Ultrasound in the diagnosis and treatment of wooden foreign bodies in the foot

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Retained radiopaque soft tissue foreign bodies (FB) in the foot such as glass, needle and stone may be detected on plain radiographs or by fluoroscopy. Nonradiopaque FB such as wood is not detectable on plain films, exploration sometimes being futile even when the FB is known to be present.¹ We present three children in whom US was used for diagnosis, intraoperative localization and removal of retained wooden toothpicks in the foot.

Cases

Case 1 was a 7-year-old boy who presented to the emergency room (ER) with a puncture injury to the sole of his left foot after stepping on a wooden toothpick. Initial radiographs and exploration of the wound in the ER under local anesthesia revealed no FB. On the following day, he was taken to the operating room and under general anesthesia further exploration was negative. He was discharged home and six weeks later presented with a persistent discharging wound on the sole of the left foot. Plain radiographs of the foot revealed neither FB nor osteomyelitis. Sonographic examination using Acuson Sequoia 512 (Siemens, Mountain View, CA) was performed with high-resolution linear-array transducers (5-8 mHz). Sonograms showed a hyperechoic focus with posterior acoustic shadowing, findings consistent with a wooden FB (Figure 1). The FB was 9.4 mm deep to the skin on the sole of the foot. In the operating room, under US guidance an incision was made and using a hemostat a 2.1 cm x 0.3 cm wooden toothpick was localized and removed with minimum dissection and operating time. His recovery was uncomplicated.

Case 2 was a 4-year-old girl who presented to ER with pain in the sole of the right foot. Examination revealed a tender swelling over the first and second metatarsals. Although plain radiographs were negative for FB, US examination showed an acoustic picture consistent with a wooden FB. Under general anesthesia, US was used to localize and remove a 1.9 cm x 0.5 cm wooden toothpick (Figure 2). She made a satisfactory postoperative recovery.

Case 3 was a 5-year old girl who presented with a complaint of pain in the sole of the right foot. Five days prior to presentation she had stepped on an object. Physical examination revealed a puncture wound on the sole of the right foot, which was tender to palpation. Plain radiographs were negative for FB. US examination showed a hypoechoic area with no FB. Two weeks later, the wound was explored but

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Accepted for publication:

August 2003

Ann Saudi Med 2004;24(6):480-481

no FB was found. After four weeks there was a persistent discharging sinus and a repeat US showed an acoustic picture consistent with a wooden FB, which was 2 cm from the skin and adjacent to a tendon. Under general anesthesia and US guidance, a piece of wooden toothpick was removed. At two weeks follow-up, the wound had healed.

Discussion

Foreign bodies in the soft tissue of the foot are a common childhood problem. If not removed, a foreign body may result in inflammatory or severe infectious complications.² The infections may include cellulitis, abscess, draining sinuses, osteomyelitis and septic arthritis.³ Failure to diagnose and remove the wooden toothpick in our first and third patients resulted in a draining sinus and abscess respectively which resolved after removal of the FB.

Because of its availability and effectiveness in detecting radiopaque objects, plain radiographs are the initial tests of choice in the investigation of FB in the foot.⁴ Plain radiographs can detect approximately 80% of FB but are negative in 85% of patients with wooden FB, and therefore other imaging studies such as US, CT and MRI are required for diagnosis.¹⁻⁸ The use of US to detect wooden FB has been reported widely but sparsely in the pediatric literature. Rockett et al, reported 20 patients with a history of stepping on a wooden object who were referred for US prior to surgery.⁹ Ten who had positive US findings wooden FB as small as 3 mm x 1 mm were removed, with the aid of preoperative markings retrieval being 100%. The sensitivity

Figure 1. Longitudinal scan showing a hyperechoic foreign body (arrowed).

Figure 2. Removed wooden toothpick.

for the detection of wooden FB is 90% to 100%.^{1,6,9,10} US is easily available, cheap, and determines the relationship of the FB to adjacent structures, measures the depth from the skin and guides removal.^{2,5,9,10} The use of US to localize FB either preoperatively or in the operating room allows for an accurate site of incision, and minimizes dissection and operating time as evident in our three patients.^{1,9} False-positive diagnosis of FB may however occur from the echogenic appearance of scars, calcified ossified cartilage, keratin plugs, hematoma, laceration and air in the soft tissue.^{4,5,10} Prior surgical exploration can sometimes make interpretation of US results difficult. Wooden FB appears as a hyperechoic focus with acoustic shadowing and a hypoechoic halo, the former related to the size of the FB, its composition and its orientation to the US beam.^{1,9} A hypoechoic halo, which appears to develop overtime, may not be present in the first 24 hours and represents an inflammatory response. Its presence should increase the suspicion of an FB as evident

in the third case.¹ Although CT and MRI can be used for the detection of wooden FB in the foot, they are more expensive than US and require sedation and are not easily available.^{7,8} However, the relationship of the FB to adjacent structures is well defined in both MRI and CT and may be used for diagnosis and planning of the surgical approach.

In conclusion, US is highly sensitive and accurate in the detection of wooden FB in the foot. It is also useful in localizing and removal of FB, thus minimizing dissection and operating time. Therefore, if there is a strong suspicion of a wooden FB in the foot of a child and plain radiographs are negative, US should be the technique of choice. The present report supports its use for detection and to aid in removal of a wooden FB in the foot.

Acknowledgments

We wish to thank Mel Rabago for her secretarial assistance.

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