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# DYNAMIC EMERGENCY MEDICINE

## The Vanishing Target Sign: Confirmation of Intraluminal Needle Position for Ultrasound Guided Vascular Access

Ultrasound-guided peripheral intravenous (USG-PIV) catheter placement has been described in the emergency medicine literature for more than a decade.[1] Several studies have shown that USG-PIV placement can decrease the number of needle insertion attempts, decrease the number of potentially unnecessary central line placements, and increase patient satisfaction scores.[1–5] Additional evidence has shown that this skill is accessible to ED staff other than physicians.[6,7] However, a randomized study of USG-PIV placement by emergency physicians with variable levels of experience did not demonstrate improved success rates, decreased time to insertion, or increased patient satisfaction.[8] In our experience, consistent success with USG-PIV placement in patients with difficult access using a dynamic one-person technique is a challenging procedure. In an attempt to help teach this effectively, we have developed a method that employs a sign we call the "vanishing target" to ensure intraluminal positioning of the catheter needle tip.

When ultrasound is used to guide needle placement into a vessel, two traditional approaches are employed: a short-axis, or out-of-plane, approach, and long-axis, or in-plane, approach. The long axis in-plane technique has the advantage of visualizing the needle shaft and tip, but the short-axis, out-of-plane technique has been shown to be more readily used by less experienced operators.[9] A recent video on the subject stated that the long-axis, in-plane technique is more frequently used for USG-PIV by experienced operators[10]; however, in our experience, a long axis, in-plane approach is less useful for peripheral veins (regardless of operator experience level), as these veins tend to be small, are accompanied by arteries, and often do not travel in straight lines.

With the out-of-plane, short axis approach, the needle tip is visualized within the vessel lumen as a hyperechoic structure, also known as the target sign (Figure 1). Obtaining a target sign does not guarantee that the needle tip is indeed intravascular and represents a potential pitfall of using this approach. At times, the vessel wall "tents" and deforms to the pressure of the needle tip but the tip remains extravascular (Video Clip S1, available as supporting information in the online version of this paper). Also, the "bull's eye" of the target sign may not always represent the true needle tip, as the ultrasound plane may be cutting across the needle more proximal to its tip. This can result in the needle tip penetrating deeper than anticipated, resulting in inadvertent puncture of the vein's posterior wall, also known as "back-walling" the needle.

We propose an additional method to confirm intravascular positioning of the needle tip using an ultrasound guided out-of-plane, short-axis approach. Once a target sign is obtained, the operator should decrease the angle between the needle and skin and then advance both the needle and the catheter 1 mm to 2 mm farther while keeping the target sign centered and visualized within the vessel. As the probe is fanned distally, the bull's eye of the target sign should stay in the center of the vessel for a couple of ultrasound planes, but disappear as fanning continues distally from the point of needle entry. This confirms that the needle tip is truly intravascular and will allow for subsequent cannulation of the vessel. Video Clip S2 (available as supporting information in the online version of this paper) demonstrates the "vanishing target sign" technique of USG-PIV placement. While helpful for peripheral vascular access, this technique can also be used for any ultrasound-guided

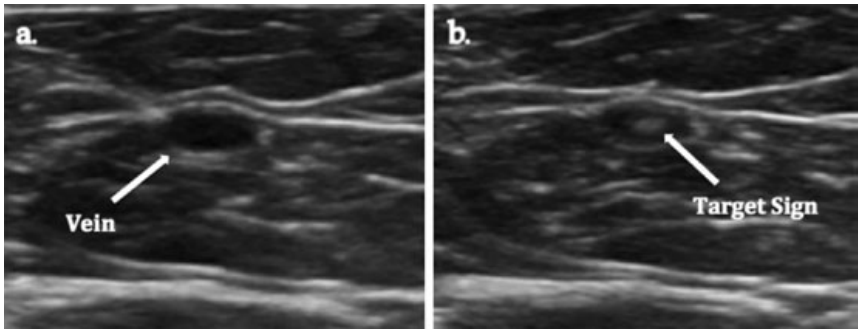


**Figure 1.** Out-of-plane short axis approach to peripheral vein cannulation using ultrasound. (a) Finding the appropriate vessel. A vein is visualized as an anechoic circular structure in the midfield using the linear transducer. (b) Cannulation of the vessel. Once the needle is within the vein, we can see it as a hyperechoic structure within the anechoic lumen of the vein. This is known as a "target sign." The "vanishing target sign" is obtained by fanning the plane of the ultrasound distal to the needle. If the needle tip is correctly positioned, the hyperechoic needle tip (the target sign) should appear then disappear exactly in the center of the vessel.


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procedure necessitating precise knowledge of the location of a needle tip. It may help avoid misplacement of the needle during central vascular access as well, where location of the needle tip in the short axis is particularly important.

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## Supporting Information

The following supporting information is available in the online version of this paper:

**Video Clip S1.** Endothelial Tenting of Vessel Wall.

**Video Clip S2.** Vanishing target sign.