Extrathoracic Subclavian Venipuncture by Using Only the J-type Guidewire for Permanent Pacemaker Electrode Placement

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Summary

Extrathoracic subclavian/axillar venipuncture is an accepted method for implanting pacemaker leads. Although several procedures have been reported, no standard method has been established yet. We evaluated the usefulness of a method in which only J-type guidewires are used. Between August 2011 and November 2012, 33 patients (20 men and 13 women; age, 77.5 ± 10.3 years) underwent permanent pacemaker lead insertion by extrathoracic subclavian venipuncture at our hospital. Thirty-two of the patients underwent primary implantation, whereas 1 patient required an additional lead because of lead fracture. The guidewires were inserted from the cubital vein to the subclavian vein. After the pacemaker pockets were created, we set the X-ray projection in the ipsilateral anterior oblique view. The distal edge of the guidewire was positioned on the ventral side of the first rib on fluoroscopy. The needle tip was positioned within the U-shaped distal tip of the J-type guidewire. The needle was held parallel to the X-ray angle and advanced towards the first rib until the tip entered the subclavian vein. The guidewire was inserted through the cubital vein in 31 patients, and through the femoral vein in 2 patients. Using this method, we successfully performed subclavian venipunctures in all 33 patients (total, 60 punctures) without any complications. Extrathoracic subclavian venipuncture using only a J-type guidewire is an easy, safe, and economical method for pacemaker lead implantation. (Int Heart J 2013; 54: 129-132)

Key words: Pacemaker implantation, Complication, Fluoroscopy, Oblique position

Intrathoracic subclavian vein puncture has been used as a standard method for the implantation of permanent pacemaker leads. The anatomically guided method of intrathoracic subclavian vein puncture has the advantage of allowing the rapid insertion of pacemaker electrodes without the need for any special instrument. However, the method has been associated with serious complications such as pneumothorax, hematoma formation, and lead fracture.1 Subclavian crush syndrome is a well-known cause of pacemaker lead fracture, resulting from the entrapment of the lead between the clavicle and the first rib after subclavian vein puncture. Its prevalence is reported to be 1-4%.2-3 To avoid lead fracture, surgical cut-down of the cephalic vein or extrathoracic subclavian/axillar venipuncture has been recommended.4-5

Although most pacemaker or cardiac resynchronization therapy needs multiple-lead insertion, it is often difficult to introduce multiple leads with the surgical cut-down of the cephalic vein. Extrathoracic venipuncture is suitable for multiple-lead placement and is believed to prevent lead fracture. Several methods for extrathoracic venipuncture have been reported, including the anatomical approach and the venography-guided approach. However, there has been no standard technique for extrathoracic venipuncture. The purpose of this study was to evaluate the safety and efficacy of extrathoracic subclavian venipuncture using only a J-type guidewire.

Methods

The subjects were 33 consecutive patients (20 men, 13 women, 77.5 ± 10.3 years old) who received permanent pacemaker implantation from August 2011 to November 2012. The indications included sick sinus syndrome in 11 patients, atrioventricular block in 20 patients, and bradycardiac atrial fibrillation in 2 patients. Among the 33 patients, 32 underwent primary implantation and the remaining 1 patient had an additional lead insertion because of the fracture of a previously implanted pacemaker lead. Informed consent was obtained from all patients.

A J-type guidewire (Technowood, Osaka, Japan) was inserted from the cubital vein of the side where pacemaker pocket creation was scheduled. Under fluoroscopy, the guidewire was advanced into the right atrium to confirm the patency of the axillar, subclavian, and brachiocephalic veins. The tip of the J-shaped guidewire was then withdrawn to the ventral side of the first rib on fluoroscopy in the ipsilateral oblique (30-40°) position (Figure 1). Thereafter, a subcutaneous pacemaker pocket was created at the infraclavicular region under local anesthesia.

After pacemaker pocket creation, the tip of the puncture needle was positioned inside the U-shaped distal tip of the J-type guidewire under fluoroscopy, in a 30° to 40° oblique position (Figure 2). The needle was inserted towards the ventral side of the first rib in the direction parallel to the X-ray (Figure...
3). If the blood refluxed the guidewire was inserted into the subclavian vein, and the sheath was detained (Figure 4). Thereafter, the permanent pacemaker was implanted using previously reported methods.

