Clinical audit of the management of stable ankle fractures

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ABSTRACT

INTRODUCTION Ankle fractures are common and 'stable' ankle fractures comprise 40–75% of this group. Studies show that these injuries can be managed successfully in a functional brace, with no need for further radiographs and minimal out-patient follow-up. We aimed to audit current practice and introduce change in order to improve treatment and produce financial savings.

PATIENTS AND METHODS A retrospective 6-month audit was carried out to establish practice. Guidelines were then drawn up and widely distributed in the accident and emergency (A&E) and orthopaedic departments. These included criteria for diagnosis of stable ankle fractures, a management protocol for treatment of these injuries in a brace and also a follow-up algorithm in the out-patient clinic. A prospective 6-month audit was then carried out to assess the effectiveness of the guidelines.

RESULTS Of patients presenting in the second 6-month period, 91% were managed in a functional brace. The mean number of out-patient follow-up appointments, weeks until discharge and repeat radiographs all decreased significantly ($P < 0.05$) after the implementation of the guidelines. The cost of treating a patient with a stable ankle fracture dropped from £310.75 to £129.80.

CONCLUSIONS Previous studies have shown that stable ankle fractures are more effectively treated in a functional brace than a plaster cast, do not displace and, therefore, do not need repeat radiographs. A previous audit demonstrated that 60% of patients with stable fractures could be treated in a brace. We have shown that, with effective and persistent education of colleagues, the vast majority (91%) of patients can be managed in this way and this results in a significant cost saving. We have also shown that an evidence-based treatment protocol can produce significant improvements in management for patients and savings for healthcare organisations.

KEYWORDS

Ankle – Fracture – Medical audit – Evidence-based medicine

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Ankle fractures form a significant part of orthopaedic practice. In a recent population-based epidemiological study,¹ ankle fractures were found to be the most common type of lower extremity fracture, making up to 22.6% of all lower limb fractures. Of these, 'stable' ankle fractures form a separate clinical group comprising 40–75% of all ankle fractures.^{2,3} Several studies have shown that these fractures can be managed in a functional brace or Tubigrip,^{4–6} without the need to repeat radiographs,⁷ and produce an insignificant rate of long-term osteoarthritis.⁸

Despite this evidence there remains a lack of effective guidelines for the management of these fractures resulting in unnecessary cost due to repeat radiographs and out-patient visits.^{7,9}

The aim of this audit was to assess the current management of stable ankle fractures at the Cumberland Infirmary and measure the change in practice after implementation of evidence-based guidelines.⁴ We also calculated the cost of management of these fractures before and after the change in practice and financial savings that can be expected.

Figure 1 Management of stable ankle fractures – diagnosis.

Figure 2 Management of stable ankle fractures – management protocol.

Patients and Methods

We initially conducted a retrospective review of the established practice of the management of stable ankle fractures (AO Type A1.2, A1.3, and B1.1) at our hospital. All patients presenting to the accident and emergency department with ankle fractures in the period from 1 January to 30 June 2004 were identified from accident and emergency coding (Group 1). Their diagnoses and orthopaedic management were confirmed from the dictated consultant letters present on the hospital database. Our exclusion criteria comprised patients less than 16 years of age, patients followed up elsewhere, wrong coding, incomplete information and multiple injuries or late presentations. The 'stable' ankle fractures were selected and information was collected regarding demographic profile, treatment modalities, total duration of follow-up including number of attendances, number of repeat radiographs, number of cast changes and the weight-bearing advice.

Following this data collection, evidence-based guidelines were drawn up in the form of two posters (Figs 1 and

2). These guidelines were adopted from the work done by Wykes *et al.*⁴ and widely discussed in the department among orthopaedic consultants, junior doctors, physiotherapists and nurses. Posters displaying these guidelines were put up in the accident and emergency department and fracture clinic and compliance was checked regularly by members of the lead clinician's team. Meetings were held with accident and emergency department doctors to inform of the policy and the management algorithm was reinforced by repetition at weekly lunch-time meetings.

After implementation of these guidelines, a second data collection was carried out by prospectively auditing all ankle fractures presenting to the accident and emergency department from May to November 2005 (Group 2).

