Goal-directed Ultrasonography for Detecting Traumatic X-ray Missed Fibula Fracture in the Emergency Department

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We present the case of a 45-year-old man who presented to the emergency department (ED) for ankle trauma sustained during a football match. Physical examination and X-ray of his ankle were negative for bone fractures. He was discharged from the ED, but returned 3 weeks later with a painful and swelling leg. Compressive ultrasonography of his right lower limb was negative for venous thrombosis, but ultrasound evaluation of the leg clearly showed a fibula fracture. Although the diagnosis of fractures usually relies on X-ray, the literature contains many reports of goal-directed ultrasound diagnosis of long bone fracture in military settings and remote locations. The usefulness of a noninvasive examination like bedside ultrasonography and goal-directed evaluation of patients in the ED are discussed, with reference to the literature.

KEY WORDS — blunt trauma, bone ultrasonography, fibula fracture, long bone fracture

CASE REPORT

Introduction

The use of ultrasound in the diagnosis of abdominal and chest trauma is widely accepted, but little information exists on its use with regard to trauma to the extremities. Although the diagnosis of fractures usually relies on X-rays, the literature contains many reports of goal-directed ultrasound diagnosis of long bone fracture in military settings and remote locations [1,2].

Case Report

A 45-year-old man presented to the emergency department (ED) for ankle trauma sustained during an amateur football match. Physical examination of his right leg was unremarkable except for pain on palpation of the distal third of the leg. X-ray examination of the ankle was negative for bone fractures. He was discharged from the ED with a 7-day course of oral analgesic therapy.
He returned to the ED 3 weeks later with a painful and swelling leg. He was evaluated by the emergency physician to rule out venous thrombosis. Compressive ultrasonography of the right inferior limb, using a commercial ultrasound scanner (model H21; Hitachi High Technology Corp Ltd, Tokyo, Japan) equipped with a 6–13 MHz linear probe, was negative for venous thrombosis, but ultrasound evaluation of the leg clearly revealed the discontinuity of the linear cortical echo with the cortical step-off of the fibula in the area indicated by the patient and in which severe pain was felt on probe contact (Figs. 1 & 2). Plain X-ray confirmed the scrappy right fibula fracture with the beginnings of callus formation, union and consolidation (Fig. 3). The patient’s right leg was immobilized with plaster and he was discharged from the ED in good condition.

Discussion

Ultrasound was previously assumed to be limited by wave reflection at bony cortices, but subsequent investigations have found that this acoustic characteristic of bone actually improves visualization of cortical disruptions; some investigators were able to image cortical disruptions as small as 1 mm in cadavers [3]. In live patients, other investigators have reported ultrasound images of long bone fractures to be “striking and not difficult to interpret” [4]. Previous investigations have demonstrated the ability of ultrasound to detect fractures of either long or short bones and to detect occult fractures not identifiable by traditional radiography [5–7]. Finally, in several clinical series, ultrasound was reported to be more...
sensitive than standard radiography in detecting rib fractures, and has the same ability with regard to sternal fractures [8].

Fractures of the long bones are of particular interest, since associated bleeding and neurovascular compromise can cause substantial morbidity. Early identification is therefore likely to affect immediate treatment or evaluation decisions, and ultrasound may be able to provide rapid and reliable diagnostic imaging of these injuries. Marshburn and colleagues prospectively compared the accuracy of ultrasound with physical examination in the identification of fractures of the humerus and femur; to increase the validity of the results, only clinicians with minimal formal ultrasound training (1 hour of standardized training in ultrasound fracture detection) participated in the study [9]. The sensitivity and specificity of ultrasound in the detection of long bone fractures by minimally trained physicians were 92.9% and 83.3%, respectively, and the sensitivity and specificity of physical examination were 78.6% and 90.0%, respectively. Thus, according to these data, ultrasound by minimally trained clinicians might be useful to rule out long bone fracture in patients with a medium to low probability of fracture.

Ultrasound examination has become an integral part of patient evaluation in emergency medicine. Other potential uses for ultrasonography are relatively early in their development. With increased interest and study, however, there exists a real potential for ultrasound to be employed in an expanded clinical role in the evaluation of traumatically injured patients outside the standard FAST (focused abdominal sonography in trauma) examination, for acute and chronic musculoskeletal injuries, and for triage of patients in natural and military disasters [10]. Ultrasound may enable prompt diagnosis not only in remote deployments (battlefields, field research teams, spaceflight crews) for rapid fracture identification and where immediate X-ray imaging is not available, but also in the emergency room during clinical evaluation of a patient without a clear clinical presentation for fractures and in a “symptom directed way of evaluation” [9].

The case described here shows the great usefulness of a noninvasive and symptom-directed examination such as ultrasonography in the ED. Radiography may be described as an area-oriented examination, while bedside ultrasonography allows the emergency physician to be goal-directed during the evaluation of patients, with a considerably shortened time to reach diagnosis.

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References