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CASE REPORTS

Mid-arm approach to basilic and cephalic vein cannulation using ultrasound guidance†

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Central venous lines are often used when there is difficulty obtaining peripheral venous access. The basilic and cephalic veins in the mid-arm region, although difficult to see or palpate, can be imaged longitudinally and cannulated using real-time ultrasonography, providing an easy alternative. These techniques are described, with reports of four typical cases.

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Obtaining peripheral i.v. access can be a challenge even to experienced physicians, especially in infants, obese adults, i.v. drug abusers, oedematous patients, or patients who are frequently hospitalized. The problem may be caused by thrombosis or scarring of normally visible veins in the hand and forearm, or difficulty in palpation or visualization of veins as a result of subcutaneous fat or oedema. Central venous catheterization with its associated risks is often used in these patients. But access to the deep veins of the arm is a logical alternative for most surgical procedures. Keyes and colleagues used ultrasonography of the cubital fossa to catheterize the cephalic or basilic veins using a transverse image of these vessels.[1] These veins are often thrombosed in drug abusers, as the anticubital fossa is one of the most frequently used injection sites.

Longitudinally imaging the basilic vein, which is located beneath the deep fascia in the mid-arm, offers an alternative site. The cephalic vein is another possibility, as it has no adjacent artery or nerve. In more than 120 patients with difficulty in gaining i.v. access, we have used ultrasonography to access the basilic or cephalic vein in the mid-arm. We describe our technique and present four typical cases.

Techniques

A tourniquet is applied high up on the arm. An ultrasound device (Sonosite® 180 Plus-Sonosite Inc., Bothell, WA, USA) with its variable frequency probe C-11 (4–7 MHz) is used to image the basilic or cephalic vein (Fig. 1). A transverse image of the vein, accompanying artery and nerve is obtained, the vein is brought into the middle of the image (Fig. 2), and the probe is rotated through 90° to visualize a longitudinal image of the vein (Fig. 3). The vein is easily compressible and flow can be confirmed by colour Doppler.

Regular technique

The skin entry site is cleaned with alcohol and infiltrated with lidocaine 1%, about 1–2 cm from the probe. An i.v. cannula is inserted at a 45° angle to the skin and visualized by real-time imaging during its advance through superficial and deep fasciae into the vein. As the needle is advanced, the vessel puncture can be seen on the screen and is confirmed by free backflow of blood. The cannula is then threaded into the vein. If the length of the cannula within the vein is less than 2.5 cm, there is a possibility of its dislodgement. In such a case, the Seldinger technique is used to insert a longer catheter. There is no need to keep the probe sterile as it does not come in to contact with the catheter.

Seldinger technique

If the vein is deep, the Seldinger technique should be used primarily, if long needle-mounted catheters (BD Angiocath (16 G, 13.3 cm long): BD Infusion Therapy Inc., Sandy, UT, USA) are not readily available. If a catheter has already been placed by the technique described above, but the length of catheter within the vein appears insufficient, a guide wire is passed through it, and the skin is prepared with Betadine and

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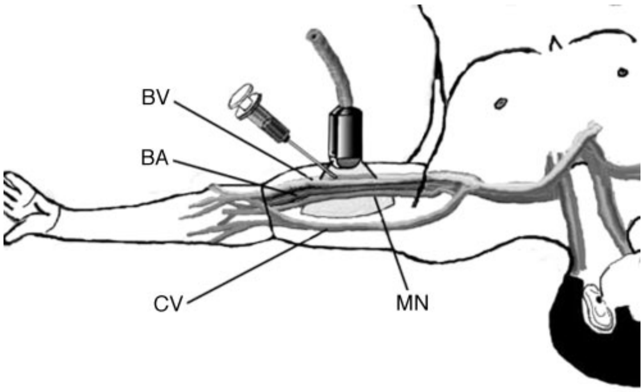

Fig 1 Relationship of vein, transducer, and needle. A longitudinal image of the vein is obtained and needle/catheter are advanced under real-time ultrasonography. BV=basilic vein, BA=brachial artery, MN=median nerve, CV=cephalic vein.