Patients were seen by the orthopaedic team on call, in fracture clinic or, in case of admission, on the ward within 24 hours and a treatment decision was made according to whether the ankle fracture was stable or unstable. Suitable patients had an Airloc® stabilisation orthosis (Bauerfeind; Birmingham, UK) applied and were encouraged to weight

bear as tolerated. The Airloc® brace allows ankle flexion/extension but counteracts rotation and can be worn inside a shoe. The patients were seen at 4-week interval and clinical evaluation was carried out as to pain and stiffness at the ankle and weight-bearing status. A radiograph was not done unless indicated. If the ankle was clinically united with good range of movement, patients were discharged at this stage with advice to return in case of any problem. If the ankle was clinically united but had less than acceptable range of movement, the patients were sent to physiotherapy and reviewed in 2–3 weeks. If the ankle was not clinically united, the patients were advised to continue wearing the brace and were reviewed in the same way. This evaluation was according to the attending surgeon's decision.

Data were collected as to the demographic profile of the patients, mechanism of injury, AO classification of ankle fracture, management in accident and emergency and at the new fracture clinic. Percentage of patients at 4 weeks showing union, full weight bearing and return to work was also noted. The cost of the Airloc® brace and a below-knee plaster cast were obtained from the purchasing department. The cost of a follow-up appointment at the orthopaedic clinic was obtained from the hospital finance department and the cost of a set of anteroposterior and lateral radiographs was obtained from the radiology department. These costs were used to analyse the overall cost of management of these fractures.

Gross obesity, massive ankle swelling or intolerance to wearing a brace were reported reasons for non-compliance with the brace in some patients. These patients were treated in a below-knee plaster cast but the remainder of the management advice regarding weight-bearing, follow-up, clinical and radiographic evaluation was identical.

Data were analysed using SPSS v.11.5 and the variables between the two sets were compared using *t*-test.

Results

Characteristics of the two groups are shown in Table 1.

Table 1 Baseline data

	Group 1 (retrospective)	Group 2 (prospective)
Patients (n)	45	66
Mean age (years)	45.7	51
M:F ratio	1:1.05	1:1.3
Proportion of AO Type B1.1	51.1%	56.1%

Retrospective data – Group 1

Of ankle fractures presenting in the first 6-month period, 40% were stable according to the criteria set out by Wykes *et al.*;⁴ of these, 89% were treated in a full below-knee cast, 7% in a back slab, 2% in a functional brace and 2% in a Tubigrip. Patients with stable ankle fractures had, on average, 1.1 cast changes with 5.0 ± 2.2 weeks in cast and 3.8 ± 2.7 weeks non-weight bearing.

Prospective data – Group 2

In the second 6-month period, we treated a total of 135 ankle fractures. Of these, 52% ($n = 70$) were classified as stable and 48% ($n = 65$) unstable fractures. Of the fractures, 77% were due to simple falls, and 17% due to sports injuries.

The most common stable ankle fracture was the AO B1.1 type making up 52% followed by A1.2, 39% and A1.3, 9%. The majority (68%) of the stable ankle fractures seen in the accident and emergency department were initially treated in a below-knee back slab.

Two patients were lost to follow-up. These patients were out of area and repeated attempts to contact them failed. Both these patients were treated initially in a brace. We had the data of 66 patients to analyse which was done by intention-to-treat principle. Of the stable ankle fractures, 91% (n

Table 2 Results

	Group 1 (retrospective)	Group 2 (prospective)	<i>P</i> -value for difference
No. of out-patient follow-up appointments	3.3 ± 1.4	1.5 ± 0.7	< 0.05
Weeks until discharge	9.2 ± 6.7	5.9 ± 3.0	< 0.05
Repeat radiographs	1.4 ± 1.3	0.1 ± 0.4	< 0.05
Principal treatment	Cast 88.9%	Airloc® brace 91%	

Values are mean $\pm$ SD.

Figure 3 Follow-up appointments, duration of follow-up until discharge and repeat radiographs for the two study groups.

= 60) were managed in an Airloc® brace; 7.6% ($n = 5$) were treated in a cast. Five patients not treated with a brace were done so due to obesity ($n = 1$), excessive swelling ($n = 1$) intolerance to the brace ($n = 2$) and extreme age ($n = 1$). These patients were treated in a below-knee plaster cast but were otherwise managed identically to the brace group.

Of the patients seen after the first 4 weeks, 80.5% had clinically united, *i.e.* had no localised pain at the fracture site. Of these patients, 78.8% were full weight-bearing on the ankle, and 43.9% had returned to work. We were able to discharge 60.6% of the patients at this stage as they had evidence of clinical union and an acceptable range of movement.

The difference between the two groups was statistically significant with a P -value of < 0.05 for follow-up appointments, duration of follow-up until discharge and repeat radiographs (Fig. 3; Table 2).