**RESULTS**

Insertion of the J-type guidewire from the cubital vein was possible in 31 of the 33 patients. Because 2 patients did not have a good cubital vein, the guidewire was inserted from the femoral vein. Extrathoracic subclavian venipuncture using only a J-type guidewire was successful in all 33 patients and all 60 punctures, and there were no complications such as pneumothorax or artery puncture (Table).

**DISCUSSION**

Extrathoracic subclavian/axillar venipuncture is widely performed, and several methods for the procedure have been reported. However, there is currently no accepted standard method. Although the anatomical approach requires few instruments, this technique requires a certain amount of skill, and, thereby, there is variation in the success rate. To improve the success rate, a method with venography assistance...
was introduced. Since this method allows visualization of the puncture site, it requires less skill and can attain higher success rates than the anatomical approach. However, it requires the use of a contrast medium, which poses the problems of renal function impairment and allergy to the contrast medium. In fact, in the present 33 cases, 6 patients had severe renal insufficiency (estimated glomerular filtration rate < 30 mL/minute/1.73m²) and 1 patient had allergy to the contrast medium. Furthermore, the use of a contrast medium may induce venous vasoconstriction. The incidence of severe venous vasospasm in contrast-guided axillary vein puncture was reported to be 8.1%.  

In the so-called double-target method, a clip is placed such that it overlaps with the distal tip of a pigtail catheter under fluoroscopy. This method is relatively easy to perform, does not require the use of a contrast medium, and is effective. With this method, we thought a clip was unnecessary, and we therefore used a pigtail catheter and the first rib as a marker for subclavian vein puncture. No complications occurred because the rib prevented the needle tip from entering the pleural cavity. However, the use of a guidewire, sheath, and pigtail catheter is often a target of health insurance assessments.

We then attempted the method in which only a J-type guidewire was used. Because a pigtail catheter and a sheath are not required, this technique also has an advantage with regard to the cost. Even after making a change to the procedure—using only the J-type guidewire instead of a pigtail catheter—we were able to perform venipuncture easily and safely, similar to when a pigtail catheter was used.

The subclavian venipuncture under ultrasound (US) guidance is another attractive method, which does not require the use of a contrast medium. With the US and Doppler images, the subclavian vein was clearly visualized and identified. Furthermore, the depth of a vein, change of an inside diameter, and spatial relationship with an artery or the lung can also be determined, and damage to an artery or a lung can be avoided. Moreover, observation of the US image enables determination of the course of an unsuccessful venipuncture. However, by this method, the patency of the venous route to the right atrium cannot be determined before preparation of the pacemaker pocket. Orihashi, et al performed US-guided venipuncture after skin incision and preparation of a subpectoralis fascial pocket. Therefore, if the subclavian/axillar vein was occluded, re-creation of the pacemaker pocket might be required. In addition, even if the patency of the axillary vein was confirmed ultrasonographically, there were cases with an occluded brachiocephalic vein. We experienced a case wherein we could not advance the guidewire into the right atrium, and confirmed the occlusion of the brachiocephalic vein by venography and the flow of the contrast medium into the right atrium by collateral circulation (Figure 5). Although venography is required to prove the veno-occlusion when the guidewire cannot be advanced to the right atrium, there is no necessity for a venography in a large majority of cases without veno-occlusion with the method using the J-type guidewire.

In addition, transvenous introduction of the lead to the right ventricle through the persistent left superior vena cava (PLSVC) is a technically difficult procedure, although there was no patient with PLSVC in this series. The isolated PLSVC is often not recognized preoperatively. By using this method with a J-type guidewire, the patency of the venous route to the right atrium and the presence of PLSVC can be confirmed before creating a pacemaker pocket. Therefore, it is possible to perform a strategic change before pocket creation if venous obstruction or the presence of PLSVC is observed.

Conclusions: Insertion of pacemaker leads through extrathoracic subclavian venipuncture using only a J-type guidewire is a safe, technically easy, and economical method. Moreover, the method also has the additional value of making it possible to confirm the venous route to the right atrium before creating a pacemaker pocket.

### References

5. Calkins H, Ramza BM, Brinker J, et al. Prospective randomized comparison of the safety and effectiveness of placement of endocardial pacemaker and defibrillator leads using the extrathoracic subclavian vein guided by contrast venography versus the cephalic