Basic Ultrasound-guided Procedures

Laurel Barr, MD[a,*], Nicholas Hatch, MD[a], Pedro J. Roque, MD[a], Teresa S. Wu, MD[b]

KEYWORDS

• Ultrasound • Peripheral intravenous access • Central venous access
• Arterial access • Suprapubic aspiration • Abscess incision and drainage
• Foreign body localization • Arthrocentesis

KEY POINTS

- Ultrasound guidance for basic procedures helps to visualize the target and surrounding structures, which saves time, increases safety, and increases first-attempt success.
- Visualizing the needle in long-axis views ensures that the tip of the needle remains in the target structure.
- Color flow or Doppler can be used to help identify a target vessel as an artery or a vein.
- Ultrasound can detect radiolucent foreign bodies such as plastic or wood.
- When using ultrasound to evaluate painful joints, use the contralateral joint for comparison.

INTRODUCTION

The use of ultrasound guidance for bedside procedures is gaining popularity in multiple clinical settings. Using ultrasound during standard procedures has been shown to increase patient safety, save time, and improve chances of success. This article discusses ultrasound guidance for basic procedures performed at the bedside. It reviews the indications and complications of the procedure, advantages of ultrasound guidance, important anatomy and sonographic correlation, and procedural technique.

Ultrasound-guided Procedures: Axis and Orientation

When performing an ultrasound-guided procedure, it is important to understand the axis and orientation of the anatomic structures and the corresponding ultrasound images produced. Vessels and other elongated structures can be visualized in the long

The authors have no disclosures or conflicts of interest.
[a] Emergency Medicine Residency, Department of Emergency Medicine, Maricopa Medical Center, 2601 East Roosevelt Street, Phoenix, AZ 85008, USA; [b] EM Residency Program, Department of Emergency Medicine, Maricopa Medical Center, School of Medicine-Phoenix, University of Arizona, 550 E Van Buren Street, Phoenix, AZ 85004, USA
* Corresponding author.
E-mail address: laurel.barr@mihs.org

Crit Care Clin 30 (2014) 275–304
http://dx.doi.org/10.1016/j.ccc.2013.10.004 **criticalcare.theclinics.com**
0749-0704/14/$ – see front matter

axis or the short axis. In the short-axis view (Fig. 1), the ultrasound transducer is placed transverse and perpendicular to the course of the vessel, and the vessel appears as circular areas of anechoic blood. In the long-axis view (Fig. 2), the ultrasound transducer is placed along the course of the vessel, which produces an elongated, hypoechoic structure on two-dimensional ultrasound.

Ultrasound probes have an indicator marker on the side of the transducer. This indicator marker is typically a dot, light, or a raised line, and corresponds with the orientation marker on the ultrasound screen. By convention, during most ultrasound-guided procedures, this indicator marker should be directed toward the patient's right side for a short-axis view, or toward the patient's head for a long-axis view. The corresponding orientation marker on the ultrasound machine should be set to the upper left side of the image.

Ultrasound-guided Versus Ultrasound-assisted Procedures

Ultrasound-guided procedures are performed by visualizing the target structure with ultrasound before beginning the procedure, followed by real-time ultrasound visualization of the needle during the procedure (dynamic guidance). Ultrasound-assisted procedures are performed by visualizing the target structure with ultrasound before the procedure, and marking the site where the needle will be inserted (static guidance). The procedure is then performed without direct ultrasound visualization.[1]

Ultrasound guidance is recommended for most procedures, such as central venous access, whereas ultrasound assistance may be more useful for other procedures such as abscess incision and drainage or lumbar punctures. In many instances, the decision concerning static versus dynamic guidance depends on physician preference and clinical circumstances. If using dynamic guidance, the procedure can be performed by 1 or 2 operators using the second operator to hold the ultrasound probe while the first performs the procedure.

Ultrasound-guided Procedures: Visualizing the Needle

It is important to identify the needle and needle tip when performing an ultrasound-guided procedure. The needle appears as a brightly echogenic line or dot with an acoustic shadow and ring-down artifact farfield on the screen. Movement of the needle results in movement of the surrounding tissue, which can help to localize the needle tip.

During the initial portion of a procedure, it is often easier to attempt to visualize the needle in a short-axis view (Fig. 3). Once the needle trajectory is visualized, and it is

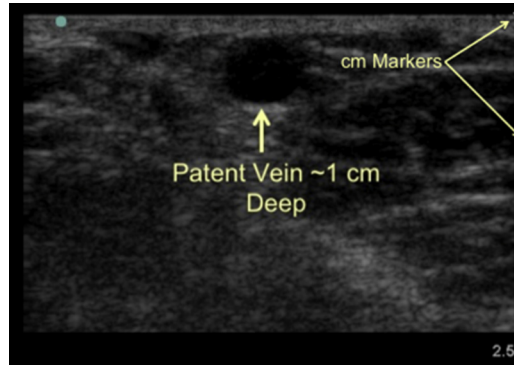

Fig. 1. A peripheral vein seen in short-axis view on ultrasound.