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Case Report

# Insertion of an active fixation lead in the inferior interatrial septum via a 9.0 Fr guiding catheter

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ABSTRACT

Placing an atrial lead in the inferior interatrial septum (IAS) reportedly reduces the incidence of paroxysmal atrial fibrillation (AF) and slows the progression to chronic AF; however, in certain cases, inferior IAS pacing is technically difficult. When this procedure is unsuccessful, insertion of the lead in the right atrial appendage can be considered, but it is associated with a risk of cardiac perforation. Here, we describe a technique for lead insertion in the inferior IAS via a 9.0 Fr guiding catheter, which may serve as an alternative technique for inferior IAS pacing when the conventional stylet-guided insertion is not successful.



## 1. Introduction

Compared to the traditional right atrial appendage (RAA) pacing, inferior interatrial septum (IAS) pacing around the coronary sinus ostium significantly reduces paroxysmal atrial fibrillation (AF) burden and recurrence and slows the progression to chronic AF [1–5]. Previous studies reported that inferior IAS pacing produces synchronous bi-atrial excitation resulting in shorter P-wave durations and reduces unnecessary right ventricular (RV) pacing by shortening the atrioventricular conduction time during atrial pacing [6–9]. Both the outcomes have a positive impact with regard to AF prevention. Moreover, IAS pacing has a potential benefit in patients who have undergone cardiac resynchronization therapy (CRT) by resynchronizing both atria and maintaining an appropriate balance of atrioventricular and left ventricular (LV) synchrony [10,11].

However, in certain cases, the insertion of an active fixation lead in the inferior IAS is difficult and time-consuming. Although a few useful devices and techniques have been introduced [12–14], positioning of the atrial lead around the inferior IAS can be challenging.

In the present report, we describe a novel technique for inserting a lead at this site using a 9.0 Fr guiding catheter (GC).

## 2. Case report

A 68-year-old man presented to our hospital with sustained ventricular tachycardia (VT) that was complicated with congestive heart failure (CHF). He had experienced a broad anteroseptal myocardial infarction at the age of 56 years; at that time, five bare metal stents were implanted in his left coronary artery. Subsequently, he experienced symptoms of CHF (New York Heart Association [NYHA] functional classification class III) despite undergoing optimal medical therapy, including 5 mg of carvedilol and 5 mg of enalapril. Immediately after admission, the sustained VT spontaneously terminated. The patient was orally administered 200 mg of amiodarone, which effectively suppressed the recurrence of sustained VT. Echocardiographic examination indicated the presence of LV dilatation with generalized severe hypokinesia. The LV end-diastolic dimension and LV ejection fraction were 68 mm and 27%, respectively. No significant valvular deficiency was observed. An electrocardiogram showed a regular sinus rhythm with a complete right bundle-branch block with right axis deviation. QRS and PQ widths were prolonged to 200 ms and 260 ms, respectively. For the purpose of secondary prevention, we recommended the implantation of an implantable cardiac defibrillator. However, since a high percentage of RV pacing is believed to be

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unavoidable due to the first-degree atrioventricular block, we eventually decided to implant a CRT device with defibrillator (CRT-D) after informed consent was obtained from the patient.

