

Outcome of the management of open ankle fractures in an ortho-plastic specialist centre[☆]



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ABSTRACT

Introduction: We reviewed the functional outcome of 68 patients with open ankle fractures managed in an orthoplastic specialist centre.

Materials and methods: Patients managed at Frenchay Hospital over a 6 year period were divided into 3 groups: group P were patients initially seen and managed at Frenchay Hospital (an orthoplastic specialist centre), group S were patients stabilised at a different unit and referred for definitive management, while group R were patients managed in a different unit and referred following complications.

Injuries were graded using the AO score and outcome was measured using the Enneking score (both validated).

Results: 19 patients (group P, mean age: 43 years), 26 patients (group S, mean age: 41 years) and 23 patients (group R, mean age: 41.9 years) made the cohort. 82.4% patients required free tissue transfer. Mean AO scores of groups P, S and R were 11.5, 12.3 and 9.7 ($p = 0.03$). Mean number of procedures for P, S and R were 2.6, 3.5 and 4.2 ($p = 0.0006$). Mean follow up time was 55.5, 61.0 and 57.0 weeks respectively ($p = 0.72$). Mean Enneking scores for groups P, S and R were 63.3, 74.8 and 73.5 ($p = 0.16$).

Conclusion: Patients from groups S and R underwent more procedures. However, a similar outcome can be achieved, highlighting the importance of managing such injuries in an orthoplastic specialist centre.

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Introduction

The management of open ankle fractures remains a challenging one, owing to the complex osseo-ligamentous structures that allow for the range of movement and stability of the joint; achieving fracture union also does not always equate with a good functional outcome, due to the articulation with the talus. Moreover, the joint is encased in a thin pliable layer of soft tissue that is easily avulsed in trauma. The 'Standards for the management of open fractures of the lower limb' [1] has championed a combined ortho-plastic approach for the management of such injuries. An ortho-plastic specialist centre has been in service since 2006 at Frenchay Hospital (Bristol, United Kingdom). This study reviewed the outcome of patients with open ankle fractures treated within the auspices of such a centre.

Materials and methods

Patients treated at the specialist centre were retrospectively identified and their medical notes reviewed. The patients were divided into 3 groups: group 'P' were patients seen and managed at Frenchay Hospital from the time of injury; group 'S' were patients who were skeletally stabilised at a different hospital and referred to Frenchay Hospital for definitive soft tissue reconstruction; and group 'R' were patients managed at different hospitals and referred for the subsequent management.

Patients from groups 'P' and 'S' are initially assessed by a senior plastic surgeon and orthopaedic surgeon with a major interest in complex limb trauma. The wound is excised in a pseudo-tumour fashion and options for reconstructions are discussed. If reconstruction is possible with a local flap, then the ankle fracture is fixed and the soft tissue reconstruction is performed at the same sitting. Otherwise, an external fixator and a negative pressure dressing are applied. Further investigations are undertaken prior to definitive reconstruction (CT scanning to assess the bony injury and the state of the axial blood vessels). A combined approach for bone reconstruction and soft tissue reconstruction with free tissue transfer is planned for the next available operating list. Patients

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Table 1
Enneking score.

	0	1	2	3	4	5
Pain	0 (severe)	1	2 (moderate)	3	4	5 (none)
Function	0 (total disability)	1	2	3	4	5 (none)
Emotional acceptance	0 (dislikes)	1	2	3	4	5 (enthused)
Supports	0 (two crutches)	1	2	3	4	5 (none)
Walking	0 (unable unaided)	1	2	3	4	5 (unlimited)
Gait	0 (major handicap)	1	2	3	4	5
Skin quality	0 (persistent problems)	1	2	3	4	5 (normal)
Donor site	0 (severe morbidity)	1	2	3	4	5 (unnoticed)

from group 'R' are normally reviewed in a combined ortho-plastic clinic where both the plastic and orthopaedic surgeons are able to plan for the delayed reconstruction. A CT angiogram is performed and a combined approach for reconstruction is undertaken.

Data was collected on a number of variables, including patient demographics, time from injury to definitive reconstruction and number of procedures undertaken to definitive reconstruction. The injuries were graded according to the Association for the Study of Internal Fixation classification [2] (AO score), following wound excision by the senior plastic surgeon. The types of orthopaedic and plastic surgery reconstructions were also noted, with any complications documented. All patients were reviewed in the combined ortho-plastic clinic post reconstruction. The functional outcome of limbs following reconstruction was evaluated using the Enneking system [3], which is robust when compared to the AOFAS ankle-hindfoot score [4]. The Enneking score is determined by clinical examination and is based on an assessment of the degree of physical disability and psychological acceptance of the reconstruction (Table 1). The higher the Enneking score (range 0–40), the more accepted and more successful is the reconstruction. The Enneking score is expressed as a percentage of the non-injured contralateral limb and was measured routinely at the ortho-plastic follow-up clinic. The score taken at the time of final review was used for the analysis. As this was a retrospective study, the patients and reviewers were not aware of the groupings in the study.

