



## Missed isolated posterior malleolar fractures

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**Objective:** The aim of this study was to evaluate the injury mechanism and clinical and radiological results of the patients with isolated posterior malleolar fracture.

**Methods:** Seven patients (5 male, 2 female; mean age: 32 years; range: 23-40) with a missed isolated posterior malleolar fracture were included in the study. All patients had initially been examined for an ankle sprain in the emergency room, where the initial plain radiographs did not show any abnormality. Due to the long lasting symptoms all patients underwent an MRI scan by the 3rd week which revealed a posterior malleolar fracture. Patients were treated with an ankle brace for 3 weeks. All patients were followed up for 1 year. Bone healing and degenerative changes were evaluated with plain Radiographs, including a 50° external rotation lateral. Clinical outcome was evaluated with American Orthopedic Foot and Ankle Society ankle hindfoot scale.

**Results:** Fracture healing was seen in 6 of the 7 patients by the 6th week. There was no radiographic healing by 6th month in the remaining patient. Mean AOFAS ankle hindfoot scores at the beginning of the treatment and at 3rd month were 20 (11-31) and 86 (43-96), respectively. There was no instability or degenerative changes at one-year follow-up.

**Conclusion:** Isolated posterior malleolar fracture should be kept in mind in patients who present with pain at the posterior part of the ankle following a forced plantar flexion and/or axial compression injury. A 50° external rotation lateral radiograph can be useful in detecting the fracture.

**Key words:** Posterior malleolar fracture; ankle sprain; isolated.

Posterior malleolar fractures may occur with trimalleolar ankle fractures or alone. These fractures accompany 14% to 44% of all ankle fractures. Posterior malleolar may occur as a result of excessive traction of posterior portion of inferior tibiofibular ligament during a supination or pronation injury as described in Lauge-Hansen classification.<sup>[1,2]</sup> Isolated posterior malleolar fractures account only 1% of all ankle fractures and are associated with axial compression and/or plantar flexion injuries that aren't included in ankle fracture classification systems.<sup>[3,4]</sup>

Functional outcomes of ankle fractures involving a posterior malleolar fracture are often less satisfactory depending on the size of the posterior fragment.<sup>[5-9]</sup> There are controversies about the treatment of these fractures but authors agree that small fragments can be treated conservatively whereas larger fractures that involve more than 25% of articular surface should be fixed to avoid instability and degenerative changes.<sup>[10,11]</sup>

Ottawa Ankle Rules (OAR) was described to decrease the number of unnecessary radiographs in ankle

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sprains at emergency room.<sup>[12]</sup> The 6 situations described in OAR are, for patients having pain at malleolar zone; bone tenderness on the distal 6 cm of the posterior edge of the tibia or on the tip of the medial malleolar; bone tenderness on the distal 6 cm of the posterior edge of the fibula or on the tip of the lateral malleolar and inability to bear weight for four steps, for patients having pain at midfoot zone; bone tenderness at the base of the fifth metatarsal; bone tenderness on the navicular bone or inability to bear weight for four steps. Patients with isolated posterior malleolar fracture usually have non-specific complaints of an ordinary ankle sprain and no tenderness would be expected on the points described in OAR. Another challenge is the difficulty of showing the posterior malleolar fracture with standard radiographic views.<sup>[13]</sup>

The aim of this study was to evaluate the injury mechanism and clinical and radiological results of our patients with a missed isolated posterior malleolar fracture.

### Patients and methods

A total of 846 patients (325 female, 521 male; mean age: 32; range: 19-64) presented with an ankle sprain between 2007 and 2011, were retrospectively evaluated. All patients were examined with OAR and 420 patients (205 female, 215 male; mean age: 37; range: 18-64) were further examined with ankle radiograph (anteroposterior, lateral and mortis views). There was a lateral malleolar fracture in 52 patients, bimalleolar fracture in

16, trimalleolar fracture in 9 and isolated syndesmotic diastasis in 6. There was no fracture, dislocation or syndesmotic diastasis in 337 patients (151 female, 186 male, mean age: 36, range: 19-58). These patients were treated with cold application, compressive bandaging, and non-steroidal anti-inflammatory drugs and limited weight bearing for 3 weeks. Written informed consent was obtained from all patients.

At the 3th week follow-up, 13 patients (6 female, 7 male; mean age: 27, range: 22-40) with persistent symptoms were further examined with magnetic resonance imaging. There was an isolated posterolateral-oblique posterior malleolar fracture (Fig. 1a) in 7 patients (5 male, 2 female; mean age: 32 years; range: 23-40), bone marrow edema at tibial plafond in 3 and total anterior talofibular ligament tear in 4. The exact size of the posterior malleolar fragment was measured on MRI. The mean proportion of the posterior malleolar fragments to the articular surface in sagittal plane 17% (12-20%). All patients were treated with an ankle brace with malleolar supports and non-weight bearing for 3 weeks. A 50° external rotation lateral ankle radiographs were taken after MRI (Fig. 1b) and at 6th week (Fig. 1c) to better visualize the fracture and evaluate fracture healing. Weight bearing was allowed after fracture healing.

