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How to Access the Cephalic Vein Using a Cut-down Approach

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The cephalic vein has been used for access and lead placement ever since transvenous leads were developed. The cephalic vein offers relatively easy access into the central venous system with a very low risk of complications [1]. There is essentially no risk of pneumothorax with the cephalic vein cut-down compared with axillary or subclavian puncture. In addition, lead longevity with cephalic access is superior to that of other common techniques such as access via axillary or subclavian veins [2]. This is because of a more gentle angle of entry with cephalic access and a lower risk of subclavian crush to the lead when compared with subclavian access [3,4].

Some physicians use cephalic access for all device implants, while others use it only for selected patients. All physicians should become proficient with implants via cephalic access as it can be useful in patients with access challenges, such as those who have a high risk of complications such as pneumothorax, as well as patients where the longevity of the lead is of prime importance such as young patients.

In this chapter we describe the techniques to gain access into the cephalic vein as well as some of the potential challenges and pitfalls.

Procedure Description

An important aspect of the cephalic vein cut-down procedure is an understanding of the anatomy of the pectoralis and deltoid muscle areas as they relate to the location of the vein. The cephalic vein runs in the deltopectoral groove. On the skin, this is the groove where the shoulder meets the chest and is visible and palpable in most people (Figure 1.1). The incision can be made either

parallel to the deltopectoral groove, or perpendicular. Care should be taken to ensure that the incision is close enough to the groove that access to the vein is unencumbered. An incision too medial will lead to a difficult dissection of the cephalic vein. An incision directly on the groove can also be uncomfortable for the patient. A typical incision is approximately 1 cm (or 1 finger's breadth) medial to the groove, approximately 1–2 cm (or 1–2 finger's breadths) below the clavicle. An incision that is too low can make for a challenging dissection and can be too close to the axilla in some individuals.

Once the incision has been made, dissection is carried through to the pectoral fascia using blunt dissection and electrocautery. A fat-pad located in the deltopectoral groove can now be easily identified in most people. The vein is located within the fat-pad (Figure 1.2). Using only blunt dissection with a small clamp (such as a “mosquito” clamp) or a pair of Metzenbaum dissecting scissors allows for removal of the fat and identification of the vein. In the fat-pad area, the use of electrocautery should generally be avoided as it can destroy the vein and render it useless for access. The vein will be thin, white, or have a blue hue in some cases. The vein may also be flat or should become flat when lifted gently. Care should be made to avoid the artery that in some cases runs adjacent to the vein. The artery can be identified as it is thicker, more rounded, and white in color. When the artery is manipulated it may constrict and pulsations can be seen during systole. Occasionally, the artery is positioned such that access into the vein is challenging; in these cases, using the clamp or pick-ups (Debaquey forceps), the artery can be moved away from the vein and a small application of electrocautery in the “cautery” mode applied to the metal of the clamp will destroy the artery.

