

Imaging in Cardiology: Implantation via the Axillary Vein Is a Safe Alternative to Subclavian Puncture

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Introduction

Venous access for the implantation of a permanent pacemaker lead presents a challenge to pacemaker and implantable cardioverter-defibrillator (ICD) implantation procedures. Several techniques can be used, but the subclavian puncture technique is by far the most popular, with the subclavian vein remaining the dominant approach [1,2]. However, the complication rate of puncturing the subclavian vein is approximately 0.6 to 5.2% with respect to the pneumothorax alone [1-5]. The cephalic vein approach presents fewer complications, but access to the cephalic vein is less feasible. In a randomized study, Calkins et al. reported a success rate of 65%, where one hundred patients were randomized to axillary vein puncture after contrast injection in the cubital vein, and the other one hundred patients to venous cut-down of the cephalic vein [6]. Another report indicated a failure rate of 17% when the cephalic vein was approached alone [7]. The puncturing technique of the axillary vein, whether guided by X-ray contrast [6,8] or Doppler signals [9], provides direct and safe access to the heart for implantation of pacemaker and ICD leads.

Case Report

An 84-year-old man was referred for pacemaker implantation due to symptomatic bradycardia and permanent atrial fibrillation (AF). His history revealed shortness of breath during mild to vigorous exercise and type II diabetes mellitus controlled by medication. He had suffered from persistent AF in recent years. His drug therapy included anti-coumarin medications, diuretics, and digitalis. A physical examination revealed mild pitting edema at the ankles, and rales at the base of the lungs. A 24-hour Holter ECG revealed permanent AF with very fast rhythms, alternated by symptomatic bradycardias. Some pauses persisted for 5 s during the night and over 3 s during the daytime. During implantation of the lead (Elox 53 BP, Biotronik, Germany) the cephalic vein was not explored, but the axillary vein was visualized (see Figure 1). Puncturing the axillary vein is preferred, since this procedure is easy, safe, and expeditious. The needle was placed tangential to the thorax, almost parallel to the axillary vein itself (see Figure 2). The guide wire was inserted, followed by an introducer sheath.

Discussion

The lead can be introduced into the axillary vein using three different methods. The first is a well-known surgical technique where the axillary vein and usually one or two tributaries are visible to the surgeon. The tributary vein can be used via the cut-down technique, which is most often applied to the cephalic vein. The disadvantage of this method is the extensive skin and muscle dissection needed for visual approach to the veins. When the main trunk of the axillary vein is used, substantial blood loss may occur. The leads should then be passed through a purse-string vascular suture (similar to a sack) to diminish extensive blood loss [10,11].

Another technique is puncturing the axillary vein. The axillary vein adjoins the subclavian vein outside the thorax and runs parallel to the deltopectoral groove, situated between the deltoid muscles and the pectoralis major muscles. The cephalic vein runs almost parallel to the axillary vein but makes a rather sharp curve to drain into it at almost a 90° angle. This sharp curve, however, may hamper insertion of the

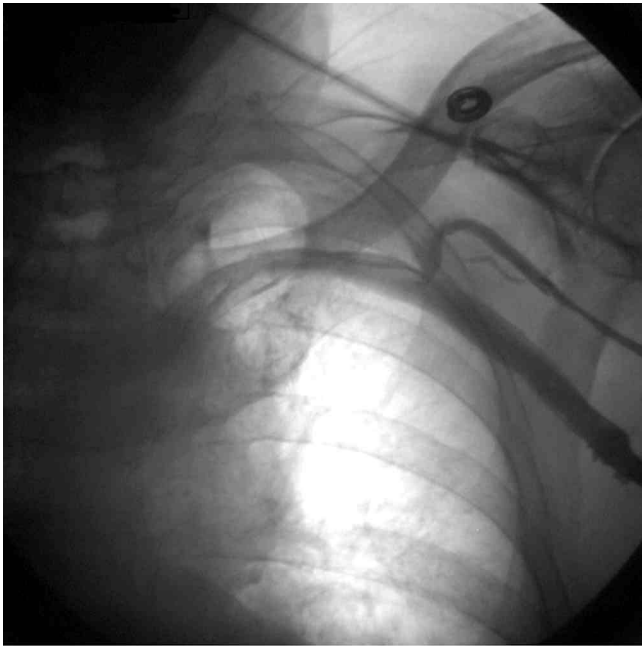


Figure 1. Chest X-ray showing the axillary vein and subclavian veins. Note the cephalic vein draining into the axillary vein at a perpendicular angle.

