



## ■ FOOT AND ANKLE

# The outcome at 20 years of conservatively treated 'isolated' posterior malleolar fractures of the ankle

### A CASE SERIES

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**We assessed the long-term (20 years) outcome of closed reduction and immobilisation in 19 patients with an isolated fracture of the posterior malleolus of the ankle treated at a single hospital between 1985 and 1990. The assessments used were an Olerud functional questionnaire score, physical examination using a loaded dorsal and plantar range of movement measurement, radiological analysis of medial joint space widening, the Cedell score for anatomical alignment of all three malleoli, and the radiological presence of osteoarthritic change.**

**There were excellent or good results in 14 patients (74%) according to the Olerud score, in 18 patients (95%) according to loaded dorsal and plantar range of movement assessment, in 16 patients (84%) as judged by the Cedell score, and for osteoarthritis 18 patients (95%) had an excellent or good score. There were no poor outcomes. There was no correlation between the size of the fracture gap and the proportion of the tibiotalar contact area when compared with the clinical results (gap size: rho values -0.16 to 0.04,  $p \geq 0.51$ ; tibiotalar contact area: rho values -0.20 to -0.03,  $p \geq 0.4$ ). Conservative treatment of 'isolated' posterior malleolar fractures resulted in good clinical and radiological outcome in this series at long-term follow-up.**

Isolated posterior malleolar fractures are rare with an estimated incidence among ankle fractures of 0.5%,<sup>1-4</sup> but the literature is unclear on the mechanism of this type of fracture. An isolated posterior malleolar fracture can either be the bony variant of a rotational injury to the posterior syndesmotic ligament, for instance a supination external rotation type III lesion in the Lauge Hansen classification system,<sup>5</sup> or be due to plantar hyperflexion combined with a vertical compression force.<sup>6-8</sup> Others believe the injury is always part of a high fibular (Maisonnette) fracture,<sup>9,10</sup> which may be missed. There is debate as to whether a posterior malleolar fracture can exist in isolation or whether there is always an associated ligamentous injury.

This fracture is interesting not only pathophysiologically but also because of its effect on the role of the posterior malleolus acting as a dorsolateral pillar in axial transfer of load from the talus to the tibia. This isolated fracture can serve as a model to investigate the effect of loss of the weight-bearing area on the long-term clinical outcome and the possible development of osteoarthritis.

The aim of our study was to perform a long-term clinical and radiological follow-up of conservative treatment in a consecutive group

of patients with an isolated fracture of the posterior malleolus of the ankle, in order to see if there was a significant risk of developing osteoarthritis.

### Patients and Methods

A prospective registry of all orthopaedically injured patients treated at the Saint Elisabeth Hospital in Tilburg (a level 1 trauma centre) was kept from 1 January 1985 onwards. From this database, all those who sustained an isolated fracture of the posterior malleolus of the ankle in the period from 1 January 1985 to 1 January 1990 were extracted for retrospective analysis. We excluded all patients who 1) were referred to our hospital for secondary treatment of complications; 2) had received primary treatment elsewhere; 3) had sustained ipsilateral crural, talar, calcaneal or Lisfranc fractures or dislocations; 4) had died before definitive treatment was given; and 5) who were skeletally immature at the time of injury.

Because of the long follow-up interval an extensive effort to retrieve patients was necessary. Patients were first invited by telephone but if they could not be reached an invitation letter was sent to their home address. If they did not respond, the national online health insurance declaration system was used to

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**Table I.** Classification of the clinical and radiological results

	Excellent	Good	Moderate	Poor
Olerud score (points) <sup>11</sup>	100 to 91	90 to 61	60 to 31	30 to 0
Loss of loaded range of movement (°)	0 to 3	4 to 10	11 to 20	> 20
Cedell score <sup>14*</sup>	Anatomical/a/a	≥good/g/g	≥poor/./.	<poor/./.
Medial clear space widening (mm)	0	≤ 1	≤ 2	> 2
Post-traumatic osteoarthritis <sup>†</sup>	No signs	Osteophytes	Sclerosis/cysts/ narrowing < 0.5	Narrowing > 0.5

\* anatomical/a/a means an anatomical result for medial, lateral and posterior malleolus; ≥good/g/g means at least a 'good' result for each malleolus, but not all anatomical according to the score of Cedell; ≥poor/./ indicates that one malleolus scores a 'poor' result according to Cedell, whereas the other two score better. The classification 'poor' is given if more than one malleolus scores a 'poor' result according to Cedell<sup>14</sup>

† narrowing means joint space narrowing between tibial plafond and talar dome compared to the joint space between medial and lateral malleolus and talus

contact their current general practitioner (GP). Individual telephone numbers or addresses were not accessible in this online system because of privacy regulations. The Google internet search engine and the Dutch online phonebook were also used to trace patients and their GPs. A total of 580 adults with ankle fractures during a period of five years (1985 to 1990) were screened, and 24 (4%) with an 'isolated' posterior malleolar fracture were detected.

