RETRIEVAL OF FOREIGN BODIES

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Foreign body injuries of the foot present the physician with several intriguing dilemmas in formulating a sound diagnostic and treatment plan. These injuries should not be considered trivial, since failure to remove all of the foreign body may lead to joint destruction, infection, or even loss of limb.[1]

History of the injury may be vague, but is necessary and useful in determining the diagnostic measures to be taken. Physical exam of a plantar puncture wound with surrounding edema, erythema, and tenderness is suggestive of a retained foreign body. These foreign bodies may implant deeply, and if not quickly removed, can be a source of chronic frustration to both the patient and practitioner.[2]

Extraction of foreign bodies may be very difficult due to lack of adequate visualization. Foreign bodies are frequently difficult to localize and a minor miscalculation can promote unnecessary probing and needless tissue damage, in addition to hours of anesthesia and surgery.

There is no substitute for a clear history pertaining to the circumstances of the injury and, if possible, the type of foreign body that may be present. However many patients, especially neuropathic diabetics, have no recollection of a traumatic event.

Utilizing the correct diagnostic imaging studies is paramount at this stage. Standard radiographs remain the most clinically practical method of screening for foreign bodies. Metallic foreign bodies are easily diagnosed on x-rays. A backup modality is the use of mammography film to increase resolution. Wooden and plastic foreign bodies may or may not be seen on standard x-rays depending on the configuration, size and orientation of the fragment in the soft tissue.[3] Woesner and Sanders[4]concluded that wood was better imaged using xerography in the positive mode. However Charney, et. al.[3] found xerography not to be superior to standard x-rays in visualizing these materials because of the secondary changes seen on x-rays such as soft tissue swelling, periostitis, and osteolytic or osteoblastic lesions of bone. Newman and Hunt[2] cited an example of a toothpick foreign body that was not evident on standard radiographs but was well visualized on computed tomography. The most reliable method of localizing retained wooden foreign bodies is computerized tomography. This was proven by Bernardino (5) who compared CT to ultrasound and xeroradiography, and found that CT was one hundred times more sensitive in the detection of wood. Glass has been shown to be highly radiopaque. Pigmented or lead-containing glass is easily visualized. Other clear glass fragments measuring greater than 0.5mm can be demonstrated on standard radiograph provided there is no overlying bone.[6] Therefore, radiographs are taken at oblique angles to pick up smaller (2mm) fragments of glass.

Once the foreign body is identified by any form of diagnostic imaging, a decision must be made on the method of retrieval. Many foreign bodies can be a source of chronic drainage, infection, and/or chronic pain. Removal is indicated if the foreign body is intra-articular, involves bone, is symptomatic, or impinges upon neurovascular structures. However other objects such as a metal pellet can remain inert for long periods of time and aggressive retrieval could harm critical neurovascular structures.

The best time to remove a foreign body is immediately after the accident because the path and site of the object is readily evident. However, a patient may wait several days to seek treatment resulting in the injury tract becoming obscured as the wound heals. Subsequently, an abscess or fibrous tissue reaction may develop around the foreign body revealing its location. This reaction usually occurs in a few weeks.[7]

The physician needs to appreciate the spatial orientation and form a three dimensional picture of the exact location of the foreign body. For example, a needle foreign body may appear to be abutting the shaft of a metatarsal in two of three x-ray projections. However, in the third x-ray the needle may be seen to be parallel to the metatarsal, yet 1.5 cm from its nearest margin. The physician must be able to visualize the two dimensional diagnostic data as three dimensional information in his mind to determine the true orientation of the foreign body. (Fig. 1)

Incision planning should not compromise the tenets of plantar skin and surgical principles. Weight bearing surfaces should be avoided and relaxed skin tension lines should be followed when possible. (Fig. 2) Where a large plantar incision is needed for prolonged dissection, a plantar Z incision or modified S should be employed. Knowledge of the plantar

anatomy is crucial to retrieval of retained foreign bodies in the bottom of the foot. Great care and respect for the delicate structures must be maintained as the physician attempts to remove a foreign body. All too often, blunt probing and dissection through a stab incision or the puncture wound itself may result in long term problems.

