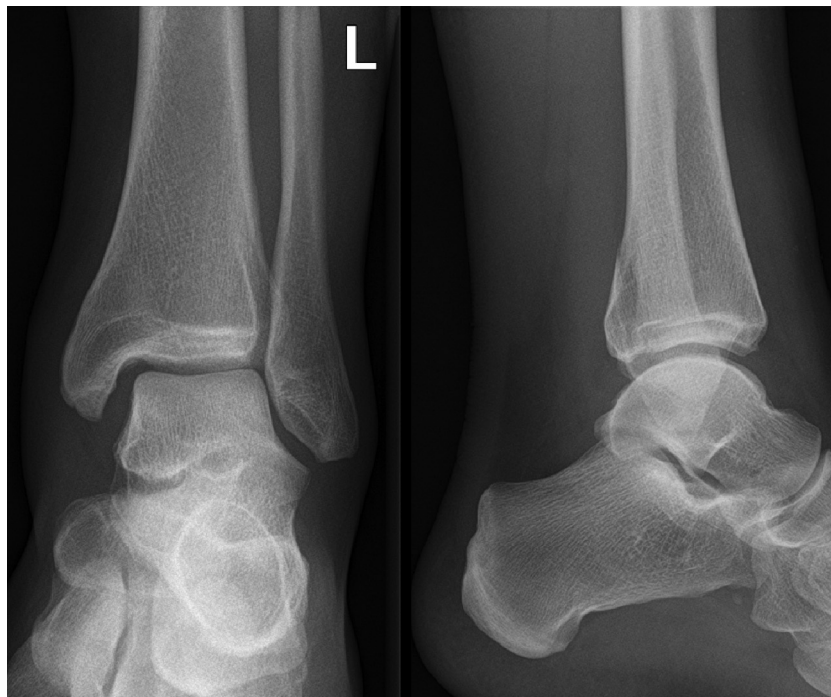


Fig. 1. Mortise and Lateral View X-ray of Left Ankle.

Mortise and lateral view X-ray of left ankle on the day of trauma showing an isolated posterior malleolar fracture which could be easily missed.

over the posterior aspect of the lateral malleolus. In addition, dorsiflexion was impossible because of pain. Further range of motion was not limited, but was subjected to pain. There were no neurovascular injuries and there was no pain at the proximal fibula. There were no wounds, no bruising, no deformity or any other signs of injuries present.

According the Ottawa rules an ankle x-ray was made which showed an isolated posterior malleolar fracture with subtle lateralization of the talus as indicated by medial widening [11]. There were no signs of a previous ankle luxation (Fig. 1). To exclude other fractures, x-rays of the knee and lower leg were made. These x-rays did not show any other fractures. Therefore, a Computed Tomography (CT) was performed, which confirmed an isolated posterior malleolar fracture with minimal displacement (Fig. 2). Lateralization of the talus was present in the coronal and transversal planes indicating syndesmotic instability (Fig. 3).

The patient was treated by operative fixation by an (orthopaedic) trauma surgeon, in which the talus was reduced and the syndesmosis stabilized with two syndesmotic screws (see supplementary). The posterior malleolar fracture was treated conservatively. After a day in hospital the patient was treated in a circular weight bearing cast for 6 weeks. The syndesmosis screws were removed 12 weeks after the initial trauma.

The patient had an uneventful recovery. Follow-up after 4.5 years showed a good functional outcome with an Olerud Molander score of 100 out of 100 points [12]. The patient only complained about a slightly decreased mobility in his ankle during ice-skating.

3. Discussion

Isolated fractures of the posterior malleolus are uncommon injuries and no large case series are available in current literature. We performed a literature search and identified 75 cases [5,6,9,13–19]. The mean age was $31.6 (\pm 5.7)$ years, with men being more often affected than women (total of 45 males and 30 females). Most of them had no or small displacement and 85% were treated



Fig. 2. Sagittal Computed Tomography Scan of Left Ankle.

Sagittal Computed Tomography Scan of left ankle one day after trauma showing an isolated posterior malleolar fracture with minimal displacement.

conservatively. Nearly all patients had an uneventful recovery and no fracture healing disorders were described (Table 1).

Posterior malleolar fractures regularly occur in combination with other malleolar fractures in supination external rotation or pronation eversion injuries. An isolated fracture of the posterior malleolus should therefore be regarded as a sign of a more complex injury of the ankle joint, until proven otherwise. It can also occur in combination with a fracture of the lower leg caused by rota-

Table 1

Previously Reported Cases of Isolated Posterior Malleolar Fractures (n = 10 prior publications).

Author	Year of publication	Number of patients	Age (y ^a)	Sex (Male/Female)	Mechanism of injury	Displaced	Size posterior malleolar fragment	Treatment	Outcome
Nugent et al. [18]	1962	2	32	F ^b	twisted ankle while stepping in a hole	no	10% to 15% involvement of the distal tibial articular surface	conservative	radiographic healing
			25	M ^c	motor vehicle accident with inversion of the ankle	NR ^d	NR	conservative	radiographic healing and pain free
Buschmeyer et al. [15]	1984	4	41	F	plantar flexion	no	2 × 0.5 cm	conservative	all without restriction of movement and radiographic healing without signs of arthrosis
			59	M	unknown	yes	3 × 1 cm	operative	
			21	F	supination	no	2.5 × 1 cm	conservative	
Boggs [13]	1986	3	17	M	supination eversion	no	3 × 0.5 cm	conservative	
			27	F	falling down the stairs	no	unknown but without involvement of the articular surface	conservative	uneventful recovery
			13	F	unknown mechanism while sliding into a base	3 mm	25% of the articular surface	operative	radiographic healing
Neumaier et al. [6]	1997	25	41	F	jump from slowly moving truck	no	a third of the articular surface	conservative	without sequelae
			32	13 F 12 M	11 were caused by slipping on ice or snow. Second most common cause was sporting accidents. 3 cases had a peculiar mechanism.	21 out 24 had small displaced fragments	the articular surface was involved in all cases between 1/10 and 4/10	22 conservative 3 operative	13 out of 22 were symptom free 8 out of 22 reported swelling and pain in the ankle following extreme overload 2 out of 22 reported decreased professional capacity