The patient's height was 155.0 cm and weight was 57.5 kg. A 5-cm-wide skin incision was made, along the Langer's cleavage line of the cutis at the left subclavian space, 3 cm caudal to the left clavicle and 1.5 cm medial to the left pectodeltoid sulcus. Three 9.0 Fr × 15 cm sheaths (Medikit Co., Tokyo, Japan) were smoothly introduced from the left subclavian vein after extrathoracic punctures were made. An 8.6 Fr × 65 cm shock lead (Sprint Quattro™; Medtronic Inc., MN, USA) was inserted in the RV apex using the standard method. We used a 6.0 Fr × 60 cm bipolar atrial fixation straight lead (Siello S™ 60; BIOTRONIK SE & Co., Berlin, Germany) for inferior IAS pacing. After several unsuccessful attempts to insert the lead in the inferior IAS by the standard method involving manually bent stylets, as described by Acosta et al. [14], we used a 9.0 Fr (7.2 Fr inner) × 45 cm GC (Attain Command™ 6250-MPR; Medtronic), because its shape appeared to be suitable for manipulation around the inferior IAS (Fig. 1). After a 0.035-in. × 220-cm hydrophilic J-wire (DRAGON™; Goodman Co., Nagoya, Japan) was inserted in the RV apex, the GC was delivered into the right atrium (RA). After pulling back the J-wire, the GC tip was directed toward the IAS with gentle counter-clockwise torque, and it was easily placed at the inferior IAS, in an upper and dorsal location to the coronary sinus ostium. The placement was confirmed by both the right and left anterior oblique views (Fig. 2). An active fixation RA lead with an inner straight stylet was then inserted into the GC without any torque manipulation. It proceeded into the GC without any resistance (Fig. 3a) and attached to the inferior IAS at the tip of the GC (Fig. 3b). A screw-in maneuver was easily performed using the right index finger. We did not need to provide any counter-clockwise torque to the lead and stylet during the fixation maneuver (Fig. 4). The protrusion of the screw from the tip of the GC was smooth and was clearly visible (Fig. 3c). The firm fixation of the lead was confirmed by proximally pulling back the GC (Fig. 3d). Subsequently, the GC was peeled away. A 6.2 Fr × 88 cm over-the-wire LV epicardial lead (Attain OTW™ 4194; Medtronic) was delivered into the lateral branch of the posterolateral coronary vein using the standard method involving a 9.0 Fr × 50 cm (7.2 Fr inner) GC (Attain Command™ 6250-EH; Medtronic). A CRT-D (Protecta XT™ CRT-D; Medtronic) was then implanted. Far-field R-wave sensing was not observed. The P-wave duration in the lead II was shortened from 118 to 84 ms. The total operation time was 98 min. The patient's post-operative course was uneventful. One week after the procedure, the patient underwent trans-thoracic echocardiography-based optimization. Ten days after the procedure, he was discharged and his symptoms had improved (NYHA class II).

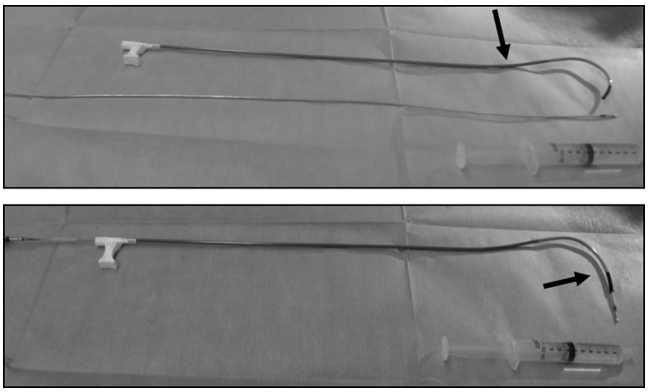

**Fig. 1.** Image of a 9.0 Fr × 45 cm guiding catheter and a 6.0 Fr × 60 cm active fixation bipolar straight lead. The guiding catheter (GC) was dorsally bent (arrow in the upper panel) with a very short tip and an acute tip angle. The curved tip was very soft, and therefore, it was stretched as a result of the lead inserted in the GC in vitro (arrow in the lower panel).

## 3. Discussion

In the present report, we describe a technique for the insertion of a 6.0 Fr active fixation atrial lead in the inferior IAS using a 9.0 Fr GC. Previous studies have indicated that inferior IAS pacing significantly reduces paroxysmal AF burden and recurrence and slows the progression to chronic AF [1–5]. Moreover, compared to a tined lead, an active fixation lead is easier and safer to remove, when required. However, in certain cases, the insertion of an active fixation lead in the inferior IAS can be technically difficult and time-consuming, which may negatively impact its application in daily practice. De Voogt et al. recommended the use of a deflectable stylet (Locator™; St. Jude Medical Inc., St. Paul, MN) for screwing into the inferior IAS [12]. However, in our experience, during lead insertion into the inferior IAS, the deflectable curve remains very large in Japanese patients, and therefore, we routinely avoid using this procedure, as in the present case. Acosta et al. introduced a modified J-form stylet method [14]. However, of the first 36 patients who underwent this technique, immediate lead dislodgement was observed in six cases (16.7%), indicating that the procedure is particularly difficult to perform during the learning curve phase. To maintain the optimal position of the tip of the lead in the inferior IAS, both of these stylet-guided techniques require continuous counter-clockwise torque at the proximal tab of the stylet while maintaining the appropriate push pressure during fixation. However, this technique makes the subsequent screw-in maneuver with a pinch-on tool somewhat difficult and awkward. Moreover, fine adjustment of the tip location is also difficult. Thus, when we encounter difficulties, we have few choices except an alternative technique involving the insertion of a lead into the RAA despite the fact that this procedure does not have the merits of IAS pacing and it is potentially associated with subsequent cardiac perforation when compared with primary tined RA lead selection.