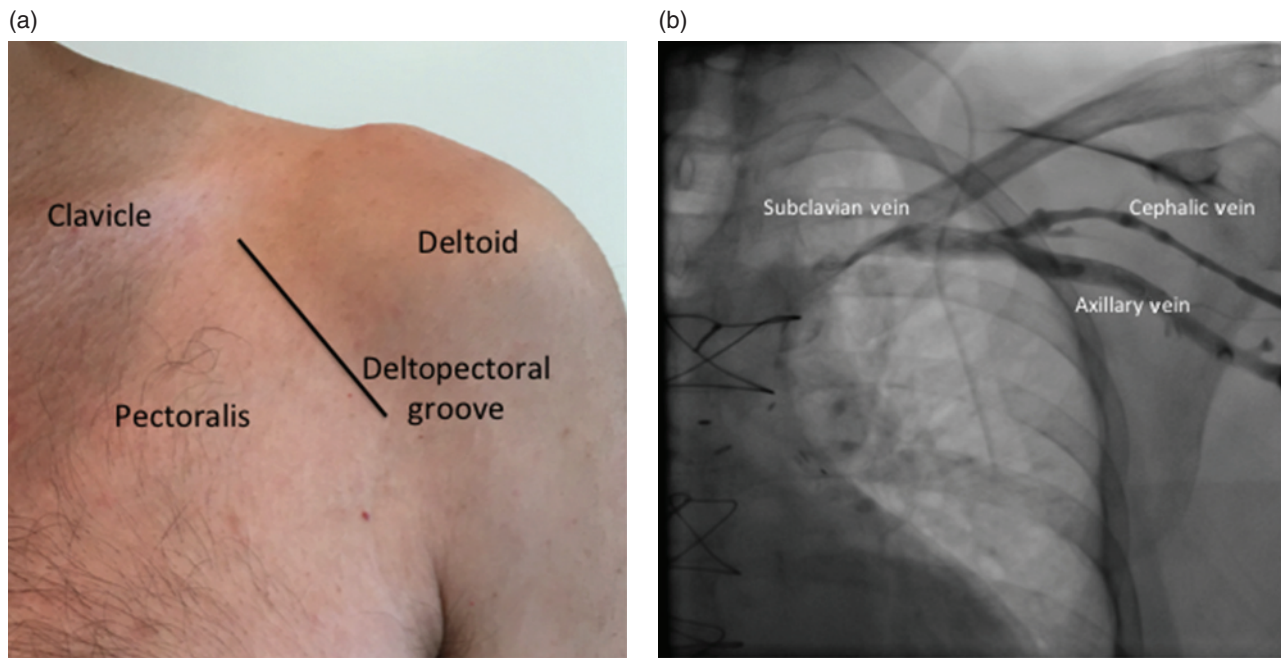


Figure 1.1 (a) Deltopectoral groove. (b) Venogram demonstrating the relationship between the bony landmarks and the cephalic vein. Also, the relationship to the axillary and subclavian veins can be appreciated.

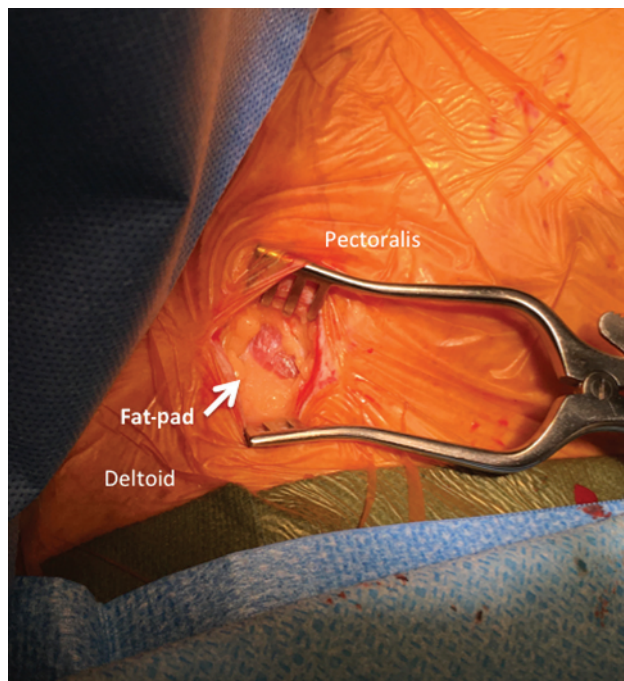


Figure 1.2 The fat-pad is located in the deltopectoral groove. The cephalic vein is within the fat-pad.

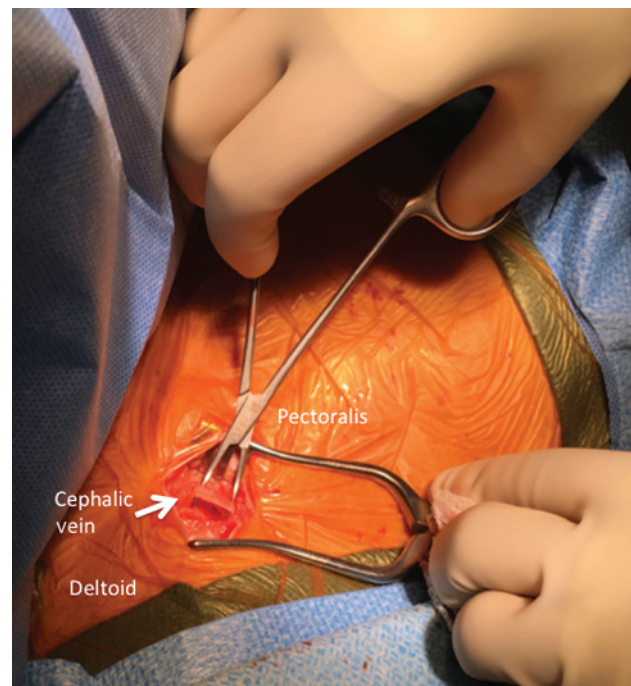


Figure 1.3 Cephalic vein isolation using a small clamp.