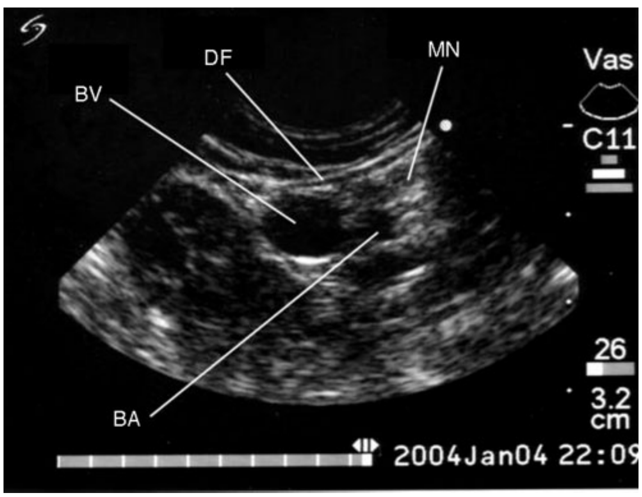

Fig 2 Transverse section of basilic vein, brachial artery, and median nerve in mid-arm. The vein is brought to the centre of the image and the probe is rotated by 90° to obtain longitudinal view. BV=basilic vein, BA=brachial artery, DF=deep fascia, MN=median nerve.

draped in a sterile fashion. The ultrasound probe is covered with a sterile sheath or a glove containing conductive gel. If there is no i.v. cannula, an 18 G needle is inserted into the vein under sonographic guidance as described above and a guide wire is inserted through it. The track is dilated by a tissue dilator, and then a 16 G, 15 cm long FlexTip® (Arrow International, Reading, PA, USA) catheter is inserted over the guidewire.

Case reports

Case 1

A 40-yr-old male with a history of i.v. heroin abuse was brought for fixation of a mandibular fracture. There were streaks of fibrosis in both arms from septic thrombophlebitis. Several attempts to obtain venous access in the hands,

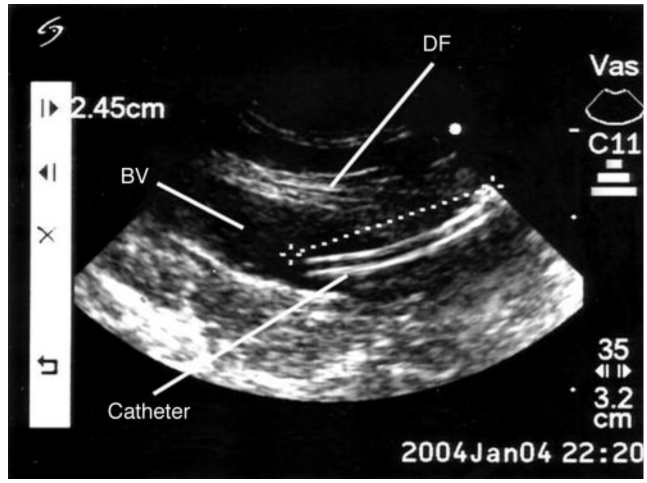

Fig 3 Longitudinal image of basilic vein showing 16 G catheter in the vein. The vein is confirmed by easy compressibility and colour Doppler flow. The i.v. segment of catheter measures 2.45 cm. BV=Basilic vein, DF=deep fascia. The advancing needle, catheter, or guide wire can be seen in real-time using this longitudinal view.

forearms, and cubital fossae failed. The ultrasound was used to image the basilic vein and a 5-cm long, 16 G catheter was introduced.

Case 2

A 50-yr-old woman with a history of hypertension, hepatitis C, cirrhosis, and i.v. heroin abuse, receiving methadone, had a fracture of the right tibia and a right shoulder injury. There had been several attempts to cannulate her veins, with resultant discolouration of her hands, wrists, forearms, and elbows. She was to undergo open reduction and fixation of a tibial fracture. A small vein on the dorsum of the left hand was cannulated with a 20 G catheter, which could not be advanced into the vein far enough to obtain secure access. General anaesthesia was induced intravenously through this catheter. Her left cephalic vein was then cannulated with a 16 G 5-cm long catheter using ultrasound imaging.

