ORIGINAL ARTICLE

Has the assessment of isolated ankle injuries altered since 1993?

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Emerg Med J 2005;22:863–866. doi: 10.1136/emj.2004.020818

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Accepted for publication
21 January 2005

Background: Performance of emergency departments in England and Wales has declined in recent years. Data from the authors' department has shown that junior doctors now see fewer patients and spend longer over their assessment than was the case previously. This study aimed to determine how the assessment of patients with isolated ankle injuries changed over an 11 year period.

Methods: A retrospective case note review was conducted. Data regarding the duration of assessment, clinical information recorded, investigations, and treatments were retrieved.

Results: During the period studied 13 555 patients presented with isolated ankle injuries; case notes of 550 of these patients were reviewed in the present study. Linear regression demonstrated that the median length of time from arrival in the department until seen by a clinician increased ($b=3.0$ min/year, 95% CI 0.7 to 5.2, $p=0.015$), but the median length of time from seeing a clinician until leaving the department was unchanged ($b=0.6$ min/year, 95% CI -1.3 to 2.5 , $p=0.475$). More clinical information was being recorded, but the proportion of patients having radiographs of the ankle ($b=0.24\%$ per year, 95% CI -1.40% to 1.87% , $p=0.751$) or in whom a fracture was diagnosed ($b=-0.20\%$ per year, 95% CI -1.59% to 1.19% per year, $p=0.752$) remained unchanged.

Conclusion: It appears from this study that the duration of assessment of patients with minor injuries is not changing although this result should be interpreted cautiously.

In recent years the performance of emergency departments (EDs) performance in England and Wales has declined.¹ Since the publication of *The NHS Plan* there has been considerable focus on minimising the length of time patients spend in the ED, and particular measures have been advocated to minimise the time patients with minor injuries spend in the ED.^{2–3} Data from our own department shows that junior doctors now see fewer patients and spend longer over their assessment than was the case previously. Junior doctors treat the majority of patients presenting to EDs in the UK,⁴ treating 78% of patients attending one paediatric ED in the UK.⁵ It is likely therefore that this fact will have considerable impact at a national level.

The patient with an isolated ankle injury is typical of many patients with minor injuries presenting to the ED. The injury occurs in a broad spectrum of the population with varying severity. Since shortly after their publication, evidence based guidelines have been routinely followed in our department for the assessment of such patients.^{6–7} These guidelines allow a rapid and structured assessment and direct the use of radiography. The way in which junior doctors are trained in the application of these guidelines has altered little, as has the treatment of these injuries. This condition therefore presents an opportunity to evaluate how the assessment of minor injuries has altered. Our study aimed to determine whether patients with isolated ankle injuries are spending longer in the ED and whether the amount of clinical information recorded or use of radiography is changing.

An emergency nurse practitioner (ENP) service was established in Sheffield in 1996. ENPs are experienced ED nurses who have undertaken a period of further training to be able to assess and treat patients with minor injuries. The number of patients seen by ENPs has increased considerably since establishment of the service. We therefore also aimed to examine whether differences exist between ENPs and doctors in terms of time taken over assessment and amount of clinical information recorded.

METHOD

We conducted a retrospective case note review. From the ED database we identified all new patients who had presented to the ED or minor injury unit in Sheffield, UK, with isolated ankle injuries between 1 April and 30 June during the period 1993 to 2003. All potentially eligible cases from each year were assigned a random number using an Excel spreadsheet (Excel 2000, Microsoft Inc). We then reviewed the notes in order of their random number until 50 eligible cases from each year had been reviewed. Cases were excluded if the patient was under 16 years of age at presentation; if the notes were not traceable or were illegible; or if on review it was found that the patient did not have an isolated ankle injury or the episode was a follow up attendance.

We used a proforma (appendix 1) to record the amount of clinical information in each set of notes, and the use of radiography, treatments, and disposal from the ED. This form was developed specifically for this study and was based on both general principles of assessment of injuries as well as specific points in the Ottawa ankle rule.^{6–7} Prior to commencement of the data collection, we assessed the interrater reliability of this method of data collection. Two researchers independently reviewed 25 set of cases notes. Kappa scores were calculated for each item on the form and showed excellent agreement on all items (mean κ score 0.94).⁸

In addition to the above information, we also retrieved data from the ED database regarding the time of arrival of patients, time seen by a clinician, time leaving the ED, and whether the patient was seen by an ENP or doctor.