All patients had been treated conservatively with closed reduction by gentle dorsiflexion to an anatomical position followed by application of a plaster cast, either with progressive weight-bearing in a lower-leg plaster cast with the foot in neutral position for six weeks ( $n = 22$ ), or with a tape bandage ( $n = 2$ ). One week after the injury a second radiograph without a cast was made to detect secondary fracture displacement. Two weeks after removal of the plaster or tape, a third radiograph was made. At follow-up one patient had died, another refused to co-operate, and three could not be traced. After obtaining informed consent, patients visited the outpatients' department where they were interviewed, examined, and radiographs were taken.

All patients were evaluated by an author (CCMAD) using the scoring system proposed by Olerud and Molander,<sup>11</sup> which is based on pain, stiffness, swelling, sports undertaken, supports required, stair-climbing and daily activity and work. The loaded dorsal and plantar ranges of movement of the tibiotalar joint were measured by the same author (CCMAD) according to the method of Lindsjö,<sup>12</sup> in which the patient, standing with the knees and hips flexed, places both feet into a mould with a hinge and a goniometer at the level of the tibiotalar joint. Supination and pronation were not measured as these movements are located mainly in the subtalar joint and the mid and forefoot.<sup>13</sup> Radiological features were assessed using the criteria of Cedell<sup>14</sup> as well as assessment of widening of the medial clear space<sup>15</sup> by an independent radiologist, who was unaware of the clinical outcome parameters. No additional evaluation of reproducibility was undertaken. Radiographs were anonymised and analysed in a random order. The Cedell classification<sup>14</sup> for radiological anatomical position describes the separate results of the lateral,

medial and posterior malleoli in terms of dislocation in millimetres. Osteoarthritis was assessed by observation of narrowing of the joint space, osteophyte formation and ligamentous calcifications. The various outcome parameters were classified as 'excellent', 'good', 'moderate' and 'poor' (Table I). The purpose of this classification was to measure objective measurable results, instead of subjective results. Therefore, we used this classification method with well-defined criteria.

**Statistical analysis.** All the data were stored and processed using SPSS version 16.0 (SPSS Inc., Chicago, Illinois). We used mean as well as median values and the Spearman's rho to correlate data. A significance level  $\alpha = 0.05$  was assumed.

## Results

**Patients and treatment data at the time of injury.** Table I presents the baseline characteristics at the time of injury of the 19 patients available for assessment. At the time of the initial trauma all the patients but one reported pain on palpation of the ventral or medial side of the ankle, suggesting ligamentous injury. The median displacement of the posterior fragment before reduction was 4 mm (1 to 15) and median fragment size as a proportion of the tibial plafond as measured on lateral radiographs was 12% (3% to 47%). No complications (infection, secondary dislocation, re-fracture or algodystrophy) had occurred in any patient. Two patients with the worst initial displacement (11 mm and 15 mm, respectively) and with the largest fragments (47% and 35% of the tibial plafond, respectively), were treated in a non-weight-bearing plaster cast for three weeks, followed by a weight-bearing plaster cast for another three weeks, and were followed up for 18 weeks (Fig. 1).

**Results at long-term follow-up.** After a median of 20 years (17 to 24) follow-up was completed in 19 out of 23 living patients. The median Olerud and Molander score was 100 points (mean 94 (75 to 100)), with 10 patients (53%) in the 'excellent', four (21%) in the 'good' and five (26%) in the 'moderate' result groups. When the loaded dorsal range of movement was reviewed, 12 patients (63%) scored an 'excellent', six (32%) 'good' and one (5%) a 'moderate' result. The loaded plantar range of movement was 'excellent' in



Fig. 1

Radiographs of an isolated posterior malleolar fracture pre-reduction.