A right-angle clamp can be used to dissect around the vein to ensure that the vein can be lifted free from any tissue in the groove. At this point the vein is inspected to ensure that any adherent tissue is removed so that only the vein is manipulated (Figure 1.3). Using the

right-angle clamp, two pieces (approximately 10cm) of non-absorbable suture (0 silk or 0 Ethibond) are brought around the vein to maintain control of the distal and proximal aspects of the vein (Figure 1.4). The vein can then be manipulated and accessed.

Figure 1.4 Sutures loops are placed around the vein to maintain control of the proximal and distal aspects of the vein.

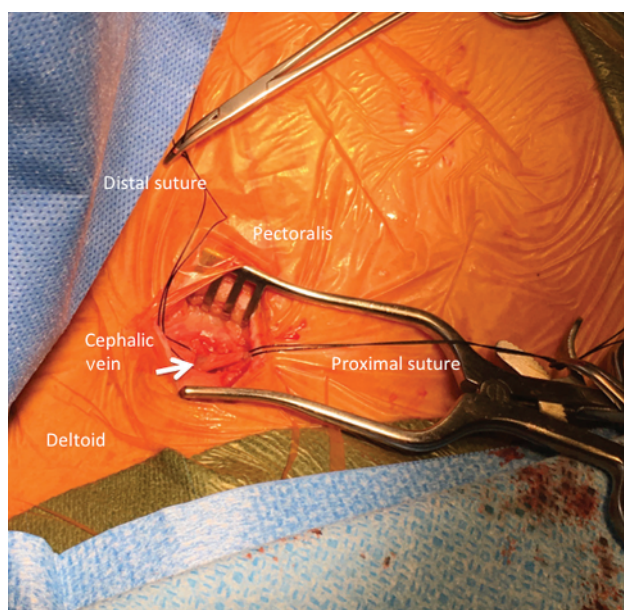
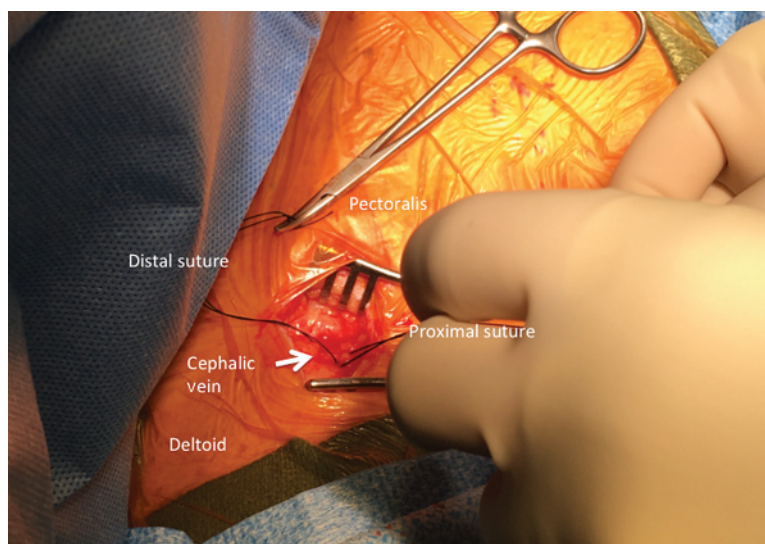


Figure 1.5 Lifting the distal suture to show the cephalic vein. This allows access either by direct venotomy or with a small Angiocath needle.

More than one technique can be used to access the vein. A commonly used technique utilizes a scalpel to make a small venotomy. This is best done while lifting the more distal suture gently as this reduces the amount of bleeding from the vein (Figure 1.5). The scalpel should have a straight blade (typically, number 11 blade) and should cut the vein initially placed in a horizontal position and lifted vertically once the vein has been pierced (Figure 1.6). Care should be taken not to make the venotomy too large so that the integrity of the vein is compromised. In addition, it is important to ensure that

the venotomy cuts into the vein rather than only the adventitia surrounding it. Typically, a small amount of blood escapes and the lumen of the vein should be visible. Once the vein has been cut, a vein pick is placed at the lip of the incision and used to lift the lip of the incision to expose the lumen of the vein. Now, under direct visualization, a small (4 French, Fr) sheath can be advanced a small amount into the vein and a hydrophilic glide wire advanced via the sheath into the venous system under fluoroscopic guidance (Figure 1.7).