The inferior IAS has a smooth-walled surface with irregularities formed by several important landmarks, including the coronary sinus ostium, Thebesian valve, sinus septum, Todaro tendon, Eustachian ridge, and infero-anterior rim of the oval fossa. Their alignment reflects the complex embryological development of this area, which is primarily derived from the primary atrial septum and vestibular spine, and is surrounded by sinus venosus posteriorly and inferior endocardial cushion anteriorly [15,16]. In addition, there are individual variations in the leaning angle of IAS, and the size and rotation of the RA. We believe that this anatomical complexity and variation around the inferior IAS is another factor contributing to the procedural difficulties.

GC-guided fixation has several merits compared with conventional stylet-guided fixation. First, it does not require counter-clockwise torque both at the lead and the proximal tab of the stylet. Therefore, the screw-in maneuver is simple and smooth, and both the hands are free as no torque maintenance is required (Fig. 4). Second, it is not necessary to bend the stylet, and therefore, it is quite easy to transmit the proximal screw-in torque to the tip screw. Generally, in Japanese patients, a smaller and more acute curve for the stylet is required, as compared to the method proposed by Acosta et al. to deliver the lead to the optimal position around the inferior IAS. This prevents the transmission of the proximal screw-in torque to the tip screw with a one-to-one response. In certain cases, a few dozen repetitions of torque manipulation were required before the screw protruded from the outer lead. Third, firm fixation of the screw in the inferior IAS can be easily confirmed. A stylet-guided bare lead insertion has intrinsically poor back-up support. Occasionally, during the screw-in maneuver, the tip slips and becomes dislodged. However, due to the support provided by the GC, easy slipping of the lead against the smooth IAS surface is prevented, and it is not pushed back during the screw-in maneuver. As shown in Fig. 3c and d, screwing into the inferior IAS and firm fixation were clearly confirmed

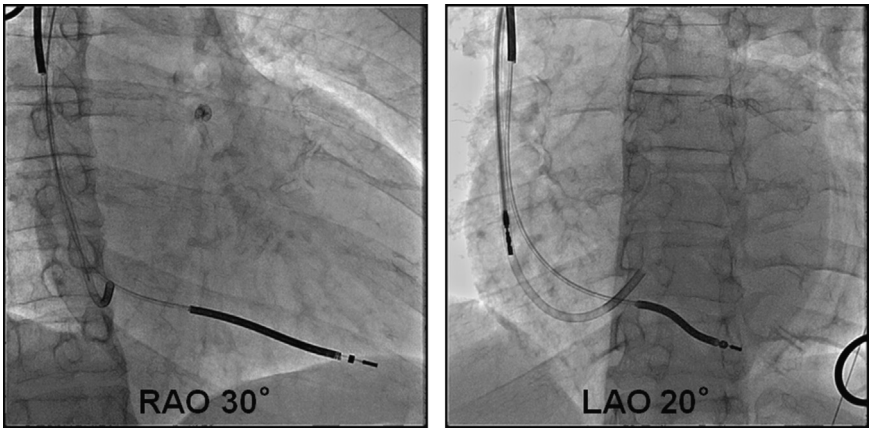


**Fig. 2.** Position of the guiding catheter before lead insertion. RAO, right anterior oblique; LAO, left anterior oblique.

