Benefits of lead delivery using a guidewire in pacemaker lead insertion

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Abstract

Pacemaker implantation is an established therapy for patients with sinus node disease or atrioventricular block. However, we sometimes encounter cases in which delivery of the leads is technically difficult. The buddy wire technique is known to be useful in delivering stents when difficulties are encountered due to vessel tortuosity or calcification during percutaneous coronary intervention. In this report, we present two successful cases of lead delivery using a guidewire when it was difficult to pass the pacing lead through the brachiocephalic vein due to an acute angle.

Keywords

Buddy wire technique; lead delivery; pacemaker.

Introduction

The first successful human cardiac pacemaker implantation in the United States was in 1960[1]. Permanent pacing is now an established therapy for patients with sinus node disease or atrioventricular block. However, we sometimes encounter cases in which delivery of the leads is technically difficult. The buddy wire technique is known to be useful for delivering stents when difficulties are encountered due to vessel tortuosity or calcification during percutaneous coronary intervention (PCI)[2]. In this report, we present two successful cases of lead delivery using a guidewire it was difficult to pass the pacing lead through the brachiocephalic vein due to an acute angle.

Case reports

Case 1

A 69-year-old man was admitted to the cardiovascular division with complete atrioventricular block. Permanent pacing was indicated under class IIa of the American College of Cardiology/
American Heart Association/Heart Rhythm Society (ACC/AHA/ HRS) 2008 guidelines[3], and implantation of a dual mode, dual chamber, dual sensing (DDD) pacemaker was planned.

The procedure commenced with venogram-guided extrathoracic left subclavian vein puncture, and a pocket was created for the generator under the left precordia. After a 7F sheath was inserted along the guidewire, we aimed to insert an active screw-in fixation ventricular lead (FinelineII, Model 4471, Boston Scientific/Guidant Inc., Natic, MA, USA) with a standard stylet manually modified into a J-shape into the right ventricle through a 7F sheath. However, we were unable to advance the lead through the junction of the left brachiocephalic vein and superior vena cava (SVC) due to an acute angle. The lead was removed from the sheath, and a guidewire was able to pass through the acute angle with no resistance. We tried a longer sheath (P190Z25TSM, Medikit Co., Ltd., Tokyo, Japan) instead, but were also unable to advance it past the same point.

The buddy wire technique is known to be useful in delivering stents when difficulties are encountered due to vessel tortuosity or calcification during PCI[2]. We applied this PCI technique to pacemaker implantation. The 7F sheath was switched to a 9F sheath (15 cm), capable of inserting both a guidewire and ventricular lead simultaneously. A hydrophilic guidewire (0.89 mm by 70 cm, Medikit Co., Ltd., Tokyo, Japan) was inserted into the sheath initially and passed into the SVC with no resistance. The ventricular lead, with a standard stylet manually modified into a J-shape, was inserted into the sheath alongside the guidewire and advanced through the SVC up to the main pulmonary artery. The ventricular lead was pulled back to the right ventricle into position at the right ventricular septum. After an active screw-in fixation atrial lead was positioned at the inter-atrial septum, a DDD pacemaker (Sensia, Medtronic Inc., Minneapolis, MN, USA) was implanted successfully using the standard technique.

Case 2

An 86-year-old woman was admitted to the cardiovascular division with symptomatic complete atrioventricular block. She had a history of pulmonary tuberculosis, having undergone right upper lobe thoracoplasty at the age of 30 years. Permanent pacing was indicated under class I of the ACC/AHA/ HRS 2008 guidelines[3], and implantation of an atrial synchronous ventricular inhibited pacemaker (VDD) was planned with consideration of her activity level, as she used a wheelchair. A right-sided implant was planned to circumvent pneumothorax of left healthy lung field, not as for case 1. The pacemaker implantation procedure was commenced with a venogram (Fig. 1) as for case 1. However, we were unable to advance the VDD lead through the junction of the right subclavian and brachiocephalic veins due to vessel tortuosity. We tried a longer sheath (P190Z25TSM, Medikit Co., Ltd., Tokyo, Japan), but were again unable to advance it past the same point. We also applied the buddy wire technique in this intractable case. We removed the lead from the 9F sheath, and a similar guidewire as case 1 was inserted into the 9F sheath. However, we were forced to switch the VDD lead over to a more slender one because we needed to insert both the guidewire and lead simultaneously into the 9F sheath. We were unable to avoid abandoning the original VDD lead, as a bigger sheath was not immediately available at that time. Another passive fixation ventricular lead (FinelineII, Model 4457, Boston Scientific/Guidant Inc., Natic, MA, USA) with a standard stylet was inserted into the sheath without the guidewire but

![Fig. 1. Venogram in case 2 (86-year-old woman) before commencing pacemaker implantation.](image-url)
could not be advanced past the same point again. Following the procedure, the lead was inserted into the sheath alongside the guidewire and was able to advance through the brachiocephalic vein. After lead sensing and pacing tests confirmed that conditions were stable at the right ventricular apex, a VVI pacemaker (Reply, Sorin Group Inc., Milan, Italy) was implanted successfully using the standard technique. Plain chest radiography (Fig. 2) and three-dimensional computed tomography (CT) scanning (Fig. 3) clearly visualized the lead running along the tortuous vessel after pacemaker implantation.

**Discussion**

The development of improved fixation mechanisms has dramatically reduced the incidence of lead dislodgement. However, even the excellent leads currently available are worthless unless the lead can be delivered to an appropriate position with suitable sensing and pacing conditions. Interventional cardiologists are well aware of the utility of the buddy wire technique when stent delivery is difficult due to vessel tortuosity and calcification during PCI\(^2\). A buddy wire, a second guidewire inserted alongside the working wire, aids in the delivery of balloons and stents through calcified and tortuous vessels. This useful technique is believed to straighten the tortuous vessel, assisting the delivery of balloons and stents. In cases of difficult delivery of stents and/or balloons, the buddy wire technique is often the optimum method, thereby avoiding unnecessary use of equipment and contrast agent and prolonged procedure times. This technique has helped us many times to perform successful PCI procedures. We applied this PCI technique to pacemaker implantation, and were able to deliver pacemaker leads successfully via both left-right accesses in two technically difficult cases. Although veins have different compliance and caliber compared with arteries, we believe that the guidewire inserted alongside the pacing lead has the same effect as straightening the tortuous vessel.

**Teaching points**

When difficulty is experienced passing the pacing lead through a vessel, switching to a longer sheath is believed to be effective. However, in both cases presented here we were unable to advance a 25 cm longer sheath through the vessel. In such cases, rather than forcing the lead through an acute angle in a vessel as in the longer sheath technique, we recommend that the buddy wire technique should be attempted. Three-dimensional CT clearly visualized the lead running along the tortuous vessel after pacemaker implantation. We have experienced only two successful cases with this procedure; it might not be favorable in another difficult case. Further experience with this technique will be required as we encounter appropriate cases in our clinical practice.
Fig. 3. Three-dimensional CT clearly visualizes the lead (light blue) running along the tortuous vessel in case 2 (86-year-old woman) after pacemaker implantation.

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**References**