An alternative approach to using a scalpel and vein pick is direct puncture into the vein with an Angiocath or a micropuncture needle. The Angiocath needle is commonly used to obtain peripheral percutaneous vascular access, while the micropuncture needle is used for central percutaneous vascular access. Once vascular access is obtained with the Angiocath needle, the catheter is advanced gently into the vascular space. With the micropuncture technique, after obtaining vascular access with the needle, a micropuncture wire is advanced into the vein and the micropuncture dilator (5 Fr) is advanced over the wire. Then, through the Angiocath catheter or the micropuncture dilator, a hydrophilic glide wire may be advanced into the central venous system.

Once the wire has been advanced, the small 4 French sheath or the Angiocath catheter is removed and the wire can be used to place a larger peel-away sheath for the lead delivery. This wire needs to support placement of a larger sheath, so a stiff angled tipped glide wire is often the best choice for this job (e.g., Glidewire). The same wire can be used for both sheath placements in the case of a dual chamber system. In this situation, the first sheath is oversized to retain the wire while placing the lead (Figure 1.8). After removal of the sheath, a second sheath can be placed over the wire and advanced.

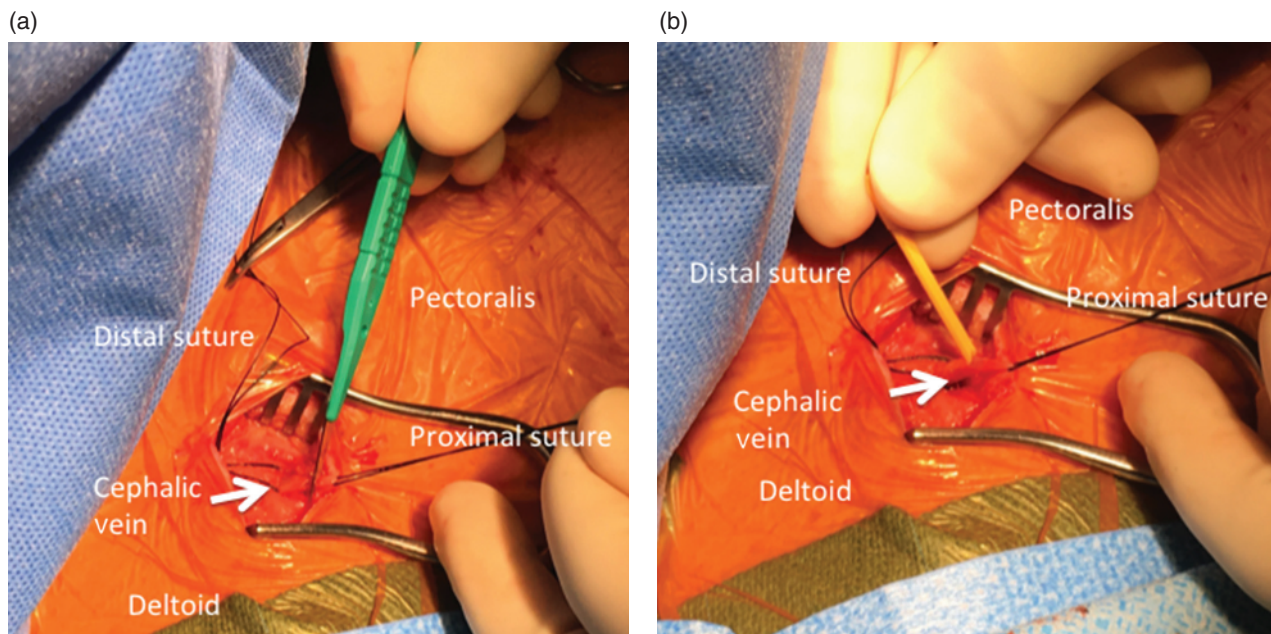


Figure 1.6 (a) Venotomy using an 11 blade with the sharp aspect of the blade pointing upwards. (b) A vein pick (yellow) is placed in the vein to maintain the opening so that a wire can be inserted.

