

# Using Ultrasound to Prevent Screw Penetration

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Ultrasound is a readily available, inexpensive, easy-to-use, and rapid diagnostic tool. Physicians can use ultrasound to identify excessively long screws or screw penetration into joints. This article illustrates ultrasound identification of problem screws. (*J Hand Surg Am*. 2016;41(3):453–456. Copyright © 2016 by the American Society for Surgery of the Hand. All rights reserved.)

**Key words** Ultrasound, fractures, distal radius, screw complications.

**U**LTRASOUND IS NOW READILY AVAILABLE in most operating facilities. It is a quick, easy-to-use, and inexpensive diagnostic tool. This article demonstrates how to identify problems of screw placement with ultrasound.

## INDICATIONS

Ultrasound is useful to identify excessive screw length, detect joint penetration, or avoid tendon impingement. For example, after the internal fixation of the distal radius or after the internal fixation of fingers, a brief examination with ultrasound can help avoid problem screws.

## CONTRAINDICATIONS

Ultrasound is a noninvasive diagnostic tool. There are no harmful effects due to the ultrasound signal. It may identify problem screws. A positive ultrasound scan gives the surgeon the opportunity to change a screw length while still in the operating room.

Screw penetration through the dorsal cortex after distal radius fracture fixation can cause extensor tendon irritation and ruptures.<sup>1</sup> Peg penetration into the radial carpal joint will cause wrist pain and cartilage

abrasion. Similarly, long screws can impinge on digital flexor tendons after phalangeal fracture fixation.

Lateral radiographs of the distal radius looking for long screws are easily misinterpreted because of the radius' trapezoidal shape. A surgeon may believe that he or she has the screws appropriately deep, below the dorsal cortex, after volar plate application, when, in fact, he or she has mistakenly placed the screw through the dorsal cortex, but below the tip of Lister's tubercle. Therefore, screws may appear to be of the appropriate length on lateral radiographs, when they are not. There are several published studies describing methods to avoid these problems. Some surgeons leave the screws a few extra millimeters short. Other surgeons rely on intraoperative fluoroscopy. Several studies describe a variety of special radiographic views to detect prominent screws.<sup>2-6</sup>

The ultrasound signal does not penetrate the cortical bone. Any structure or screw, deep, inside, or behind a bony cortical surface is invisible to ultrasound imaging. This is referred to as being in the shadow of the cortex. Metal is highly echoic and appears bright on ultrasound. Metal inside a bone is in the cortex's ultrasound shadow and, therefore, is not seen. On a brief ultrasound scan, an examiner can easily see any screw or peg that penetrates the bony cortex. If a screw is visible, it is through the cortex and, therefore, a possible problem. If no screw is seen, none are through the cortex and unlikely to cause problems of tendon or joint irritation.

Most operating rooms have ultrasound machines readily available. Our anesthesia colleagues use ultrasound for guided regional blocks. It takes only a few minutes to set up these machines for use in surgery. Most of these available machines are designed for

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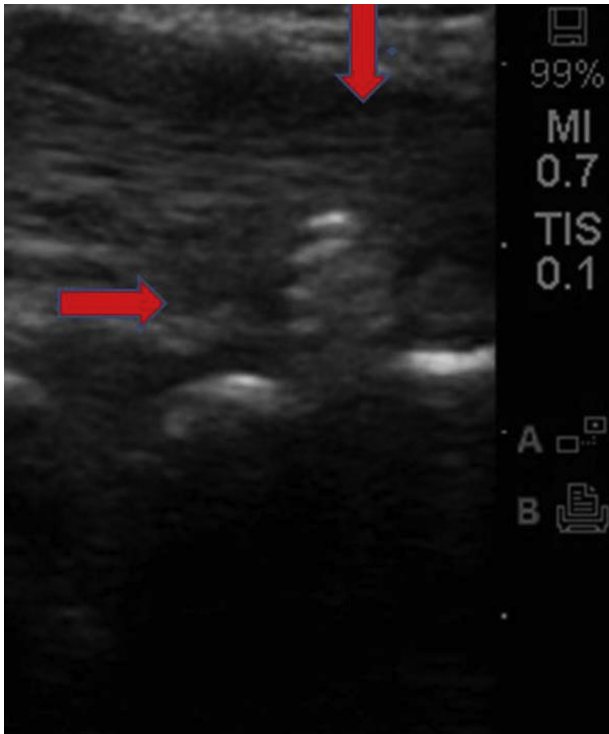
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**FIGURE 1:** The ultrasound transducer is positioned parallel to the articular surface of the distal radius.



**FIGURE 3:** Plain radiographs suggest peg penetration into the wrist joint.



**FIGURE 2:** Screw is penetrated 5 turns of threads out of the cortex. The arrows point to the tendon irritation.



**FIGURE 4:** Ultrasound images document peg penetration.

musculoskeletal use and the default settings work well for the use described here. Magnetic resonance and computed tomography accomplish the same thing but are not readily available in the operating room.

### TECHNIQUE

Figure 1 shows an ultrasound transducer aligned along the articular surface of the radius. This position best

demonstrates pegs penetrated through the radius joint surface. To scan for dorsal radius screw penetration, position the transducer at 90° to the cortex. Place the transducers in sterile, commercially available sleeves and apply a small amount of unsterile gel inside the sleeve. Then, apply some sterile gel directly on to the skin.

Place the transducer on the palmar surface of the finger or the hand at 90° to the finger surface to scan for screws penetrated into digital flexor tendons. Ultrasound is very sensitive to the transducer-receiver position. The examiner will need to try various transducer positions during the examination (Fig. 1).

### ILLUSTRATIVE CASES

The first case shows a screw prominent on the dorsal cortex, eroding an extensor tendon. This female patient had a distal radius fracture treated by another

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