

## CASE REPORT

# Relation between the occurrence of bony union and outcome for fractures of the lateral process of the talus: a case report and analysis of published reports

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Fractures of the lateral process of the talus are uncommon, but the incidence has probably risen because of the increased popularity of snowboarding, an increased awareness of doctors, and the ready availability of computed tomography scanning. One case report and a review of the literature are provided. Aggressive management rarely resulted in non-union (7%) and was always associated with a good outcome (100%), even if the fracture fragments were excised initially. The relations between method of treatment, bony union, and outcome were significant (Fisher's exact test,  $p < 0.01$ ).

Fractures of the lateral process of the talus are uncommon. The incidence may have risen because of the increased popularity of snowboarding and the consequent increase in injuries,<sup>1–3</sup> an increased awareness of doctors, and the ready availability of computed tomography (CT) scanning.<sup>4–5</sup>

Reports in major journals and standard textbooks<sup>6–12</sup> indicate that displaced and comminuted fractures are best treated with early surgery. This study was undertaken to assess the available evidence for this recommendation.

Less than 60 cases have been reported.<sup>1–7 13–17</sup> A careful review of the literature allowed me to classify 40 previously reported cases and one new case of intra-articular fracture of the lateral process of the talus into fracture type (undisplaced, displaced, comminuted) and treatment provided (missed, conservative, closed reduction with cast immobilisation (CR), operative reduction and internal fixation (ORIF), and early excision) and relate these factors to the outcome.

### METHODS

Medline was searched using combinations of the keywords: talus, fracture, lateral process, outcome. The reference list in every paper identified was studied to identify further references to this fracture.

The literature was analysed to extract cases for which the following could be determined: classification of single fragment fractures into undisplaced, displaced, or comminuted fractures; classification of treatment into missed without appropriate treatment (in some cases the fracture was missed, but appropriate conservative treatment was applied), conservative (usually casting and non-weight bearing for a variable period), ORIF, CR, initial surgical excision of the fracture fragment(s). Extra-articular fractures—that is, those not involving the subtalar joint—were excluded. If the presence or absence of displacement was not mentioned in the paper nor ascertainable from the radiographs provided, the fracture was assumed to be undisplaced.

The outcome was classified as good or poor, with good corresponding to no or minimal residual pain and resulting functional limitation, and poor corresponding to significant residual

pain with function limitation or the need for subtalar fusion. Follow up was of the order of one to five years.

Table 1 lists the papers from which the data were extracted. The published cases did not provide the details of the rehabilitative programmes used. One new case is reported.

Group statistical comparisons were made by Fisher's exact test using Statview 4.51 by Abacus Concepts, San Francisco, California, USA, 1995.

### CASE REPORT

A 37 year old man fell 20 feet while mountain climbing, sustaining a forced dorsiflexion injury to his right foot. CT scanning showed a displaced, partially comminuted fracture of the lateral process of the talus. The injury was treated conservatively by casting for six weeks, followed by a further six weeks of non-weight bearing. Active mobilisation began at six weeks and was pursued vigorously with physiotherapy, swimming, and later cycling once weight bearing was recommended. Weight bearing, once begun, was extremely painful over the lateral process and was associated with severe subtalar joint inflammation, stiffness, and the development of chronic plantar fasciitis, despite continuing active mobilisation.

Non-union of a very large fracture fragment involving a significant portion of the subtalar joint was not recognised for 13 months. Excision of the fragment 15 months after the injury did not relieve the pain, although subtalar motion was improved. A subtalar fusion was required for progressive subtalar joint osteoarthritis, 23 months after the injury.

### RESULTS

Table 2 gives the results. In most of the reported cases, the injury was the result of a fall from a height or an automobile accident, representing high impact injuries.

Poor outcomes were all associated with pain and resulting functional limitation which were due to subtalar joint osteoarthritis, except for one case of bony impingement which was due to bony overgrowth.

A good outcome occurred in 12 of 20 (60%) cases of fractures managed non-aggressively (conservative treatment or where the fracture was missed). A good outcome occurred in all 21 aggressively managed (ORIF, CR, or initial excision) cases. Two by two table analysis with Fisher's exact test for independence gave  $p < 0.01$  for the relation of good and poor outcome to aggressive and non-aggressive management.