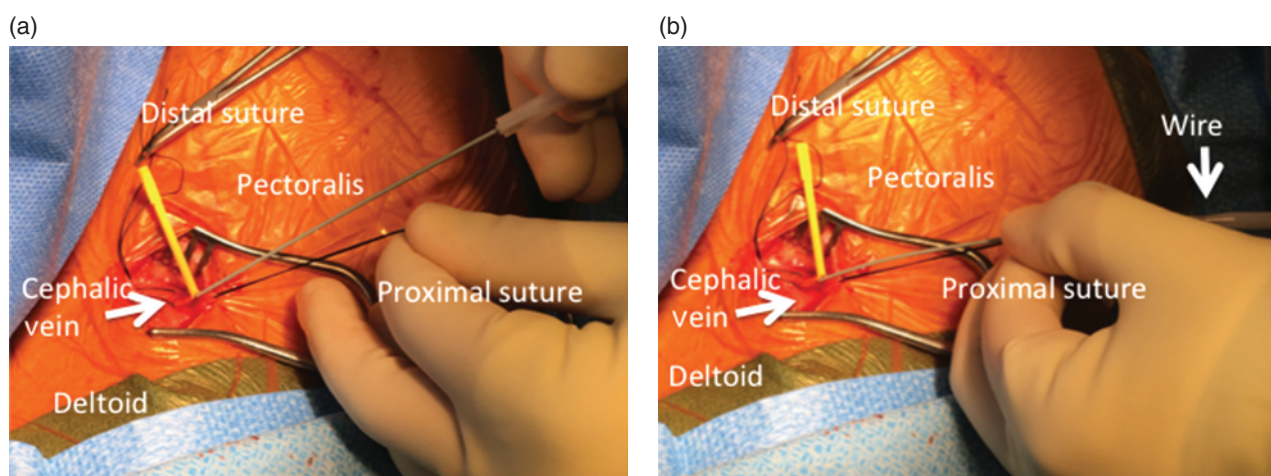


Figure 1.7 (a) Introduction of the 4 Fr sheath. (b) The hydrophilic guide wire is placed via the 4 Fr sheath and advanced into the vein. It can be advanced into the heart under fluoroscopy.

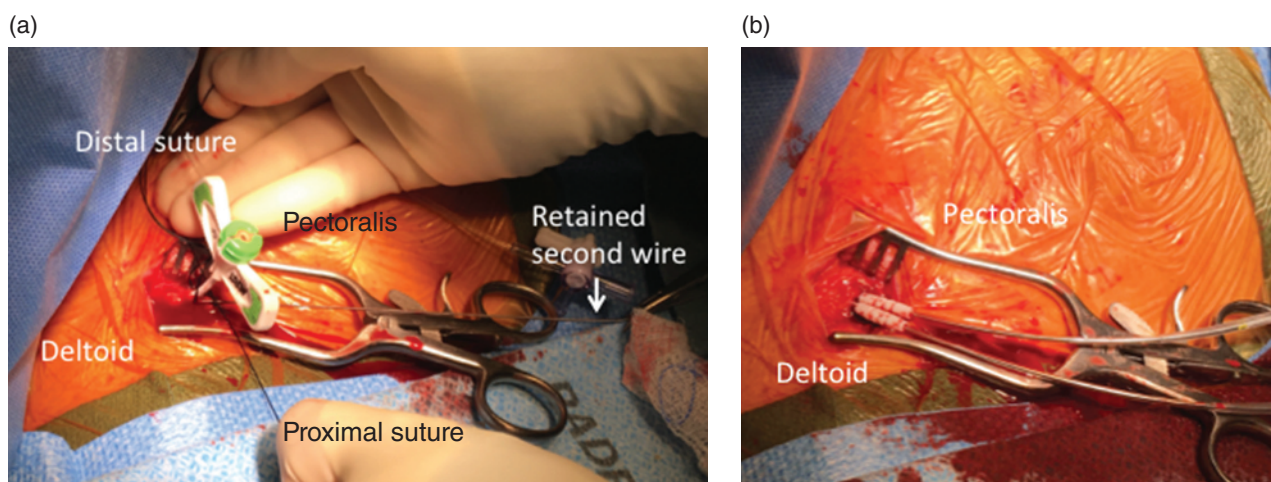


Figure 1.8 (a) The proximal suture is tied to limit "forward" bleeding. Also, a second wire can be inserted by the side of the sheath. This wire can be inserted within the first sheath and then the sheath can be removed retaining two wires in the vasculature. This wire can be retained for placement of the second sheath. (b) Two leads can be easily placed and sutured to the fascia in this location.

