Case Report

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Injection of contrast medium through a delivery sheath reveals interventricular septal vascular injury in a case of left bundle branch pacing

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Abstract

A 70-year-old woman with symptomatic bradycardia caused by persistent atrial fibrillation and atrioventricular block was referred to our institution for pacemaker implantation. After we failed to obtain adequate His bundle capture thresholds (>2.5 V at 1.0 ms) at three pacing sites, left bundle branch pacing was attempted as an alternative technique. The tip of the 3830 lead was screwed towards the left side of the interventricular septum. Contrast medium was injected through the C315 sheath, which was placed close to the right side of the interventricular septum to determine the exact depth of the 3830 lead inside the septum. Unexpectedly, the vessels in the interventricular septum were revealed by the contrast, which showed that the lead had penetrated one of the septal vessels. To the best of our knowledge, this is the first reported case of a patient in whom injection of a contrast agent through a delivery sheath showed damage to the interventricular septal vessels. Findings from this case suggest that injection of contrast medium through a C315 sheath that is placed close to the interventricular septum is a potential method for excluding damage to interventricular septal vessels.

Keywords

Physiological pacing, left bundle branch pacing, lead implantation, atrial fibrillation, contrast medium, interventricular septum

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Introduction

His bundle pacing (HBP) has been long considered the most physiological pacing method. However, several factors limit wider adoption of HBP in routine clinical practice, such as operational difficulty with a relatively long fluoroscopic exposure time, and a high and unstable threshold.[1,2] As an alternative of HBP, left bundle branch pacing (LBBP) has been introduced recently.[3] Theoretically, LBBP has a potential risk of damaging the vessels inside the interventricular septum. We report a patient in whom LBBP was attempted and contrast medium was injected through a C315 sheath to reveal injury to interventricular septal vessels during deployment of leads.

Case presentation

A 70-year-old woman with symptomatic bradycardia caused by persistent atrial fibrillation (AF) and atrioventricular block was referred to our institution for pacemaker implantation. HBP was attempted because the patient needed permanent ventricular pacing. A delivery sheath (C315 His; Medtronic Inc., Minneapolis, MN, USA) was inserted via the left axillary vein into the His bundle region. The Select Secure™ (model 3830, 69 cm; Medtronic, Inc.) pacing lead was advanced through the sheath. After we failed to obtain adequate His bundle capture thresholds (>2.5 V at 1.0 ms) at three pacing sites, LBBP was attempted using the dual-lead technique.[4] The first Select Secure lead temporarily remained in the His bundle region as a marker. A second Select Secure lead was inserted and moved from the His bundle region towards the ventricular apex approximately 1 to 1.5 cm below the tricuspid valve, using fluoroscopic images under a right anterior oblique projection of 30°. The thickness of the interventricular septum was 10 mm on echocardiography. The paced QRS complex at the right side of the interventricular septum presented with a notched S wave in lead V1 (known as the "W pattern"). The tip of the 3830 lead was then screwed towards the left side of the interventricular septum under fluoroscopic monitoring under a left anterior oblique projection of 30°. Once the left bundle branch potential was recorded and the paced QRS morphology in V1 presented with a right bundle branch conduction delay pattern, advancement of the lead was stopped. Pacing at this site met the criteria of LBBP proposed in the literature,[4] with a pacing threshold of 0.9 V at 0.4 ms and impedance of 700 Ω.

Contrast medium was injected through the C315 sheath placed close to the right side of interventricular septum to determine the exact depth of the 3830 lead inside the septum. Unexpectedly, the vessels in the interventricular septum were revealed by the contrast (Figure 1), which showed that the lead had penetrated one of the septal vessels. This vessel rose from the mid-septum to high