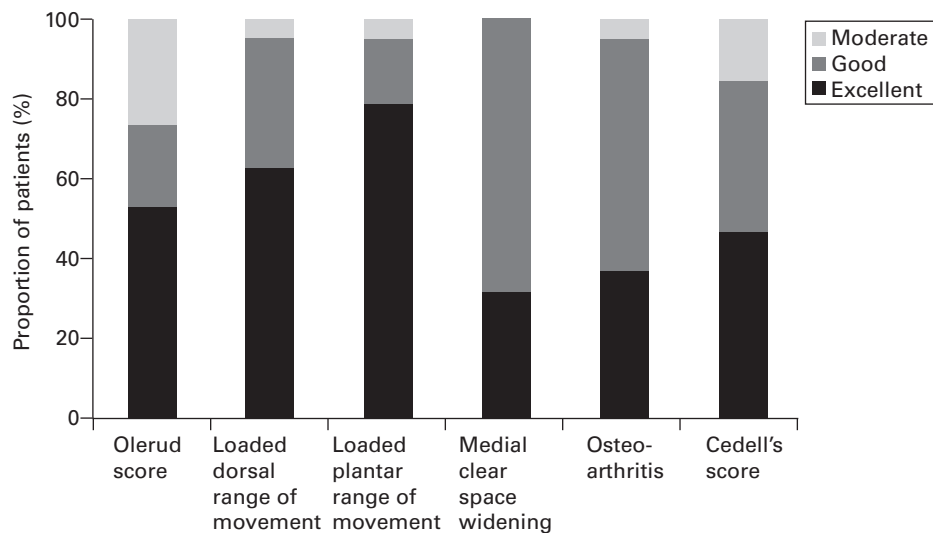


Fig. 2

Overview of the results of each parameter for all patients.

15 patients (79%), 'good' in three (16%) and 'moderate' in one (5%). Medial joint space widening was 'excellent' in six patients (32%) and 'good' in 13 (68%). Concerning osteoarthritis there was an 'excellent' score in seven patients (37%), a 'good' score in 11 (58%) and a 'moderate' score in one (5%). Considering the Cedell score, nine of the patients (47%) scored an 'excellent', seven (37%) a 'good' and three (16%) a 'moderate' result. No patient scored a 'poor' result in any of the outcome parameters (Fig. 2). When judging the Cedell score only for the posterior malleolus the result was

'anatomical' or 'good' in 95% (n = 18) (Table II). The two patients with severe displacement of large fragments both scored 'excellent' results as judged by the Olerud and Molander score, the loaded dorsal range of movement and the Cedell scores, and 'excellent' or 'good' results in relation to medial joint space widening and osteoarthritis. There was no correlation (Spearman's test) between the size of the gap and the clinical results (Olerud score:  $\rho = -0.12$ ,  $p = 0.62$ ; Dorsal flexion:  $\rho = -0.11$ ,  $p = 0.65$ ; Osteoarthritis:  $\rho = 0.04$ ,  $p = 0.88$ ; Medial clear space widening:  $\rho = -0.05$ ,

**Table II.** Baseline characteristics of 19 patients at the time of injury

Characteristic	
Gender (n, %)	
Male	13 (68.4)
Female	6 (31.6)
Localisation (n, %)	
Left	12 (63.2)
Right	7 (36.8)
Mean age (yrs) (range)	31 (16 to 52)
Pre-existing disease	0
Trauma (n, %)	
Traffic	1 (5.3)
Sports	9 (47.4)
Domestic	6 (31.6)
Work	1 (5.3)
Other	2 (10.5)
Soft-tissue injury <sup>20</sup> (n, %)	
Grade 0	19 (100)
Posterior displacement in mm of posterior fragment (median (range))*	4 (1 to 15)
Percentage fragment of total joint contact area (median (range))*	12 (3 to 47)
Painful palpation at ventral side of the fibula or medial malleolus	
Yes	18 (94.7)
No	1 (5.3)
Plaster cast (n, %)	
Weight-bearing	4 (21.1)
Non-weight-bearing	15 (78.9)
Physiotherapy (n, %)	
Yes	6 (31.6)
No	13 (68.4)
Complications/secondary dislocation	0
Median duration of outpatient treatment (weeks) (range)	8 (0 to 19)

\* measured on lateral radiographs

$p = 0.833$ ; Cedell score:  $\rho = -0.16$ ,  $p = 0.51$ ), nor was there correlation between the percentage of the tibiotalar contact area compared with the clinical results (Olerud score:  $\rho = -0.09$ ,  $p = 0.73$ ; Dorsal flexion:  $\rho = -0.20$ ,  $p = 0.40$ ; Osteoarthritis:  $\rho = -0.03$ ,  $p = 0.89$ ; Medial clear space widening:  $\rho = -0.10$ ,  $p = 0.67$ ; Cedell score:  $\rho = -0.14$ ,  $p = 0.58$ ).