Outcome measures

We determined the following outcome measures:

- Waiting time—calculated as the length of time from arrival in the ED until the patient was seen by a clinician (either a doctor or ENP).

- Treatment time—calculated as the length of time from seeing a clinician until the patient left the department.
- Total department time—calculated as the length of time from arriving in the ED until the patient left.
- Clinical score—calculated as the sum of the number of points in the history and examination that had been recorded on the data collection form. Each point was assigned a value of one unit. The maximum possible score was 13.

To allow comparison of changes in the numbers of all patients presenting to the ED, we also retrieved data regarding the number of patients presenting to the department during the study period (regardless of presenting complaint), and the number of these patients who underwent radiography.

In line with local policy, ethics committee approval was not required for this study.

Data analysis

We analysed the data using Access 2000 (Microsoft Corporation, Redmond WA) and SPSS for Windows 11.5 (SPSS Inc, Chicago, IL). Changes in the mean waiting time, treatment time, department time, and clinical score were examined using linear regression to determine if these were related to year of presentation. A similar approach was taken to examine the significance of changes in the proportion undergoing radiography, the proportion seen by ENPs, and the proportion in whom a fracture was diagnosed. The regression coefficient "*b*" represents the rate of change in the parameter estimate (for example, mean waiting time) over the 11 year time period.

We calculated mean waiting time, treatment time, department time, and clinical score separately for doctors and ENPs and assessed the significance of any differences with Student's *t* test. Statistical significance was defined as $p < 0.05$.

RESULTS

During the period studied there were 201 875 new patient episodes in the ED database, of which 13 555 (6.7%) were identified as isolated ankle injuries. A total of 592 sets of ED notes were searched of which 42 (7.1%) were excluded for the following reasons: ED notes untraceable ($n = 28$), follow up attendances ($n = 8$), injuries in addition to ankle injury ($n = 2$), ED notes illegible ($n = 1$), and other reasons ($n = 3$). Patients whose case notes were included ranged in age from 16 to 93 years (mean age 35.8, 95% confidence interval (CI) 34.5 to 37.1), and 262 were men (47.6%). Mean age by year during the study period is shown in table 1. There was no

Figure 1 Changes in mean waiting time (WT), treatment time (TT), and total time in department (DT) from 1993 to 2003.

change in the mean age over the study period ($b = 0.14$ years per year, 95% CI -3.9 to 0.67 , $p = 0.558$).

Overall, the mean waiting time was 56.4 minutes (95% CI 50.8 to 62.0), the mean treatment time was 42.9 minutes (95% CI 39.9 to 45.9), and mean department time was 99.3 minutes (95% CI 93.0 to 105.7). The changes in each of these time periods between 1993 and 2003 is shown in fig 1. Linear regression confirmed that mean waiting time increased over time ($b = 3.0$ min/year, 95% CI 0.7 to 5.2, $p = 0.015$), as did the mean department time ($b = 3.6$ min/year, 95% CI 1.0 to 6.2, $p = 0.012$). However, mean treatment time did not change ($b = 0.6$ min/year, 95% CI -1.3 to 2.5, $p = 0.475$).

The changes in mean clinical score, number of patients seen by ENPs, number of patients undergoing radiography, and the number of patients in whom a fracture was diagnosed for each year are summarised in table 1. The mean clinical score increased significantly ($b = 0.26$ points per year, 95% CI 0.12 to 0.40, $p = 0.002$). There was no change in the proportion of patients undergoing radiography ($b = 0.24\%$ per year, 95% CI -1.40% to 1.87% , $p = 0.751$), or the proportion of patients in whom a fracture was diagnosed ($b = -0.20\%$ per year, 95% CI -1.59% to 1.19% , $p = 0.752$). The percentage of patients seen by ENPs increased considerably—from none in 1993 to 52% in 2003. There was no relation between clinical score and the percentage of patients undergoing radiography ($b = -1.36$, 95% CI -6.42 to 3.70 , $p = 0.558$) or the between clinical score and the percentage of patients diagnosed as having a fracture ($b = -3.12\%$, 95% CI -6.85% to 0.61% , $p = 0.91$).