Clinical outcome was evaluated with American Orthopaedic Foot and Ankle Society ankle hindfoot scale.<sup>[14]</sup> SPSS software was used for statistical analysis (NCSS Statistical Software, Kaysville, UT, USA). Chi-square test was used to compare scores. All patients were



**Fig. 1.** (a) A sagittal MRI STIR (Short TI Inversion Recovery) sequence of a 27-year old female patient with persistent pain 3 weeks after a plantar flexion injury. Note the fracture line (arrow) and surrounding high signal intensity of bone marrow indicating missed posterior malleolar fracture. (b) A 50° external rotation lateral radiograph of the same patient taken 3 weeks after plantar flexion injury showing missed posterior malleolar fracture (arrow). (c) 50° external rotation lateral radiograph of the same patient taken at 6th week follow-up showing healed posterior malleolar fracture (arrow) with minimal callus formation.

followed up for 1 year and ankle radiographs were taken on the 1st year follow-up for evaluating degenerative changes.

## Results

All patients had pain on the posterior aspect of the ankle and severe ankle pain with weight bearing during their first visit. The posterior malleolar fractures were detected only after the MRI examination, 3 weeks after the initial injury. Three weeks after the detection of the fracture, 6 of the 7 patients were symptom free, but the remaining one, who had a posterior malleolar fracture involving 18% of the articular surface, still had pain at 3-month follow-up and no radiographic evidence of bony healing by 6 months. This patient did not accept surgical treatment.

There was no instability or degenerative changes at 1st year follow-up, in all 7 patients, including the patient with nonunion by 6 months.

Mean AOFAS ankle hindfoot scores at the beginning of the treatment and at the 3th month follow-up were 20 (11-31) and 86 (43-96), respectively. There was a statistically significant increase at 3rd month follow-up ( $p=0.001$ ).

## Discussion

Isolated posterior malleolar fractures may mimic simple ankle sprains. The common classification systems like Lauge-Hansen system, do not include these rare injuries.<sup>[3]</sup>

In our series injury mechanism of isolated posterior malleolar fracture was forced plantar flexion alone or combined with axial compression in all patients.<sup>[3]</sup> Six of the seven patients were able to describe the injury mechanism during their initial presentation. Two patients had described the injury as a fall during snowboarding and a fall during flanker position in an American football game resulting to compression and plantar flexion. Other 4 patients described the injury as a stagger during walking resulting to forced plantar flexion. One patient couldn't describe the mechanism of injury.

OAR is a useful clinical tool for evaluation of ankle sprains and its efficiency is shown in various studies in literature. However isolated posterior malleolar fractures remains as a gap and could be neglected in this classification. Knudsen et al. reported that, in a series of 1014 ankle sprains, with the use of OAR, 578 (57%) patients had radiographs and ankle fractures were diagnosed in 98 (17%) of them. In the same study, 2 of the 4 missed fractures were isolated posterior malleolar frac-

tures.<sup>[15]</sup> In our series, the OAR algorithm and the initial radiographs did not reveal the fracture in any of our 7 patients. This exception for isolated posterior malleolar fractures shows that standard ankle radiographs are not effective for diagnosing these fractures.<sup>[15,16]</sup> Ebraheim et al. reported that, posterior malleolar fractures that could not be demonstrated on ankle radiograph series were detected on 50° external rotation lateral radiograph.<sup>[17]</sup>

In current literature, posterior malleolar fractures involving less than 25% of the articular surface are described as stable and 2 mm stepping defect does not affect the ankle joint biomechanics and functional results.<sup>[2,7,10]</sup> On the other hand, a number of surgeons support fixation of all posterior malleolar fractures regardless of their size, for syndesmotic stability.<sup>[18]</sup> In our series, none of the patients had a displacement of the fracture during the first 3 weeks, before the diagnosis of the posterior malleolar fracture. Although isolated posterior malleolar fractures are usually stable, their neglect can lead to chronic pain and ankle arthritis. Due to the small size of the posterior malleolar fragment and overlapping with distal fibula, these fractures may be missed on standard ankle radiographs. These small fragments can only be seen on 50° external rotation lateral ankle radiograph.

In our series we have seen that, once diagnosed, these fractures can be treated conservatively with satisfactory results. Current literature shows satisfactory outcomes for conservative treatment of isolated posterior malleolar fractures at long term follow-up. Donken et al. reported that conservative treatment of isolated posterior malleolar fractures resulted in good clinical and radiological outcome at long-term follow-up.<sup>[19]</sup>

OAR is a useful clinical tool for the evaluation of ankle injuries but standard ankle radiographs are not effective for detecting isolated posterior malleolar fractures. Isolated posterior malleolar fractures should be kept in mind in patients who describe a forced plantar flexion and/or axial compression injury with pain at posterior part of the ankle. A 50° external rotation lateral radiograph can be useful in detecting a possible small sized isolated posterior malleolar fracture. These isolated posterior malleolar fractures can be conservatively treated with non-weight bearing and a malleolar supporting brace with satisfactory outcome.

**Conflicts of Interest:** No conflicts declared.

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