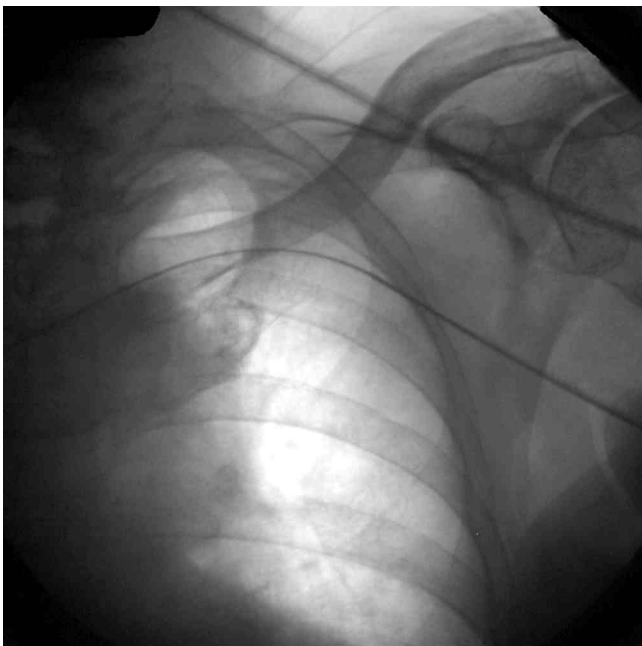


Figure 2. Lead implantation via the axillary vein in the patient from Figure 1. In the lower part of the figure, the needle is inserted through the skin incision and the tip of the needle is advanced under fluoroscopy, in the craniomedial direction of the patient. The skin incision for the pocket is made parallel to the deltopectoral groove. The wire is introduced into the axillary vein.

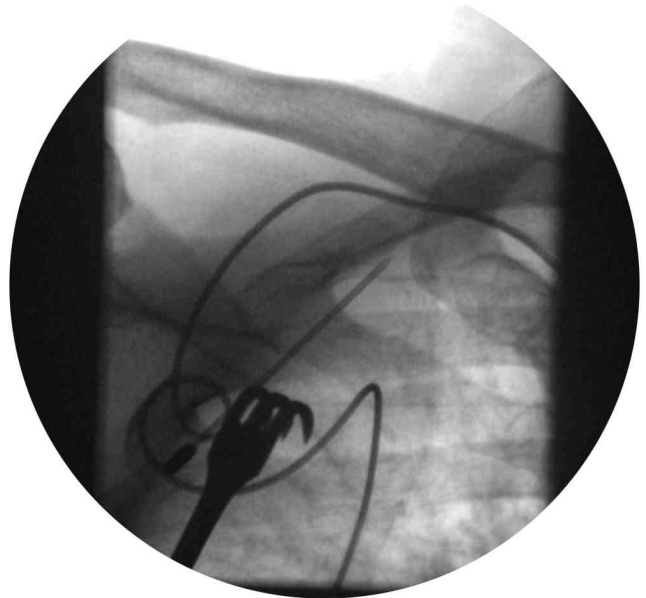


Figure 3. Lead implantation via the axillary vein in another patient. The direction of the needle and the position with respect to the clavicular bone is clearly visible. An old pacemaker lead is already present, but it was abandoned due to a very high threshold.

lead into the veins. The guide wire of the puncture set can be introduced after blind puncture of the vein. It has to be stressed that the needle angle should be directly tangential to the craniomedial ribs (see Figure 3). The puncture can be easily performed through the incision when the incision is parallel to the deltopectoral groove. A high percentage of successful access was reported in 165 out of 168 cases [12].

The third method is a modification of the blind puncture technique. The puncture is guided by the visualization of the venous system using X-ray contrast. The images can be stored and reproduced digitally, or they may be recorded 1 or 2 days before implantation. For experienced surgeons, the success rate is high, and the procedure can be performed quickly [6,8]. For inexperienced surgeons, the success rate may be only 80%, but it has to be stressed that a learning curve should be taken into account [13]. Another guidance method uses a Doppler probe, which has to be covered by a sterile surgical sheath and requires an assistant to identify the axillary vein [9].

Conclusion

The third technique of introducing the lead into the axillary (modification of the blind puncture technique) is the preferred method. This procedure can be performed by less experienced surgeons. A peripheral injection of contrast into the vein is very helpful for the visualization of the axillary vein and the puncture. After more experience has been gained with this method, a blind puncture can be used instead. The hitherto rarely employed axillary vein technique is a very useful alternative to the more commonly used methods.

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