Table 1 Changes in variables over the study period

Year	Mean age (years)	Mean clinical score	No of patients undergoing radiography (%)	No of patients diagnosed with a fracture (%)	No of patients seen by ENPs (%)
1993	35.44	6.76	41 (82)	5 (10)	0 (0)
1994	34.52	6.50	43 (86)	9 (18)	0 (0)
1995	37.82	6.78	44 (88)	13 (26)	0 (0)
1996	35.08	8.54	38 (76)	6 (12)	3 (6)
1997	32.00	7.34	33 (66)	10 (20)	8 (16)
1998	38.94	8.08	38 (76)	5 (10)	16 (32)
1999	32.38	9.06	37 (74)	4 (8)	9 (18)
2000	38.9	8.06	42 (84)	9 (18)	10 (20)
2001	34.6	8.56	43 (86)	6 (12)	10 (20)
2002	36.3	9.82	39 (78)	4 (8)	24 (48)
2003	37.48	8.58	45 (90)	11 (22)	26 (52)

Table 2 Number of patients receiving treatments (percentage of total for that year shown in parenthesis)

Year	No treatment	Prescription*	Tubigrip†	Plaster cast	Splint	Orthopaedic referral	Crutches
1993	26 (52)	0 (0)	20 (40)	2 (4)	0 (0)	1 (2)	2 (4)
1994	14 (28)	7 (14)	27 (54)	8 (16)	0 (0)	2 (4)	9 (18)
1995	7 (14)	14 (28)	27 (54)	7 (14)	0 (0)	1 (2)	10 (20)
1996	8 (16)	12 (24)	35 (70)	4 (8)	1 (2)	0 (0)	6 (12)
1997	9 (18)	10 (20)	32 (64)	3 (6)	0 (0)	2 (4)	7 (14)
1998	10 (20)	3 (6)	27 (74)	1 (2)	1 (2)	0 (0)	7 (14)
1999	1 (2)	26 (52)	38 (76)	3 (6)	1 (2)	0 (0)	7 (14)
2000	5 (10)	22 (44)	38 (76)	4 (8)	0 (0)	1 (2)	4 (8)
2001	13 (26)	9 (18)	31 (62)	2 (4)	1 (2)	2 (4)	7 (14)
2002	6 (12)	25 (50)	31 (62)	2 (4)	0 (0)	1 (2)	6 (12)
2003	9 (18)	18 (36)	24 (48)	7 (14)	0 (0)	4 (8)	5 (10)

*Significant change over time.

†SSL International, Oldham, UK.

The percentage of patients receiving no treatment in the ED for their injury did not change ($b = -2.06\%$, 95% CI -4.56% to 0.44% , $p = 0.1$). The percentage of patients given a prescription increased by just over 3% per year during the period studied ($b = 3.33\%$ per year, 95% CI 0.29% to 6.36% , $p = 0.04$). The use of other treatments did not change. The findings are summarised in table 2.

Changes in the all ED patient episodes

We have previously demonstrated that during the period studied the number of patients presenting during the three month period in each year increased at a rate of 1.3% per year.⁹ The median treatment time of all episodes increased from 50 minutes in 1993 to 90 minutes in 2003 ($b = 3.0$, 95% CI 1.74 to 4.26 , $p < 0.001$). The overall proportion of patients having at least one radiograph increased from 9.3% in 1993 to 45.1% in 2003 ($b = 3.24\%$ per annum, 95% CI 0.90 to 5.6 , $p = 0.012$).

Doctors versus ENPs

The mean waiting time was significantly lower in those patients seen by ENPs than in those seen by doctors (34.2 v 61.5 min, $t = -3.9$, $df = 533$, $p < 0.001$). The mean department time was also significantly lower (74.7 v 104.9 min, $t = -3.8$, $df = 535$, $p = 0.001$). There was no difference in mean treatment time ($t = -0.67$, $df = 524$, $p = 0.50$). There was no difference in the proportion of patients undergoing radiography ($\chi^2 = 1.55$, $p = 0.21$) or proportion found to have a fracture ($\chi^2 = 0.98$, $p = 0.32$). The mean clinical score of 9.9 in the ENP group was significantly higher than that of 7.6 in the group seen by doctors ($t = 10.94$, $df = 550$, $p < 0.001$).