Statistical analysis was performed using the one way ANOVA test (GraphPad InStat; Graph-Pad Software, Inc., La Jolla, Calif.) to assess the statistical difference between the various groups. A value of $p < 0.05$ was deemed to be statistically significant.

Results

Sixty eight patients were treated in this series. These included 44 males and 24 females, with a mean age of 42 years old (range: 11–84 years). 19 patients were from the 'P' group, 26 from the 'S' group and 23 from the 'R' group. The median time from injury to definitive surgery was 5 days (1–27 days) for patients in group 'P', 9 days (2–33 days) for patients in group 'S' and 125 days (31–884 days) for patients in group 'R'. One patient from group 'R' had his definitive surgery 2119 days post injury.

The mean AO score for patients in group 'P' was 11.5 ± 2.6 , 12.3 ± 2.5 for patients in group 'S' and 9.7 ± 2.2 for patients on group 'R'. The difference in AO scores was deemed to be statistically significant ($p = 0.03$).

Table 2
Skeletal fixation modalities.

	ORIF	Ex-Fix	Ex-Fix and ORIF	ROM	Ex-Fix and ROM	Circular frame
Group P	13	4	2	0	0	0
Group S	16	5	0	0	2	3
Group R	16	0	0	5	2	0

The patients in all 3 groups underwent a variety of orthopaedic procedures, which included open reduction and internal fixation (ORIF), the use of external fixator and circular frame and removal of metal work (ROM) (Table 2).

67 of the 68 patients underwent soft tissue reconstruction (Fig. 1). 56 (82.4%) patients had free tissue transfer, 50 (89.3%) patients with fascio-cutaneous flaps and 6 (10.3%) patients with muscle flaps. One patient had a below knee amputation as the limb was not deemed to be salvageable.

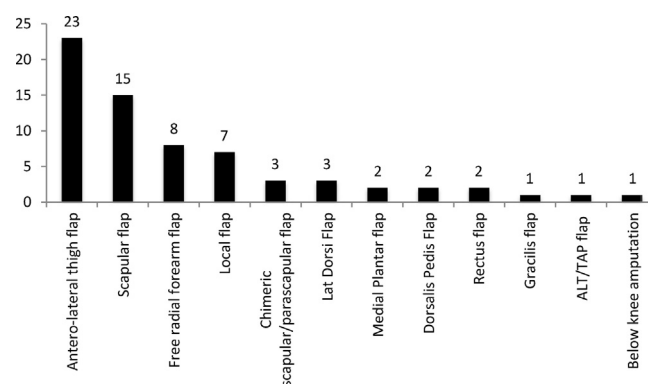
Complications were noted in 7 patients. One patient (group 'R') had tip necrosis of the flap which was excised and the subsequent defect skin grafted. There were 3 cases of haematomas (group 'S': 2; group 'R': 1) which were evacuated, with no subsequent detrimental effect. There were 2 cases of infection (group 'P': 1 and group 'R': 1). One patient developed post-operative infection requiring debridement and intravenous antibiotics. The other patient developed soft tissue infection following liposuction of the flap, which was treated with antibiotics. One flap (Group 'R') failed as the result of venous thrombosis, due to an incomplete venous system.

The mean Enneking score for patients in group 'P' was 63.3 ± 18.0 (mean follow up time: 55.5 weeks), 74.8 ± 14.5 for patients in group 'S' (mean follow-up time: 61.0 weeks) and 73.5 ± 18.8 for patients in group 'R' (mean follow-up time: 57.0 weeks). No statistical difference was noted among the 3 groups ($p = 0.16$).

The mean number of procedures underwent by patients in group 'P' was 2.6 ± 0.9 , 3.5 ± 1.0 for patients in group 'S' and 4.2 ± 2.2 for patients in group 'R'. These differences among the three groups were noted to be statistically significant.

Discussion

Ankle fractures are the commonest of foot and ankle fractures, with 20% of these being open injuries [5], with a peak incidence in mid to older age women and young men [6,7]. The literature is littered with reports on the skeletal management of such injuries;

**Fig. 1.** Soft tissue reconstruction.

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