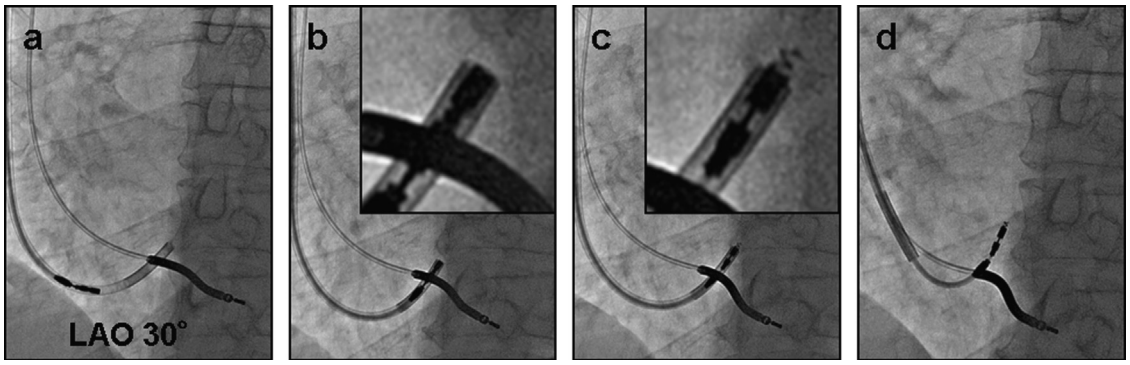


**Fig. 3.** Active fixation procedure. The GC was fixed in the IAS, which was confirmed in both the RAO and LAO views. The lead proceeded in the GC (a). The curved tip of the GC was not stretched in vivo because the tip of the GC was fixed in the inferior IAS. The protrusion of the screw from the tip of the GC attached to the IAS was clearly noted (b and c). Optimal fixation was easily confirmed by pulling back the GC (d). GC, guiding catheter; IAS, inferior interatrial septum; RAO, right anterior oblique; LAO, left anterior oblique.

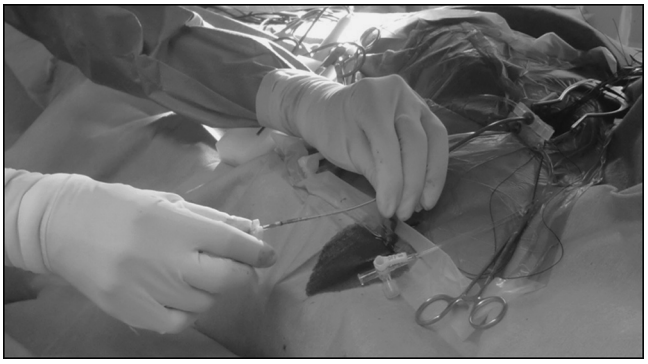

**Fig. 4.** Hand position during the fixation maneuver (view from the patient's left cranial side). It was not necessary to maintain counter-clockwise torque at the proximal tab of the stylet.

fluoroscopically by the protrusion of the screw from the tip of the GC, which attaches to the IAS. Finally, fine adjustment of the insertion location is easy because of the better intrinsic torque transmission and local fixation of the 9.0 Fr GC compared to those associated with the use of a stylet-guided bare lead.

There are several limitations to the procedure described herein. The present GC was developed for engaging the coronary sinus via a right-sided approach. However, this GC was bent dorsally and had the shortest tip and most acute tip angle among the Attain™ family, which facilitated its placement into the inferior IAS via a left-sided approach. Because the size and rotation of the heart is individual and variable, several combinations with various shapes, lengths, and Fr sizes may be required. At present, a recently developed active fixation lead (CapSureFix MRI™ 5086; Medtronic) with magnetic resonance imaging (MRI) capability is too thick (7.0 Fr) to insert in the current 9.0 Fr (7.2 Fr inner) system. However, the technique described herein will become an attractive option when a much thinner active fixation lead with MRI capability is developed. Although the tip of the present GC is sufficiently soft and safely facilitates bare manipulation in the right heart, careful and gentle manipulation was required to avoid mechanical injury inside the RA. Detailed three-dimensional anatomical knowledge combined with fluoroscopic biplane cardiac imaging is believed to be essential for such procedures. To avoid any complications, this technique should not be applied to sites other than the IAS. The SelectSecure™ system involves the use of a lumenless deflectable GC-delivered bipolar lead [13]; however, the deflectable GC curve is too large for IAS selection, and its tip is much harder compared with the GC used in the present case. Since a significantly high rate of complications was reported in domestic initial clinical experience with the above-mentioned system, it is not routinely used in Japan.

In conclusion, we describe a technique for lead insertion in the inferior IAS using 9.0 Fr GC. In cases where conventional stylet-guided lead insertion has failed, this technique should be considered as an alternative option for inferior IAS pacing before considering RAA insertion.

## Conflict of interest

All authors have no conflicts of interest to declare.

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