Cost analysis

The cost of various modalities included to calculate the final cost is shown in Table 3. These costs were obtained from various departments in the hospital. The cost of managing ankle fractures per patient was £310.75 as per the previous established practice. By following the guidelines and standardising practice, we were able to reduce the cost of

managing these fractures to £124.30 per patient thus achieving a net reduction of £180.95 or 58.2% of the original cost. This implies an overall saving of £11,942.7 in 6 months or £20,473.20 annually.

Discussion

Isolated lateral malleolar fractures, in the absence of any medial bony or ligamentous injury, have been shown to be stable in configuration.¹⁰ Moreover, it has been shown that in these types of fractures, the apparent external rotation of the lateral malleolar fragment is due to the internal rotation of the proximal fibula rather than the external rotation of the distal malleolar fragment in relation to the talus.^{11,12}

This evidence has resulted in the treatment of these fractures with a non-operative approach. Deitrich *et al.*⁵ compared non-operative with operative management of isolated Weber B fractures and reported an excellent result according to the Olerud–Molander ankle score of 100 in 85% of patients treated with pneumatic cast brace and a maximum score of 95 in 64% of operated patients. Stuart *et al.*¹³ reported 84% clinical union at 6 weeks with functional bracing and significantly better patient comfort at 24 h with a pneumatic brace as compared to a plaster cast. We achieved similar results with 80.3% clinical union at the end of 4 weeks. Port *et al.*⁶ compared immediate weight-bearing and mobilisation with immobilisation in a plaster cast and reported significantly fewer symptoms, significantly higher Olerud scores and significantly better range of movement in the first 2 months after injury, in the mobilisation group.

A pneumatic ankle brace has been shown to achieve better results in the initial months after injury.¹⁴ Our observations have shown that patients demonstrate excellent compliance with the brace as they can wear it in their shoes. Continuous pressure exerted by the brace reduces swelling. Although pressure sore development is a reported complication, we experienced no such instances following our guidelines.

We saw no patients with secondary displacement as has been previously reported with non-operative management. Our strict use of guidelines to identify stable ankle fractures may explain our success, as we specifically excluded

Table 3 Cost of treatment of stable ankle fractures

	Radiographs	Follow-up appointments	Below-knee walking cast	Airloc® brace	Total cost	Cost per ankle fracture
Cost per item	£40	£67	£20.13	£26.80		
Total cost Group 1	£2600	£10,050	£1172.90	£160.80	£13,983.70	£310.75
Total cost Group 2	£360	£6499	£100.65	£1608.00	£8567.65	£129.80

patients with medial tenderness or unusual fracture morphology with this protocol.

Overall, 91% of our patients were treated in a brace. This is a significant change in practice after our retrospective audit showed that we were treating 89% of these fractures in a cast. Wykes *et al.*⁴ reported difficulties in following guidelines in their department and achieving a change in practice, as their best compliance rate was 60%; they felt they could do better.

Detailed discussion with the consultants, involvement of junior doctors, physiotherapists and nurses was instrumental in implementing the guidelines. Use of posters displaying clear instructions as to the diagnosis and management of these fractures in accident and emergency and fracture clinic helped the staff to follow the protocol. By following the guidelines and implementing a uniform practice in our unit, we achieved a significant decrease in the average number of follow-up appointments from 3.3 to 1.5 and the duration of follow-up from 9 weeks to 5.9 weeks. We also achieved a reduction in the number of repeat radiographs taken from 1.4 to 0.1.

This reduction in the number of follow-up appointments and repeat radiographs was the biggest reason for our cost savings. We did not include the cost of seeing the patient in accident and emergency and new fracture clinic appointment as these will be same for both groups. We also did not include the cost of physiotherapy or hospital admissions.

The actual cost of treatment of ankle fractures, therefore, is probably more than we have calculated but, following a uniform policy and guidelines, definitely improves the outcome both for the patients and for the department.

The success of this audit raises the question of whether we can take the idea of evidence-based treatment protocols further. It would seem possible, and probably more cost effective, for patients such as those audited above to be seen in a nurse-led clinic for follow-up of their stable ankle fracture. They do not need X-ray interpretation but simple physical and functional assessment and referral to physiotherapy or back to the surgeon if any concerns are raised. This form of nurse-led assessment may also be possible for wrist and hip fractures and could be combined with osteoporosis screening.

Conclusions

Stable ankle fractures are common injuries that can be effectively treated in a functional brace. Studies show that these injuries do not need repeat radiographs and need minimal out-patient follow-up. We have shown that after

good communication with colleagues, distribution of evidence-based guidelines and persistent reminders of a protocol, a high rate of successful treatment can be obtained. We have also shown that, following an evidence-based treatment, protocols can produce significant improvements in management for patients and savings for healthcare organisations.

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