Bourdon et al. [14] Donken et al. [5]	2008 2011	1 20	56 31	F 6 F 13 M	unspecified 1 traffic 9 sports 6 domestic 1 work 2 other	NR median of 4 mm displacement	NR median of 12% joint contact area	NR conservative	NR median Olerud Molander score was 100 points (median of 20 years of follow-up) radiographic healing, return to full activity without limitations in 20 weeks 6 out of 8 with late diagnosis and treatment had sequelae 0 out of 4 with early diagnosis and treatment had sequelae AOFAS ^f ankle hindfoot mean score of 86 at 3 month follow-up 1 non-union at 6 months. no instability or degenerative changes at 1 year follow-up in all patients AOFAS score of 96
Miller et al. [17]	2012	1	19	F	10 foot high fall	no	less than 25%	conservative	
Comat et al. [16]	2014	12	30.6 (R 20–40)	12 M	parachute jump	no	8 intra-articular involving less than one-third of the joint surface	conservative	
Ozler et al. [9]	2014	7	32 (R ^e 23–40)	2 F 5 M	forced plantar flexion alone or combined with axial compression in all patients (2 during sports, 4 staggered while walking and 1 was unable to describe the mechanism)	no	mean of 17% to the articular surface	conservative	
Serbest et al. [19]	2015	1	37	F	pushing brake pedal during a traffic accident while wearing high heels	yes	involving more than 25% of the articular surface	operative	

If more than 5 patients were reported, mean numbers with standard deviation in parentheses were supplied if available.

^a y = years.

^b F = Female.

^c M = Male.

^d NR = not reported.

^e R = range.

^f AOFAS = American Orthopaedic Foot & Ankle Society.



Fig. 3. Tansversal and Coronal View Computed Tomography Scan of Left Ankle. Tansversal and coronal view Computed Tomography scan of left ankle one day after trauma showing lateralization of the talus.

tional force [20]. Furthermore, these fractures are known injuries in parachute landings or as part of a pilon tibiale fracture [16]. They result from impression of the talus on the posterior edge of the distal tibia [20]. Besides other fractures, it should also be noted that ligamentous injuries can exist [5]. Obviously, the tibiofibular syndesmosis injury should be suspected and the medial malleolus should be inspected for hematoma and tenderness. Therefore, knowledge of the Lauge Hansen classification, and injury pattern is important to understand the fracture type.

Initially, an isolated posterior malleolar fracture can easily be missed on plain radiographs and diagnosed as ankle sprain [9]. Delayed diagnosis has shown to be associated with longer incapacity and more severe physical sequelae (cracking, pain and stiffness) [16]. These findings indicate that a fracture of the posterior malleolus should be actively searched for. An x-ray of the lower leg, including the knee, should always be made to exclude a Maisonneuve fracture as in pronation eversion stage 4 injuries. A CT scan should be performed to confirm lateralization of the talus. Another advantage of the CT scan is the possibility to evaluate the size of the fragment and the congruency of the joint surface. In our opinion, stress radiographs or magnetic resonance imaging (MRI) should not be part of the standard diagnostic work-up for posterior malleolar fractures. As the diagnostic accuracy of X-rays of the ankle for undisplaced fractures is disputable, a MRI scan might be considered in patients with persistent ankle complaints without a clear diagnosis [4,21]. The advantage of MRI in this subset of patients is the ability to diagnose ligamentous injuries and osteochondral lesions.

When an isolated posterior malleolar fracture has been diagnosed, both non-operative and operative treatment are described (Table 1). The indication for surgical treatment is still under debate [22]. Size of the fracture fragment and joint congruency are often used to determine the indication for operative treatment. However, most of these discussions concern posterior malleolar fractures as part of more complex ankle injury. Surgical treatment should be considered if the fragment is larger than 5% to prevent radiographic osteoarthritis. However, the influence of fragment size and joint congruency on osteoarthritis on the long-term has only been demonstrated radiographically but not clinically [23]. Several surgical techniques are used for fixation of the posterior malleolus. Good functional outcomes are described after leg screw fixation, buttress plating of the posterior fragment or screw fixation of syndesmosis injuries [24].

This case report and literature review shows that an isolated posterior malleolar fracture might occur as part of a more complex ankle injury, in combination with a fracture of the lower leg or after high-energy trauma. Physicians should be aware of these associated injuries. Diagnostic work-up should include X-rays of the knee and lower leg and a CT scan of the ankle. If diagnosed and

treated properly, an isolated posterior malleolar fracture has a good long-term functional outcome.

Conflicts of interest

No conflicts of interest.

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Ethical approval

No ethical approval was deemed necessary.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Study concept and design: DS AND FH.

Data collection: DS.

Data analysis or interpretation: DS, RH and FH.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.ijscr.2017.10.062>.

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