## Discussion

This cohort of 19 patients with 'isolated' posterior malleolar fractures from 24 such injured patients who were available for long-term evaluation from a database of 580 consecutive ankle fractures suggests that the true incidence of this injury may be much higher (4%) than that reported in the literature (0.5%).<sup>1-4</sup> However, despite our efforts to select only isolated posterior malleolar fractures, we cannot exclude the possibility that patients with associated injuries were included. Based on initial data from the 1985 prospective database, as judged by local medial tenderness, isolated posterior malleolar fractures would seem to be generally accompanied by ligamentous injury. The long-term prognosis is excellent or good, and radiologically severe post-traumatic osteoarthritis was not observed, although there were some radiological features of arthritis in 63% of cases. Although in our study there was

no statistical correlation between the size of the gap and the percentage of the tibiotalar contact area compared with the clinical results, our sample size might have been too small to detect statistically significant differences (a type II error). The high incidence in our study of isolated posterior malleolar ankle fractures could be the result of our prospective registration or due to different definitions in the literature. If we had assumed that all the patients with pain at the medial side of the ankle had a ligament injury and excluded them in order to select only 'truly' isolated posterior malleolar fractures, this would have left just one patient out of 580 ankle fractures. Brostroem, Liljedahl and Lindvall<sup>8</sup> performed arthrography in 18 patients with isolated posterior malleolar fractures and almost invariably found a blush of contrast at the side of the anterior syndesmotic ligament, suggesting that it had ruptured. In three patients arthrography was performed after three, four and seven days and there was no leakage of contrast, possibly prevented by fibrin deposition and clotting. It was thought that a truly isolated posterior malleolar fracture without concomitant ligamentous injury does not exist.

A systematic review<sup>16</sup> found only one previous clinical study of isolated posterior malleolar fractures,<sup>6</sup> in which 22 patients were followed for a mean of 4.7 years (9 months to 10 years). At follow-up 13 patients were symptom-free and 11 had no signs of osteoarthritis. In the three operated patients with large fracture fragments the anterior syndesmotic ligament was torn. Owing to patient history the authors state that the fracture must be the result of extreme plantar flexion combined with axial loading such as might occur falling backward with the foot sliding forward on an uneven slippery surface. This suggests that the mechanism is similar to the Lisfranc injury. Although the sample size described was larger than ours, the follow-up was too short to detect end-stage osteoarthritis.<sup>6</sup> Horisberger, Valderrabano and Hintermann<sup>17</sup> showed that the latency period between injury and end-stage ankle osteoarthritis can be as long as 20 years.

The reasonable number of patients in our study without or with limited osteoarthritis or clinical symptoms long after an isolated posterior malleolar fracture suggests that there is little risk of developing osteoarthritis after closed reduction of this type of fracture. An experimental study showed no reduction of the tibiotalar contact area in isolated posterior malleolar fractures, but only a change in distribution of the forces, suggesting that stability is mainly the result of a stable lateral and medial malleoli.<sup>18</sup> None of our patients had a CT scan to estimate the size of the fracture fragment, which was measured on a plain lateral radiograph in accordance with common practice at that time. However, we now know that this leads to severe underestimation of loose or impacted posterior osteochondral fragments, and that radiographs have poor inter- and intra-examiner reliability.<sup>19,20</sup>

Despite the retrospective design of our study it has several strengths. Our sample size was larger than in other studies on

posterior malleolar fractures. Moreover, the number of patients lost to follow-up and the amount of missing data were small. Unfortunately, our sample size might have been too small to detect the development of osteoarthritis. The main problem with most scoring systems is the use of relative terminology which makes the results subjective and difficult to compare. To avoid this problem we tried to use reproducible criteria such as the Olerud and Molander score, although as > 50% of the patients scored the maximum number of points, one can question whether the Olerud and Molander score was sufficiently discriminating to evaluate this outcome in our study.

We found that isolated posterior malleolar fractures may be under-reported in the literature. Although concomitant ligamentous injury is frequently present, the true pathophysiological mechanism remains uncertain. However, conservative treatment of isolated posterior malleolar fractures seems justified.

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