Ultrasound detection of foreign body and gas contamination of a penetrating wound

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KEYWORDS

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Air bubbles;
Gas gangrene.

Abstract We report a case in which ultrasonography (US) examination was used in the Emergency Department to reveal and diagnose gas contamination of a penetrating wound. Air microbubbles are extremely small and their typical distribution and movement are like those of "sparkling-wine microbubbles". US assessment of spontaneous disappearance of the air bubbles can distinguish a harmless traumatic nature of the wound from a life-threatening gas-producing bacterial infection.

Sommario Descriviamo un caso di ferita penetrante superficiale contaminata da microbolle d'aria, studiato con esame ecografico in Pronto Soccorso. Le microbolle d'aria sono caratterizzate da piccole dimensioni, distribuzione lungo il tragitto della ferita e da peculiari movimenti "a bollicine di spumante". L'ecografia consente di documentarne la scomparsa nelle ore successive, confermandone la natura traumatica ed escludendo una potenziale complicanza infettiva da germi anaerobi.

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Introduction

Detection of a superficial foreign body (FB) may be difficult, especially if non-radiopaque. The accuracy of ultrasonography (US) in detecting radiopaque and non-radiopaque FBs in soft tissues and possible complications is well established both in vitro [1] and in vivo [2] studies.

We report a case in which US was used in the Emergency Department to reveal gas contamination of a penetrating wound with a retained FB in the soft tissue.

Case presentation

A young man arrived at the Emergency Department complaining of a painful wound in his right forearm. He had been hit by slivers while working with a lawn-mower some hours before. Informed consent was obtained from the patient.

His temperature was normal. X-ray of the forearm showed a radiopaque object near the radius (Fig. 1). US examination using Acuson X150™ ultrasound system (Siemens, Erlangen Germany) and a 10.0 MHz small parts probe detected the FB retained in the muscle and surrounded by gas microbubbles (Fig. 2). As it was not clear whether the gas was endogenous (infective) or exogenous

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Fig. 1 Radiographic image of the right forearm showing the radiopaque foreign body with regular borders (arrow).

(air deriving from the FB), the patient was hospitalized for observation. US documented the complete disappearance of the gas, thus ruling out complications due to infection (Fig. 3).

Fig. 2 US image of the right forearm right on the wound (at 10.00 pm). The 7 mm-long foreign body lies in the brachioradial muscle and presents an irregular surface with a layer of air microbubbles around it (*). A sequence of air microbubbles follows along the entrance path of the foreign body from the skin (arrows).

Fig. 3 US image of the right forearm right on the wound (4 h after Fig. 2). The foreign body appearance is unmodified (*). The gas microbubbles along the passage of the foreign body have disappeared.

Discussion

Gas bubbles can be found in penetrating wounds. Their presence can be traced back to the dragging of the FB through the wound track (in which case they rapidly disappear), or to bacterial production (gas gangrene). In the latter case, early diagnosis is important in order to begin treatment including aggressive surgical debridement and antibiotic therapy [3].

We report a case in which gas microbubbles were detected by US in soft tissue surrounding a radiopaque FB some hours after a penetrating trauma. The mono-dimensional linear distribution [4] and the small size of the microbubbles (<1 mm) did not allow the forming of the typical US artifacts (comet tails), but gas was suspected due to spontaneous and pressure provoked movements like "sparkling-wine microbubbles". The clinical picture was uncertain because the trauma was recent, but the patient complained of increasing, localized pain with edema, although there were no general symptoms. The size of the gas bubbles, their nonconfluence and the characteristic distribution along the wound track of the FB suggested a traumatic rather than infectious origin, but the diagnosis was confirmed only after complete disappearance of the gas bubbles. The presence of gas bubbles in the soft tissue did not affect detection, localization and measuring of the FB, as also recently reported in an experimental model [5], although its surface appeared less smooth than it did on the X-ray.

In conclusion, air microbubbles can contaminate penetrating wounds up to several hours after the trauma. In the Emergency Department, US examination is recommended to define the characteristics of the gas bubbles in order to distinguish a normally healing wound from a life-threatening infection.

Conflict of interest statement

The authors have no conflict of interest.

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