Preoperative localization of foreign bodies expedites their surgical excision and minimizes the extraneous probing and dissection. There have been many variations using hypodermic needles at various angles for localization. Hunt[8] described triangulation where needles are placed at 90 degree angles to be used as coordinates in localizing the foreign body. (Fig. 3) A sinus tract can be injected with iothalamate meglumine (Conray) mixed with gentian violet. This solution will show the outline of the sinus tract on x-ray and gentian violet helps to visualize the sinus tract during surgery.[9] C-arm fluoroscopy is now regarded as the preferred choice of visualizing and locating radiopaque foreign bodies. It is an imaging technique that produces instantaneous images of the foreign body in real time on a monitor. The immediate visualization of the target object as well as the instrumentation is invaluable. The image produced can be preserved to memory on one of several monitors or converted to a hard copy. The C-arm eliminates surgical delays resulting from x-ray processing time.[6] The C-arm combined with the needle localization technique has demonstrated excellent results.

Miscellaneous foreign bodies that are seemingly harmless may provide challenging cases to the physician. Examples are pet hair or hair from a beard that can cause a puncture wound and ensuing abscess when stepped on axially. Numerous types of shells or debris from the beach are likely to elicit a foreign body reaction. Dirt, gravel, weeds, thorns, and grass can all puncture the skin plantarly. Treatment should consist of scout x-rays, debridement and irrigation, tetanus prophylaxis, and appropriate antibiotic coverage. The wounds should be packed open, kept clean and dry and reevaluated in 24 to 48 hours. If the appearance of the wound deteriorates, an aggressive incision and drainage should be performed.

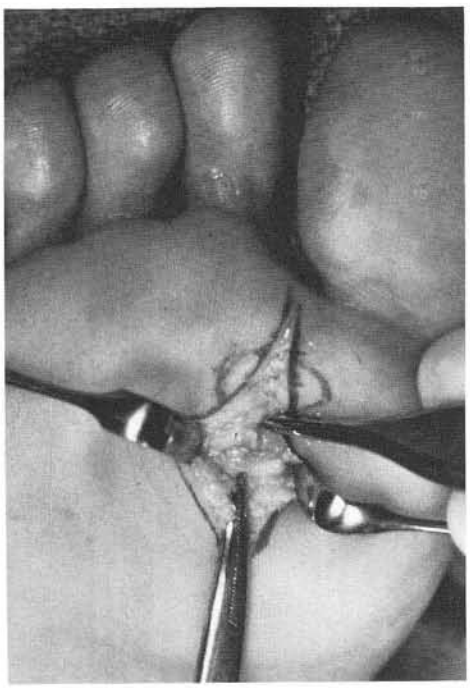

Fig. 2. Glass foreign body encased in granuloma removed with plantar incision.

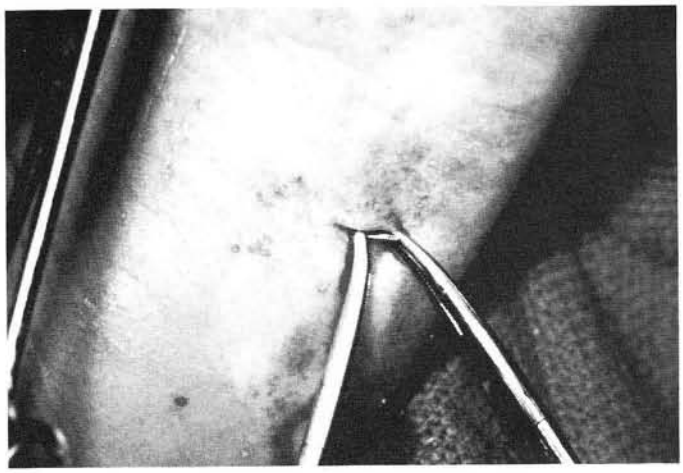

Fig. 1. Positioning of instrumentation mimics the orientation of the foreign body.

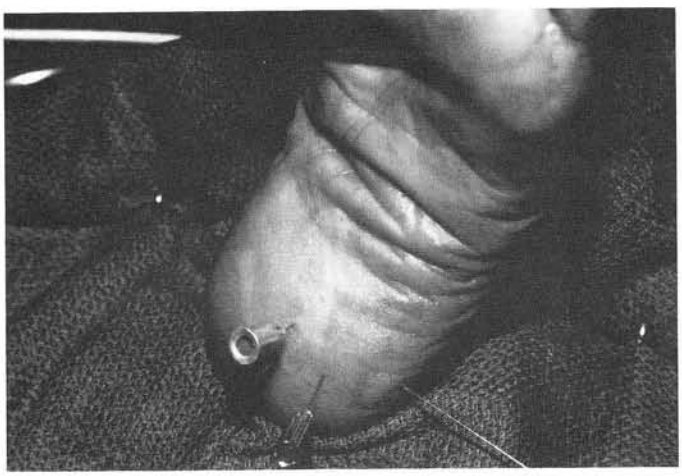

Fig. 3. Needle localization technique.

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