DISCUSSION

The length of time patients with isolated ankle injuries wait to be seen has increased considerably from 1993 to the present day. However, once seen by a clinician, the time taken to conclude the assessment and treatment of their injury remains unaltered. For this particular clinical scenario, our present findings did not support our assertion that clinicians are becoming slower in their assessment of this group of patients, although they may be assessing other patients more slowly, resulting in longer waiting times for the group of patients under investigation. These results should, however, be interpreted cautiously. The treatment time encompasses much more than the assessment by the treating clinician, including the time taken for investigations, treatments, and any period of waiting between these events. Given the overall mean treatment time of 42.9 minutes in the present study one would expect the clinical assessment to account for only a fraction of this period in most cases. Hence

alterations in the duration of clinical assessment may be masked by changes in the duration of other events. From a patient's perspective this probably matters little, with the total length of time spent in the ED being of greater importance. Similarly, from the point of view of the ED it is the total time in the department that will be of greatest importance as maintaining throughput is important in preventing overcrowding and prolonged stays in the ED.¹⁰

Our study showed that the amount of clinical information recorded is increasing, with ENPs recording more than junior doctors. This of course does not necessarily equate to better overall quality of care. It was not the intention of this study to compare the quality of care provided by ENPs and doctors as this has been previously investigated and been shown to be equivalent.¹¹ The vast majority of patients seen by ENPs in this study would have been seen in minor injury units either on the site of the main ED or at a separate facility. The mean total department time was around 30 minutes less for patients treated by ENPs, but there was no difference in the proportion undergoing radiography or in whom a fracture was diagnosed. This finding supports the use of separate streams for patients with minor injuries.²

It is notable that the mean treatment time for isolated ankle injuries was unchanged over the period studied, but that for all ED episodes increased considerably. Similarly, utilisation of radiographs remained unchanged for ankle injuries but increased when all ED episodes were considered. A number of factors are likely to have brought about these effects. The Ottawa ankle rules have been routinely used for many years in our department. The use of such a protocol to determine the need for investigation probably accounts for the constant rate of use of radiographs following the uptake of the Ottawa ankle rule. The constancy of the mean treatment time possibly results from the increasing provision of specific services to treat patient with minor injuries, such as the increasing use of ENPs and specific streams for minor cases.

In conclusion, it is clear from our present study that increases in waiting time and not treatment time have resulted in the increase in total department time in the patient group studied. There has been little change in the use of investigations or treatments in these patients. Further investigation of the factors that have resulted in an increase in waiting time is required in order for departments to be able to address this issue.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to Mr J Wardrope who conceived the original idea for this study and to Declan Hyland, Josie McCabe, Lola Ojo, Megan Powell, Melissa Siddorn, Panas

Symeonides and Olivia Walker whose assistance with data collection made this study possible.

CONTRIBUTION OF AUTHORS

TL, SM and JW designed the study. TL and MT collected data and performed the analysis. TL, MT and SM contributed to the production of this manuscript. TL acts as guarantor for the paper.

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Competing interests: none declared

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APPENDIX 1

Data collection form (I)

Comment in notes on:	Tick box if present	Tick box if absent
Mechanism of injury ("injury to ankle" does not count)		
Time of injury (or time since injury)		
Gait/able to weight bear		
Swelling		
Deformity		
Lateral Malleolus		
Medial Malleolus		
Navicular or midfoot		
5 th Metatarsal or forefoot		
Lower leg		
Ipsilateral knee		
Pulses (or capillary refill)		
Sensation		

Data collection form (II)

Treatment:	Outcome:
None	Discharged
Prescription	Physio referral
Tubigrip	A&E clinic
POP	# Clinic
Splint	Admit
Referred	Social services
Crutches	
Tick as many as required	
X Ray: Yes/No	
Diagnosis:	
Fracture	Sprain
Other soft tissue injury	No diagnosis given

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