Clinical Evaluation of Ankle Inversion Injuries in Family Practice Offices

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Background. The use of radiography in evaluating inversion ankle injuries remains high despite several studies suggesting that x-ray examination should be limited to patients meeting certain clinical criteria. These studies were all done in emergency departments. The present study examined detection of ankle fractures by clinical evaluation alone in private family practice offices.

Methods. Twelve physicians in three family practice offices participated. Check-off forms were developed to record clinical data. The physicians all attended a session to standardize terminology. The physicians then evaluated 94 consecutive patients with inversion ankle injuries.

Results. Eight fractures were detected by radiography, five of which had not been suspected on clinical examination (5.9% false-negative rate). Only one fracture required treatment different from that for a sprain. Tenderness on the dorsum of the foot, impaired weight-bearing ability, recentness of injury (less than 12 hours earlier), and presence of additional injuries were significantly associated with a fracture. Unlike several previous studies, swelling was not associated with fractures. If radiography had been limited to patients presenting with inability to bear weight fully or tenderness on the dorsum of the foot, none of the fractures would have been missed, and the use of radiography would have been reduced from 90% to 61%.

Conclusions. The fracture rate in these family practice offices is lower than that reported in most emergency department studies. It is important that family physicians order radiographs judiciously rather than routinely for patients with inversion ankle injuries. The clinical criteria reported here are likely to reduce unnecessary ordering of radiographs and are compatible with recently published, prospectively validated rules for acute ankle injury in an emergency department setting.

Key words. Ankle; ankle injuries; radiography; physical examination; family practice. (*J Fam Pract 1993; 37:345-348*)

Ankle injuries are frequently encountered in family practice. In particular, inversion injuries of the ankle are common. Although it is widely recognized that the prevalence of fractures is low in this setting, radiography is often routinely employed to exclude a fracture. In many institutions, x-ray films are ordered for more than 90% of emergency department visits for inversion ankle injuries.[1,2]

Previous studies have suggested that using clinical criteria alone could greatly reduce the use of radiography in evaluating ankle injuries.[1–13] Clinical indicators of variable importance in determining the presence of an ankle fracture have been identified. Color change,[5] distal fibula tenderness,[1,5,7,12,14] weight-bearing status,[1,2,12,14] mechanism of injury,[4] age of the patient,[1,5,12] and presence of swelling[3,4,7–11] have each been shown to correlate with the presence of a fracture. In two studies, swelling was considered to be a sine qua non of fracture.[7,8] One

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study found that a bimalleolar ratio of less than 1.065 effectively ruled out fracture.[9] In another study, however, 11% of malleolar fractures manifested no swelling.[1] In a third study, the probability of a fracture was higher in the group of patients without swelling than in the total study population.[2] Only four of these studies were limited to inversion ankle injuries.[1,3,7,11]

A recent study[15] showed that there was good interobserver agreement in assessing bone tenderness and ability to bear weight. Agreement on other variables, however, was less consistent. In previous studies, clinical evaluation had low false-negative rates when compared with evaluation of x-ray films for fracture determination. When physicians were asked to judge whether a fracture was present after clinical evaluation, there was a 5% miss rate in one study. Nevertheless, this would have resulted in no significant changes in patient management.[6] In several studies, when clinical indicators found to be significant were retroactively applied to their study populations, false-negative rates of 0% to 2.5% resulted.[1–3] A clinical point system was evaluated in another study.[5] In that population, 27% of radiographs could be avoided while somewhat less than 10% of fractures were missed.

Recently, decision rules were published for the use of radiography in acute ankle injuries that were prospectively validated.[14] The authors recommended that an x-ray series of the ankle be taken if there was pain near the malleoli and either (1) inability to bear weight both immediately and in the emergency department (four steps) or (2) bone tenderness at the posterior edge or tip of either malleolus. An x-ray series of the foot was recommended if there was pain in the midfoot area and either (1) inability to bear weight both immediately and in the emergency department (four steps) or (2) bone tenderness at the navicular or the base of the fifth metatarsal. These rules, called the Ottawa ankle rules, were 100% sensitive and potentially reduced the number of radiographs by 30% to 34%.

All of these studies were done in an emergency department or a trauma room. Unfortunately, despite these studies, the use of radiography has been very high in emergency departments. While not documented in the literature, experience indicates that use of radiography continues to be high in family physicians' offices as well. This may result from a number of factors including liability concerns, patient demands, and, possibly, lack of confidence in the applicability to the office setting of criteria used in previous studies.

In order to address the latter issue, we undertook a study of clinical evaluation of inversion ankle injuries in private family physicians' offices.

Methods

Three private family practice offices were involved in this study. Two were located in suburban communities and one was in an urban area. A total of 12 physicians participated. All were either residency trained or board certified. The physicians' practice experience ranged from 1 year to over 30 years.

Forms were developed on which to check off information on the following: time elapsed since injury, mechanism of injury, weight-bearing status, pain on various movements, deformity, crepitation, instability, sites of point tenderness, drawer sign, swelling (amount and location), discoloration (amount and location), and pain on squeezing the tibia and fibula.

Each physician attended an orientation session to become familiar with the forms and to standardize terminology. Terms for and definitions of various degrees of swelling and discoloration were reviewed.

Participants were asked to evaluate all inversion ankle injuries in which no projectile or ballistic mechanism was involved and no previous medical care for the injury had been obtained. Participants were asked to make a clinical judgment as to whether a lateral inversion sprain had occurred and whether a fracture was present before any x-ray films were obtained. The physicians were asked to order x-ray films as they normally would to evaluate the injuries. Radiographs were performed in the clinics by the usual staff personnel, to be read only after the information forms had been completed. Confirmatory reading by a radiologist was done according to the usual practice of the physician.