Case 3

A 12-month-old infant undergoing excision of a tongue tie and release of bilateral congenital trigger thumbs was anaesthetized by inhalation induction. He had no visible veins on his feet and ankles. Several attempts at blind saphenous vein cannulation failed. His right cephalic vein was imaged with ultrasonography and a 20 G, 5 cm catheter was introduced under real-time imaging.

Case 4

A 42-yr-old man with a huge bony cyst of the right index finger and a history of i.v. drug abuse, had no vein suitable for i.v. access. His left basilic vein was visualized and cannulated. This vein was deep because of overdeveloped muscles; a 20 G, 5 cm cannula could only be inserted less than 1 cm.

The cannula and arm were cleaned with Providone and draped in sterile sheets. A guide wire was passed through the cannula and, using the Seldinger technique, a 16 G, 15-cm long Flextip® catheter was inserted and left in place for more than 5 days without problems.

Discussion

In all of the patients described, there had been multiple unsuccessful blind attempts to cannulate peripheral veins. We used real-time sonography to locate and guide the needle into the veins. Direct visualization made the process possible in less than 1 min with i.v. catheters, and less than 5 min with the Seldinger technique (from the time of first needle puncture until suturing of the catheter). This technique is different from the one previously described by Keyes and colleagues,[1] in which the ultrasound beam visualized the antecubital and basilic veins in a transverse plane and advance of the needle was not seen in real-time. In our method, the probe is rotated through 90° and the veins are visualized longitudinally. This enabled us to see the needle as it was advanced under the ultrasound beam and as it entered the vein. The guide wire, if used, could also be seen. Coiling of a guide wire or a soft catheter against a venous valve can be observed by real-time imaging in cases of difficulty advancing the guide wire, and it can be renegotiated across the valve under imaging. This also confers the advantage of preventing inadvertent arterial puncture, multiple vessel punctures, and nerve damage.[1 2]

The median and ulnar nerves are in close proximity to the basilic vein in the proximal part of the arm (Fig. 1), and advancing the needle blindly may lead to nerve injuries. Keyes and colleagues found 8% of catheter dislodgement or extravasation within 1 h of initial successful cannulation.[1] In contrast, with our technique, we could ensure a sufficient length of catheter inside the vein. If this was found to be less than 2.5 cm, the Seldinger technique was used to insert a 15-cm long, 16 G catheter. We had no case of extravazation, unlike Keyes and colleagues.[1] We chose a cannulation site higher up the arm than was used in the previous study, as there were no patent veins in the majority of our cases in the antecubital fossa. This location also eliminates the chance of dislodgement of the catheter by movement at the elbow. The basilic vein lies beneath the deep fascia in the upper two-thirds of the arm. The vein is almost always patent in this region, even in long-term i.v. drug abusers. The cephalic vein, which is more superficial, is usually preserved in most obese patients because it is buried deeply in adipose tissue. The cephalic and basilic veins are thus excellent alternatives to central venous lines. Keyes and colleagues,[1] and Kramer and colleagues,[2] observed nerve injuries in 1 and 8% patients, respectively, as a result of this procedure. We have performed this technique in more than 120 patients without any nerve injury so far.

Webre and Arens used cephalic and basilic veins in the cubital fossa and palpation for inserting central venous catheters.[3] Ultrasound has been used for inserting central venous catheters in the antecubital region by Sofocleous and colleagues,[4] and Parkinson and colleagues.[5] They used a transverse view of the vessels. We use a longitudinal view of the vein, which allows easy visualization of an advancing needle, catheter or guide wire in real-time.

Thrombosis of the arm veins is a well-known complication especially of medium to long-term central venous access, and can cause venous insufficiency or even gangrene. We have used these lines for short-term venous access in the operating room or immediate perioperative period and have not encountered any thrombosis, although we accept that our experience is small. Most of these lines were inserted in the mid-arm as most of our patients were i.v. drug abusers, having no suitable veins near the antecubital fossa.

The use of ultrasound for venous access in the mid-arm region is a suitable and easy alternative to central venous catheterization in situations where it is otherwise difficult to gain i.v. access.

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