Ultrasound-Guided Arm Ports: Indications, Techniques, and Management

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Abstract

Purpose: *Various venous access devices are available, including peripheral venous lines, peripherally inserted central catheters lines, and subcutaneous port catheters. The latter provides medium-to long-term venous access and includes medical devices that can be inserted either on the chest (chest ports) or in the arm (arm ports). We report the techniques, dedicated indications, and main complications of arm port insertion using the ultrasonography (US) guidance method.*

Methods: *Tips and tricks of percutaneous real-time US-guided vein access technique in the arm are reviewed, and a brief literature review is reported.*

Results: *Technical feasibility is almost 99%. US guidance allows depiction of anatomic variants, reduces the number of failed attempts, and increases the technical access rate compared with venography-guided access. Comparison of arm ports to chest ports reveals a higher global complication rate. We also report typical (mechanical) complications and dedicated indications, including contraindications to chest port insertion and selected patients for whom chest ports are not possible (eg, those with breast, head, and neck cancer; obesity; cosmesis; and requiring upright position).*

Conclusions: *Arm port insertion under US guidance is safe and effective, and has dedicated indications.*

Keywords: *arm port device, central venous access, PICC*

Introduction

Long-term central venous access is of prime importance when treating patients with malignant disease or chronic illness. Devices for permanent central venous access include externalized tunneled catheters, peripherally inserted central catheters (PICCs), and port catheters.[1] Compared with externalized tunneled catheters and PICCs, the main advantages of port devices include better cosmetic results, absence of limitations in daily life activities, and a lower global device-related complication rate.[2] In the early 1980s, arm port insertion was reported by using surgical vein cutdown and percutaneous venography-guided technique.[3-5] Thirty years later, the largest series in the literature shows that arm port device techniques are safe and effective.[6-9] Because ultrasound (US) guidance is available worldwide, is cost-effective, and reduces the technical failure rate of percutaneous vein access,[10] this review reports the technical aspects, main complications, and dedicated indications of arm ports inserted under US guidance.

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Technique

The procedure is performed under local anesthesia and sterile conditions in an interventional radiology suite, after written informed consent has been obtained. From now on, US guidance for venous access of the percutaneous procedure should be the gold standard.[11] Indeed, US monitoring has a triple goal when dealing with percutaneous venous access. First, before the procedure, to perform an overall mapping of the upper limb venous network from the elbow up to the subclavian and neck area. Downstream vein patency (ie, innominate veins and superior vena cava) can be assessed by disclosing the persistence of respiratory phasicity and cardiac pulsatility on both subclavian (SCV) and internal jugular veins spectral via Doppler US.[12] Second, during the procedure, US helps to determine the venous anatomic variants in the arm (eg, vein dominance, basilic-brachial vein junction location, brachial vein duplication, and presence and level of valves), the precise location of the brachial artery, and the median nerve (Figure 1) and subsequently the target (main diameter) vein to be accessed.[13] The basilic vein is preferentially accessed in the mid-third of the inner arm, where the median nerve and brachial artery still remain distant to the basilic vein. Given a minimal diameter threshold of 3 mm, the basilic vein is chosen as the target vein of arm access 85% to 92% of the time.[9-14] When the basilic vein caliber is < 3 mm or less than the brachial vein caliber, the brachial vein is the second target vein option. US guidance helps the operator in locating the median nerve and brachial artery, which are both close to the brachial vein and closer to the basilic vein in the upper third of the arm (Figure 1B). Moreover, the brachial vein can be located at the posterior aspect of the artery in 8% of patients.[15] In such cases, real-time US guidance lowers the risk of iatrogenic brachial arteriovenous fistula, whose occurrence rate is 0.1% in venography-guided arm port procedures.[9] Median nerve compression requiring device explantation has been reported in 0.1% to 0.6% of procedures.[7,9]