Non-union occurred in 12 of 20 (60%) cases of fractures managed non-aggressively. Non-union occurred in only one of 21 (5%) aggressively managed fractures, although in six cases the fracture fragment(s) was initially excised. Two by two

**Abbreviations:** ORIF, operative reduction and internal fixation; CR, closed reduction with cast immobilisation; CT, computed tomography

**Table 1** Reports from which data were extracted

Reference	Journal	Year	Number of cases described	Number of cases used in meta-analysis
Hawkins <sup>15</sup>	<i>J Bone Joint Surg</i>	1965	13	11*
Fjeldborg <sup>17</sup>	<i>Acta Orthop Scan</i>	1968	3	2*
Mukherjee <sup>14</sup>	<i>J Bone Joint Surg</i>	1974	13	12†
Heckman <sup>13</sup>	<i>Clin Orthop</i>	1985	9	9
Kettunen <sup>7</sup>	<i>Acta Orthop Scan</i>	1992	1	1
Noble <sup>4</sup>	<i>Br J Sports Med</i>	1992	1	1
Nicholas <sup>2</sup>	<i>J Am Board Fam Pract</i>	1994	1	1
Ebraheim <sup>5</sup>	<i>J Ortho Trauma</i>	1994	6	1‡
Tucker <sup>6</sup>	<i>Foot Ankle Int</i>	1998	2	2

\*Three cases not used as probably extra-articular fractures.

†One case deleted as inadequate follow up.

‡Five cases deleted as outcome not stated clearly, but three were treated with operative reduction and internal fixation presumably with good results, one case was missed with resultant non-union, one was a comminuted fracture treated conservatively because of diabetes.

**Table 2** Outcome of fractures of the lateral process of the talus by method of treatment

	Number of cases	Non-union rate (%)	Good outcome (%)
Undisplaced (conservative)	8	4 (50)	6 (75)*
Undisplaced (missed)	1	0	1†
Displaced (conservative)	3	3 (100)	1 (33)‡
Displaced (missed)	4	3 (75)	3 (75)§
Displaced (ORIF or CR¶)	11	1 (9)**	11 (100)
Displaced (initial excision)	3	0	3 (100)††
Comminuted (conservative)	4	2 (50)	1 (25)‡‡
Comminuted (ORIF or CR§§)	4	0	4 (100)
Comminuted (initial excision)	3	0	3 (100)

\*One successful late excision of small fragment, one successful excision of large fragment at one month.

†Successful late ORIF at four months.

‡One successful excision of large fragment at three months.

§Two successful late excisions of small fragments.

¶Two cases.

\*\*One successful excision of large fragment at six months.

††Early arthritis on radiograph in one case.

‡‡One case.

§§The good outcome occurred in a fracture that united; the other case of union was complicated by bony impingement.

ORIF, operative reduction and internal fixation; CR, closed reduction with cast immobilisation.

table analysis with Fisher's exact test for independence gave  $p < 0.01$  for the relation of non-union and union to aggressive and non-aggressive management. If the five missed fractures and the six cases where the fracture fragment(s) was excised initially are excluded, a variable period of immobilisation resulted in non-union of fractures in nine of 15 cases (60%), and ORIF or CR resulted in non-union in one of 15 cases (7%). The  $p$  value remains significant at  $< 0.01$ .

Overall, non-union was associated with a poor outcome in seven of 13 cases (54%), whereas union (excluding those fractures treated with initial excision) resulted in a poor outcome in only one of 22 cases (5%). Two by two table analysis with Fisher's exact test for independence gave  $p < 0.01$  for the relation of good and poor outcome to union and non-union.

Table 2 notes the details of the six good outcomes in the non-union group; three were very small fragments which were excised late (about a year after the injury). The other three were also the result of excisions for larger fragments which occurred within six months of the injury. If the three cases of non-union of very small fragments are excluded, non-union of large intra-articular fragments led to a poor outcome in seven of 10 cases (70%). Instability of the subtalar joint and ankle joint was not reported after excision of the lateral process.