The choice to retain the wire with the second sheath is often based on physician preference, with the advantage of keeping the wire being that access is maintained until both leads are placed. Alternatively, once the first sheath is placed, another wire can be advanced in the case of a dual chamber system and the sheath then removed, leaving two wires in place that can each be individually accessed with a sheath. In this case, there is no need to use an oversized sheath.

Potential Pitfalls and Complications

A common challenge is seen in patients who are overweight. In these patients, the deltopectoral groove is not always easy to see, so this may result in an incision that is too lateral or medial. This makes the dissection much more difficult, especially given the large amount of fat and the depth of the dissection needed. In these patients, taking the time to perform deep palpation and finding the area where the deltopectoral groove lies is of utmost importance. Typically, the operator begins palpation at the shoulder and “walks” his or her fingers over the deltoid muscle towards the chest until finding the “deepest” area. This is the deltopectoral groove.

In very thin individuals the surface landmarks are typically easy to find; however, the fat-pad area may be devoid of any fat. In these patients, examining the muscle fiber orientation of the pectoralis and the deltoid muscles leads to identification of where the cephalic vein should run.

Occasionally, the cephalic vein is very small which makes it a challenge to access. Presence of a small vein should not necessarily result in abandoning the approach, as often one can still place two leads via a small cephalic. The use of a small amount of local anesthetic (lidocaine) may help increase the girth of the vein, as sometimes manipulation of the vein can result in some spasm. Typically, a few drops of local anesthetic directly on the vein helps. Once a wire is placed through the cephalic and advanced into the right atrium, or preferably the inferior vena cava, a sheath can be advanced through the vein. In these cases, the vein will be destroyed with advancement of the sheath, but this rarely causes any long-term problems. In some cases, the vein cuff is tight

around the sheath causing difficulty with sheath advancement and lead–lead interactions. The use of electrocautery to cut the vein cuff will allow the sheath to be advanced. In some cases, the vein needs to be dilated with progressively larger dilators until the sheath can be placed. The use of a stiff wire such as a “super-stiff” Glidewire can be useful to help advance the sheath. Occasionally, even after the vein is dilated and the sheath advanced, there can be significant interaction between the leads placed together in the cephalic. In these patients, care not to dislodge a lead when removing a sheath and manipulating the other lead is critical. Sometimes, the interaction is too severe and can impact implant success. In these cases, a separate subclavian or axillary puncture for the second lead can simplify the procedure significantly. In devices with three leads, while they can all be placed via the cephalic vein, it is generally preferred to place the smaller of the leads in the axillary or subclavian vein. This is commonly the left ventricular pacing lead.

When the vein is very large, the main problem is bleeding around the leads. This back bleeding can become an issue in patients with a large cephalic vein and high venous pressures, such as those with congestive heart failure. Often, simple manual pressure at the entry site of the cephalic vein is adequate to quell the bleeding after the leads have been placed. In some cases, a purse string suture may be needed. This should be placed carefully with an absorbable suture to ensure that the lead is not compressed within the suture or otherwise damaged by the suture needle. A reasonable approach is to place the purse string suture prior to placement of the leads when significant back bleeding is anticipated.

Conclusions

The cephalic vein cut-down procedure is a simple technique to gain access for lead placement, with very low risks and a high success rate. Once the operator becomes proficient, it can be performed as quickly as an axillary or subclavian puncture. Understanding the potential difficulties, the operator can usually succeed in obtaining access using this technique.

References

- 1 Chang HM, Hsieh CB, Hsieh HF, Chen TW, Chen CJ, Chan DC, *et al.* An alternative technique for totally implantable central venous access devices: a retrospective study of 1311 cases. *Eur J Surg Oncol* 2006;32:90–93. doi: 10.1016/j.ejso.2005.09.004
- 2 Gallik DM, Ben-Zur UM, Gross JN, Furman S. Lead fracture in cephalic versus subclavian approach with transvenous implantable cardioverter defibrillator systems. *Pacing Clin Electrophysiol* 1996;19:1089–1094.

- 3 Roelke M, O'Nunain SS, Osswald S, Garan H, Harthorne JW, Ruskin JN. Subclavian crush syndrome complicating transvenous cardioverter defibrillator systems. *Pacing Clin Electrophysiol* 1995;18:973–979.
- 4 Parsonnet V, Roelke M. The cephalic vein cutdown versus subclavian puncture for pacemaker/ICD lead implantation. *Pacing Clin Electrophysiol* 1999;22:695–697.