In cases where x-ray films were not taken, follow-up was documented to ascertain if any residual pain or disability occurred. This was done at follow-up visits if scheduled by the examining physician. If no visit was scheduled or no other office visit occurred in the interim, a follow-up telephone call was made 3 to 6 months later.

Data were collected over a 2-year period, from May 1983 to April 1985.

Contingency tables were created to correlate individual clinical indicators with the presence of fractures. For 2×2 tables with small cell sizes, Fisher's exact test was performed. For 3×2 tables with ordinal and binary data, respectively, the Mantel-Haenszel chi-square statistic was determined. Sensitivities, specificities, and positive and negative predictive values were calculated.

Results

One hundred one forms were returned. Of these, 7 were excluded because of missing data or because the injury

Table 1. Association of Clinical Factors with Presence of Fracture in 94 Patients with Inversion Ankle Injuries

Clinical Factor	No. of Patients (n = 94)	No. of Fractures (n = 8)
Age of injury (hours)*		
≤12	20	4
>12–48	47	4
>48	26	0
Ability to bear weight*		
No	14	4
Partial or full	80	4
Tender dorsum of foot†	8	3
Additional injury present†	8	3
Fracture suspected†	9	3

*$P < .05$.
†$P < .01$.

did not meet the study criteria. Of the remaining 94 forms, 58 were for female patients and 36 for male patients. The age range of the patients was from 9 to 85 years. The median age was 23 years. Thirty-eight percent of the injuries resulted from a fall. Sixteen percent of the injuries occurred on stairs, and 13.8% occurred while the patient was running. Four patients had a history of a previous ankle injury.

The rate of radiograph use was 90.4%. Nine patients did not have x-ray films taken, and for those patients, the recording physician's clinical impression was that no fracture was present. Follow-up contact revealed that eight had good outcomes with no residual pain or disability. One patient did have residual pain intermittently for several months. He did not return to the office for further evaluation of that problem but at subsequent visits reported complete resolution.

A total of eight fractures were diagnosed. Five fractures were unsuspected by clinical assessment. These included three nondisplaced fractures of the distal fibula, one posterior malleolar fracture, and in one patient, both a fracture of the dorsum of the talus and a phalangeal fracture.

Eight patients had other injuries in addition to the ankle inversion injury. Three of these patients had ankle fractures. The additional injuries were a plantar flexion injury, a fracture of a proximal phalanx, and a contusion of the knee.

In nine patients fractures were suspected on the basis of clinical assessment. X-ray films were taken for all nine, of whom only three actually had fractures. These were a fibular avulsion fracture, a lateral malleolus fracture, and a chip fracture of the lateral border of the talus.

Several clinical factors were significantly associated with the presence of a fracture (Table 1). The sensitivity, specificity, and positive and negative predictive values of these indicators are shown in Table 2. The following clinical factors were not significantly associated with the presence of a fracture: patient age, mechanism of injury, pain on various movements, deformity, crepitation, instability, other sites of point tenderness, drawer sign, swelling, and discoloration and pain on squeezing the tibia and fibula.

Of the unsuspected fractures, only one required management that was different from management of an acute ankle sprain. This was a posterior malleolar fracture with minimal displacement that required casting. The fracture of the dorsum of the talus was a slight chip of questionable age and was treated with a compression dressing and weight-bearing limitation. The three distal fibular fractures were marginal and nondisplaced and did not require casting.

Discussion

Fracture rates in emergency room studies vary from 3.5%[3] to 29% of all patients with ankle inversion injuries.[8] The median rate of fracture for all series was 12.6%. The fracture rate of 8.5% in our study is lower than the

Table 2. Clinical Factors as Predictors of Ankle Fracture

Clinical Factor	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)
Age of injury ≤ 48 hours	100	30	12	100
Unable to bear weight	50	88	29	95
Tender dorsum of foot	38	94	38	94
Additional injury present	38	94	38	94
Fracture suspected	38	93	33	94

median rate of fracture from previous studies and probably reflects differences in study setting. In this setting, injuries perceived as being more severe by the patient may have been seen in an emergency department instead of in the office.

The 90% radiography utilization rate in this study is on the low end of the range noted in studies of emergency departments, which have found rates ranging from 93% to 99%.[1,2]

Our 5.9% rate of fractures detected by radiography but unsuspected clinically is consistent with the findings of a similar study in an emergency department setting.[6] This rate is considerably higher than the rates theoretically possible to achieve when specific clinical protocols are strictly applied.[1–3,14] This would suggest that improvement in clinical evaluation is possible.

Unlike several previous studies,[3,4,7–11] swelling was not significantly associated with fractures. Two other studies[1,2] have also found swelling to be an unreliable predictor of a fracture.

Although inability to bear weight was associated with the presence of a fracture, the patient with the only unsuspected fracture requiring casting was able to bear weight. The presence of additional injuries was an indication of more severe trauma and was strongly associated with fracture, but there was no clear pattern in the distribution of these injuries.

In this study, if x-ray films had been obtained only for patients with tenderness on the dorsum of the foot or inability to bear weight fully, none of the fractures would have been missed. Furthermore, radiography would have been avoided in 36 patients, with a reduction in x-ray utilization from 90% to 61%. Although this study was not designed to test the recently published, prospectively validated Ottawa ankle rules,[14] our findings are consistent with them.

In conclusion, radiography should be limited to patients with clinical features predictive of a fracture. Fractures will occasionally be missed, but with the close follow-up available in family practice, this should not lead to mismanagement or adverse outcomes. The Ottawa ankle rules appear to apply to family practice office settings as well as emergency departments.

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