## DISCUSSION

Two main factors affect the outcome of traumatic joint injuries: the degree of initial cartilage injury and the accuracy

of the restoration of joint surface congruity by the treatment provided.<sup>11, 12</sup>

Fractures of the lateral process of the talus are unique among hind-foot fractures involving the subtalar joint in that non-union is very common.<sup>11, 12</sup> From the data, it can be seen that conservative treatment or misdiagnosis of intra-articular fractures of the lateral process of the talus often leads to non-union and this is not likely to be associated with a good outcome, unless the fracture fragment(s) is very small or excised early. Yet, initial excision of a fracture fragment(s), at the time of the injury, consistently produces good results, as does ORIF. Prolonged weight bearing on the intra-articular non-unioned fracture probably leads to severe joint inflammation and joint stiffness, which greatly contributes to subtalar joint degeneration.

Subtalar joint instability has not been reported after excision of the lateral process of the talus, but it has been mentioned as a possible complication<sup>11</sup> of this procedure. The absence of this complication is not surprising, as the only ligament that contributes to subtalar joint stability that is compromised by resection of the lateral process is the relatively unimportant lateral root of the inferior extensor retinaculum.

For displaced and comminuted fractures of the lateral process of the talus, every effort should be made to achieve reduction and fixation of the fracture. If non-union occurs, the fragment(s) should be excised promptly. For a comminuted fracture of the lateral process that is not amenable to ORIF,

immediate excision of the comminuted fragments is most appropriate, to allow early mobilisation. If such a fracture is treated conservatively, in the hope that congruent union will occur, close follow up by CT scanning to assess any effort to effect closed reduction of the fracture and to detect non-union and assess the fragment size is essential. However, closed reduction should not be considered a reliable technique for managing this injury, as experience is limited (three cases only; see table 2), and the achievement and maintenance of joint congruity is likely to be difficult, and mobilisation delayed. Early excision should be undertaken if non-union occurs. If the fracture fragment is single, displaced, and very small and thus also not amenable to ORIF, late excision for non-union may be successful in relieving pain, but there seems no point in delaying the excision.

There are weaknesses in this study: the retrospective, uncontrolled nature of the comparison of the treatment options studied and the relatively small number of cases available for review. However, this study represents the full extent of information available specific to the treatment of this injury. The fractures that resulted in poor outcomes may have been the result of more severe primary cartilage injuries, but this appears to be an unlikely explanation given the very high incidence of good outcomes when congruent union occurred. Conservative treatment regimens varied, and some may not be considered adequate, which could have affected the union rate. Also, the extent to which patients attempted to mobilise the subtalar joint, as part of a rehabilitation programme, could not be assessed. As restoration of joint motion is thought by some to be important in preventing osteoarthritis, the different rehabilitation programmes may explain the different outcomes. However, there are no studies to support the view that different rehabilitation programmes affect the incidence of post-traumatic osteoarthritis. Therefore this is also unlikely to explain the significant association between non-union without early excision and poor outcome.

Classifying the degree of displacement was difficult, as radiographs were not always provided and in older cases CT scans had not been performed. I erred on the conservative side and classified the fracture as undisplaced if uncertain. For this reason undisplaced and displaced fractures were not separated in the analyses. Some of the fractures classified as undisplaced may in fact have been displaced, explaining the unexpectedly high non-union rate in the undisplaced group. However, it is apparent that even minimal displacement (<2 mm) of lateral process fractures as seen on plain radiographs indicates that non-union is likely if the fracture is treated conservatively.

Two other studies in which the fractures could not be adequately classified for inclusion lend support to the conclusions of this study. In a series of nine patients with unclassified fractures, all managed conservatively, six (67%) had residual pain and four (45%) had limitation of function. The authors concluded that conservative treatment should be reappraised.<sup>8</sup> In another series of 13 patients managed

conservatively, all patients with significantly displaced fractures fared poorly, compared with patients with undisplaced fractures. Alternative treatment was recommended for displaced fractures.<sup>10</sup>

In conclusion, it is important to ensure congruent bony union or the absence of loose intra-articular bone fragments before weight bearing is allowed in patients with this injury. Thus, from the available evidence, the best treatment for displaced or comminuted intra-articular fractures of the lateral process of the talus is to achieve accurate reduction and fixation of the fracture. If this is not possible, early excision of non-united fragment(s) should be performed. A trial of inevitably painful weight bearing on a non-united fracture is counterproductive. These conclusions are consistent with all other published recommendations for the treatment of this injury.<sup>1-17</sup>

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