

# Original Research

## Limiting the use of routine radiography for acute ankle injuries

In the diagnosis of ankle injuries routine radiography is often unproductive. An international survey of the average number of radiographs made of injured ankles suggested that two projections are adequate to detect fractures. This was confirmed in a prospective study of 242 patients coming to a hospital emergency department with recent ankle injuries. All the fractures could be identified on an anteroposterior or a lateral projection, although some were more obvious on an oblique view. As well, all the fractures were associated with malleolar soft-tissue swelling. Thus, radiography for acute ankle injuries could safely be restricted to patients with soft-tissue swelling, and fractures could be diagnosed using only two routine projections, though for management purposes additional projections might be needed. With a policy of limiting the use of radiography substantial cost reductions are possible.

Dans le diagnostic des blessures de la cheville la radiographie de routine est souvent non contributive. Une enquête internationale portant sur le nombre moyen de radiographies prises lors de blessures de la cheville a indiqué que deux projections sont suffisantes pour déceler, les fractures. Ceci fut confirmé dans une étude prospective chez 242 patients qui s'étaient présentés au service d'urgence d'un hôpital souffrant d'une blessure récente à la cheville. Toutes les fractures pouvaient être identifiées en position antéropostérieure ou latérale, même si certaines étaient plus évidentes en position oblique. De même, toutes les fractures étaient associées à une inflammation des tissus mous malléolaires. La radiographie des blessures aiguës de la cheville pourrait donc en toute sécurité être limitée aux patients qui présentent une inflammation des tissus mous, et les fractures pourraient être diagnostiquées par l'utilisation de routine de seulement deux positions, bien que, pour le traitement, d'autres positions peuvent être nécessaires.

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**Avec une politique visant à limiter l'emploi de la radiographie, des réductions de coûts appréciables sont possibles.**

Ankle injuries are common, inversion injuries occurring in an estimated 1 person per 10 000 per day.<sup>1</sup> People with ankle injuries may constitute up to 12% of the patients coming to an emergency room, and many of these individuals are subjected to radiographic examination of the ankle or foot. Since a high proportion of these investigations yield negative results, and some of the routine views initially obtained may be superfluous, there is considerable interest in avoiding overuse of the radiology department so as to lower costs and reduce the population's exposure to radiation. We designed a two-part study to investigate this matter and to determine whether we could confirm de Lacey and Bradbrooke's conclusion,<sup>2</sup> which can be paraphrased as "No soft tissue swelling — no x-ray."

### Survey

### Methods

To determine the number of radiographic projections usually obtained for the diagnosis of acute ankle trauma, we prepared a questionnaire in English, French, Spanish and German. We sent about 200 copies to radiologists in 36 countries: 13 European countries, 9 African nations, 5 Central and South American states, 4 Asian nations, the 3 North American countries (through their radiology federations), Australia and New Zealand. The results from radiologists working in hospitals operating in a salaried health service in Europe, other hospitals and private offices were separated. The response rate was better than 85%, with 170 questionnaires being returned.

### Results

The average number of routine films obtained for a patient with ankle trauma was 2.5 world wide, 2.9 for the United States (hospitals and offices combined), 2.3

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for hospitals operating in a salaried health service in Europe and 2.0 for developing countries. Overall, the hospital radiologists took more views (2.6) than the radiologists working in private offices (2.4).

### Prospective study

#### Methods

Included in this part of the study were 242 consecutive patients who had come to the emergency room of our hospital within 24 hours of having incurred an ankle injury. The injuries were subsequently radiographed with four projections, as was standard in this community. The referring physicians were not informed that a prospective study was under way so as not to perturb their patterns of practice.

#### Results

The radiographs showed that 70 (29%) of the patients did have fractures; all 70 had definite soft-tissue swell-

ing investing one or both malleoli. Soft-tissue swelling was also noted in 84 (49%) of the remaining 172 ankles in which no bone abnormality was seen in the radiographs. There were 34 left- and 36 right-sided fractures, but among the patients with no demonstrated fracture 97 left ankles and 75 right ankles were involved. We have no explanation for this left-sided predilection. The proportion of fractures was considerably higher among older patients than among patients in their second and third decades, in whom ligamentous lesions were more frequent. Whenever a fracture was present it was detectable in either the anteroposterior or the lateral view.

### Discussion

Obviously many interpretations can be placed on the findings of our international survey, but two general conclusions are probably warranted. First, there is no unanimity as to what constitutes an appropriate number of projections. Second, the lower figure for developing countries reflects economic constraints that do not



**FIG. 1—Standard four views of ankle. Medial malleolar fracture is barely perceptible (arrow) in anteroposterior view but is clearly evident (arrowhead) in oblique view obtained with 20° of internal rotation.**

operate to the same extent in the United States health care system.

The results of our hospital study confirm the British findings that an absence of soft-tissue swelling around either malleolus is a valid criterion for not routinely ordering an ankle radiograph after a recent injury.<sup>2</sup> Furthermore, the oblique views provided no additional diagnostic information, although they were occasionally useful for determining the management of fractures.