Usually, the cephalic vein is nondominant and remains the last option of arm target vein access, owing to the 10-fold risk of reported phlebitis compared with basilic or brachial veins.[14] Moreover, cephalic vein arch catheterization can also be challenging particularly when using Groshong valved catheters. Tourniquet application, forearm muscle flush pumping, and valve targeting are useful tricks that increase the target vein diameter and feasibility. When valves are present, the target vein diameter is increased by at least 30% on a 15-mm-long area. A venous micropuncture set may limit the risk of procedure-related phlebitis, particularly when vein diameter is $\sim$ 3 mm. US monitors the mixed saline and 1% lidocaine solution (10 mL/10 mL) to perform an underskin hydrodissection over the long axis of the target vein and device pocket. A single-step vertical blade skin incision should be performed to both prepare the chamber subcutaneous pocket and allow target vein needle puncture. Target vein puncture should be done along the long axis of the vein via the unique skin incision, thus reducing the tunnelization procedure time. Further single-step vertical skin incision permits target vein needle puncture

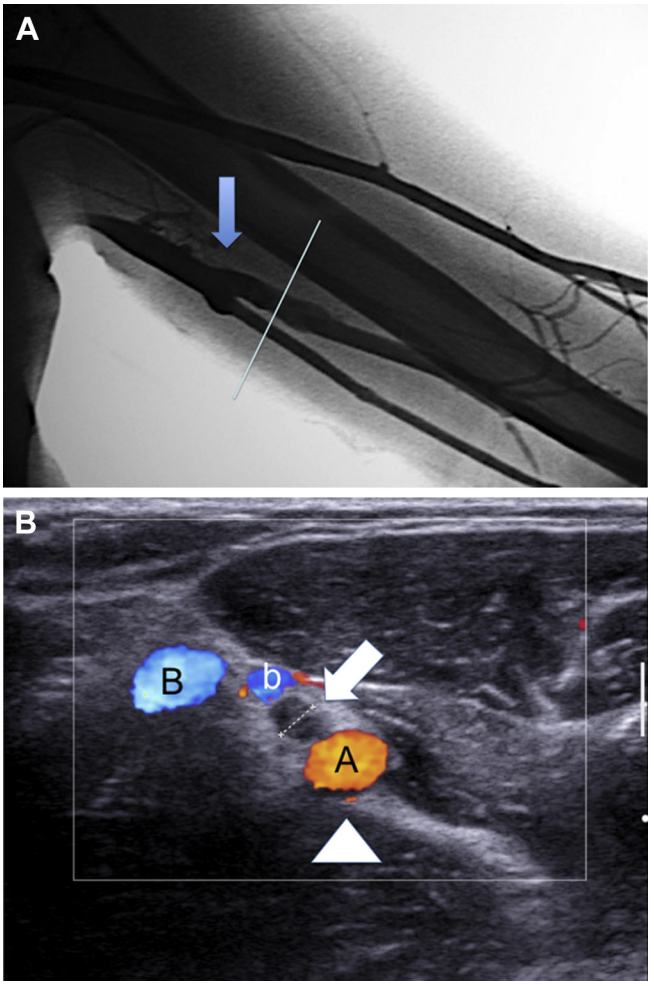

Figure 1. **A, Basilic-brachial vein anatomy on venogram, where Type 1 traditional basilic-brachial vein junction (arrow) at the axillary level with paired brachial veins is shown and reported in 66%. Type 2 (17%) corresponds to junction location at the mid/lower one-third of the arm, with brachial vein duplication. Type 3 (17%) corresponds to Type-2 junction location without brachial vein duplication.[12] The axillary vein can be duplicated in 17.5%, and basilic vein can be absent in 5%. B, Basilic-brachial vein anatomy on ultrasound, with a corresponding ultrasound axial scan displaying a dominant basilic vein, and the 2 key elements (ie, median nerve and brachial artery) to be sought during arm venous access. Note absence of brachial vein duplication and vicinity of median nerve (arrow) located between the brachial vein (b) and artery (A) (arrowhead). Median nerve has a fibrillar aspect on longitudinal scan (not shown). Brachial vein (b) can be retro-arterial in 6%.**