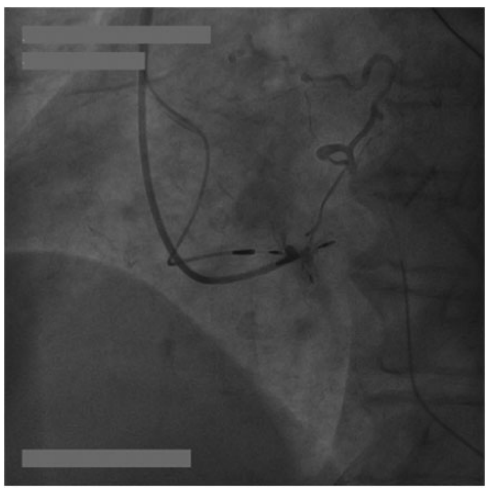

Figure 1. Fluoroscopic image in a left anterior oblique projection of 30° with the first attempt of left bundle branch pacing. The interventricular septal vessels are shown by injection of contrast medium through a C315 sheath that was placed close to the interventricular septum.

septum, and then turned to the atrial side. We decided to withdraw the lead because of the potential risk for hematoma in the interventricular septum in this patient with AF who was on oral anticoagulant therapy, as well as owing to the fact that hematoma formation near the tip of the lead would result in an increase in pacing thresholds. Unscrewing and withdrawing the tip of the lead proved unusually difficult. After several attempts, the lead was finally withdrawn. We found that the helix at the tip of the lead was distorted and the lead was subsequently abandoned. We successfully withdrew the first 3830 lead.

LBBP was then attempted at a different site. Finally, the lead was successfully implanted. Injecting contrast agent through the C315 sheath showed that the lead in the septum did not damage any interventricular septal vessels (Figure 2). Pacing at this site also met the criteria of LBBP proposed in the literature,[4] with a pacing threshold of 0.8 V at 0.4 ms, R-wave sensing amplitude of 12.7 mV, and impedance of 613 Ω. An additional right ventricular lead was placed at the right ventricular apex for backup pacing. A dual-chamber rate-responsive pacemaker was implanted with the LBBP lead in the atrial port and the right ventricular lead in the ventricular port. No complications, such as chest pain, thrombosis, or an abnormal increase in the pacing threshold, were observed during the intraprocedural period, peri-procedural period, and follow-up of 3 months.

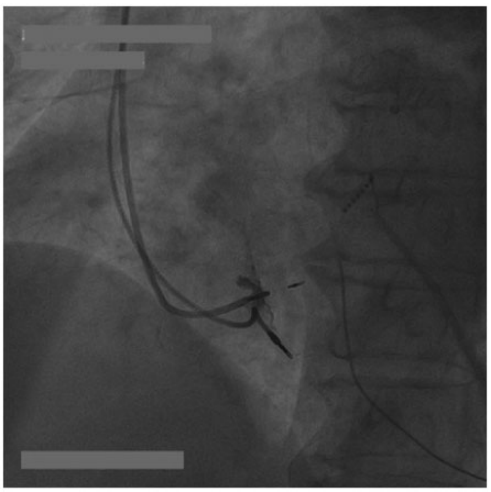

Figure 2. Fluoroscopic image in a left anterior oblique projection of 30° with left bundle branch pacing at a different site. Injection of contrast medium through a C315 sheath shows the depth of the lead in the interventricular septum.

The study protocol was approved by Beijing Chao-Yang Hospital's ethics review committee. The patient provided verbal informed consent for publication.

Discussion

Capturing the left bundle branch during LBBP typically requires that the tip of the pacing lead to be anchored deeply into the interventricular septum. Theoretically, this maneuver is associated with a potential risk for injury to the interventricular septal vessels. To the best of our knowledge, this is the first reported case of a patient in whom injection of contrast medium through a delivery sheath revealed damage to the interventricular septal vessels.

Coronary angiography and venography can be used to exclude damaging interventricular septal vessels. However, routine use of these imaging modalities can complicate the procedure and increase duration and costs. Findings in our case suggest that injection of contrast medium through a C315 sheath that is placed close to the interventricular septum is a potential method for excluding damage to interventricular septal vessels. However, the delivery sheath could lead to myocardial injury if it is too close to septum. In such a case, the contrast may enter the perforated vessel directly, which is another potential explanation of our observation by contrast medium.

Once interventricular septal vessel damage is detected, the lead should be withdrawn and implanted at another site. This should be

performed to reduce the risk for complications, such as hematoma of the interventricular septum and unstable pacing parameters, especially in patients on continuous oral anticoagulant therapy.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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