On rare occasions a small flake avulsion fracture at the talar attachment of the anterior talofibular ligament could be missed without an oblique view, but in our series there were two examples of this fracture, both visible in the anteroposterior view. Since such patients have local soft-tissue swelling and fingerpoint tenderness at the ligamentous attachment, clinical examination alone should be sufficient to indicate the nature of the injury. Small isolated fractures of the posterior tibial lip can be difficult to detect without a semioblique projection,<sup>3</sup> but no such fractures were seen in this series. Similarly, some vertical fractures passing through the cancellous distal tibia near the medial malleolus may be hard to see in the anteroposterior view, when the lesion would be obvious in an oblique view, but careful inspection will reveal an interruption of the subchondral bone plate (Fig. 1). The same considerations apply to undisplaced Salter-Harris 4 fractures.

Anyone who has dealt with emergency room requests for radiographs of injured ankles will be familiar with the dual order for examination of both the ankle and the foot. This usually reflects an inadequate clinical examination. To be sure, an inversion injury can be associated with both a lateral malleolar lesion and an avulsion fracture of the styloid process of the fifth metatarsal, but an adequate clinical examination should detect this rare combination.

No radiographic technique is foolproof for the detection of purely ligamentous injuries of the ankle, unless there is gross instability. Stress views including the anterior drawer sign have their value here.<sup>4,5</sup> Some advocate ankle arthrography within 24 hours of the injury, but unless there is a policy of early operation for ligamentous lesions of the ankle in the particular institution, an aggressive radiologic approach to the diagnosis of ligamentous rupture may not be warranted.<sup>6</sup>

### Implications

There is no doubt that radiography of the injured ankle is often unnecessary. Some authors contend that a clinical examination and a carefully taken history are sufficiently accurate to make the need for radiographic examination questionable in the diagnosis of most inversion injuries.<sup>7,8</sup> This may seem to be a radical viewpoint, but studies in Britain, the United States and now Canada all indicate clearly enough that local swelling and point tenderness are valid high-yield criteria for the presence of fractures in acutely injured ankles.<sup>2</sup> Furthermore, our analysis indicates that two routine projections are adequate for the initial diagnosis, although additional views may subsequently be needed for clinical management. Routine requests for radio-

graphs of the foot, as well as of the ankle, are not warranted.

Given the frequency with which ankle injuries occur, there are great savings to be realized by making ankle radiographs only in cases with high-yield criteria. In our institution such a restriction would have affected 36% of the 695 injured ankles seen in the emergency room during 1 year; \$5000 would have been saved. If routine oblique views had been eliminated, costs would have been reduced a further \$2700 — all without affecting the quality of care. This would have reduced the radiologic costs generated by emergency room visits related to ankle injuries by 57%. If a policy of “No ankle swelling — no x-ray” had been implemented in one British hospital their costs would have been reduced by 35%.<sup>2</sup> The projected overall savings in that institution were less than at our hospital because oblique views were not routinely taken there.

The possible economies arising from such policies nation wide plainly represent a considerable sum, but such speculations are empty unless these findings are widely applied. Education is one route to be followed. Fears of the potential for medical malpractice actions are always raised in discussing such matters and must be allayed. Since at least five analyses have now reached similar conclusions regarding the indications for routine radiography of the injured ankle, it seems to us that this should be sufficient defence for malpractice purposes.<sup>2,7</sup>

### References

1. RUTH CJ: The surgical treatment of injuries of the fibular collateral ligaments of the ankle. *J Bone Joint Surg [Am]* 1961; 43: 229-239
2. DE LACEY G, BRADBROOKE S: Rationalising requests for x-ray examination of acute ankle injuries. *Br Med J* 1979; 1: 1597-1598
3. MANDELL J: Isolated fractures of the posterior tibial lip at the ankle as demonstrated by an additional projection, the “poor” lateral view. *Radiology* 1971; 101: 319-322
4. JOHANSEN A: Radiological diagnosis of lateral ligament lesion of the ankle. A comparison between talar tilt and anterior drawer sign. *Acta Orthop Scand* 1978; 49: 295-301
5. BOOMSMA JHB: A new method for x-ray examination of the anterior-posterior stress of the ankle. *Diagn Imaging* 1979; 48: 90-92
6. GARFIELD JS: Is radiological examination of the twisted ankle necessary? *Lancet* 1960; 2: 1167-1169
7. BROOKS SC, POTTER BT, RAINEY JB: Inversion injuries of the ankle: clinical assessment and radiographic review. *Br Med J* 1981; 282: 607-608
8. BRAND DA, FRAZIER WH, KOHLHEPP WC, SHEA KM, HOFER AM, ECKER MD, KORNGUTH PJ, PAIS MJ, LIGHT TR: A protocol for selecting patients with injured extremities who need x-rays. *N Engl J Med* 1982; 306: 333-339