

EP CASE REPORT

Percutaneous transhepatic route for cardiac resynchronization therapy in a patient with superior vena cava occlusion

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A 72-year-old male patient was admitted to our hospital with heart failure. A DDD pacemaker had been implanted 9 years earlier due to sick sinus syndrome. Diagnosis showed that he had dilated cardiomyopathy, atrial fibrillation, left bundle branch block (LBBB), and New York Heart Association (NYHA) Class IV heart failure. Echocardiography showed the diameter of the left ventricle to be 66 mm and the left ventricular ejection fraction (LVEF) to be 22%. He had indications for both cardiac resynchronization therapy (CRT) and implantable cardioverter-defibrillator (ICD), namely CRT-D. Unfortunately, both the left and right subclavian veins were occluded. The superior vena cava was also occluded with collateral circulation. CRT-D implantation via superior vena cava route was inaccessible (Panels A and B).

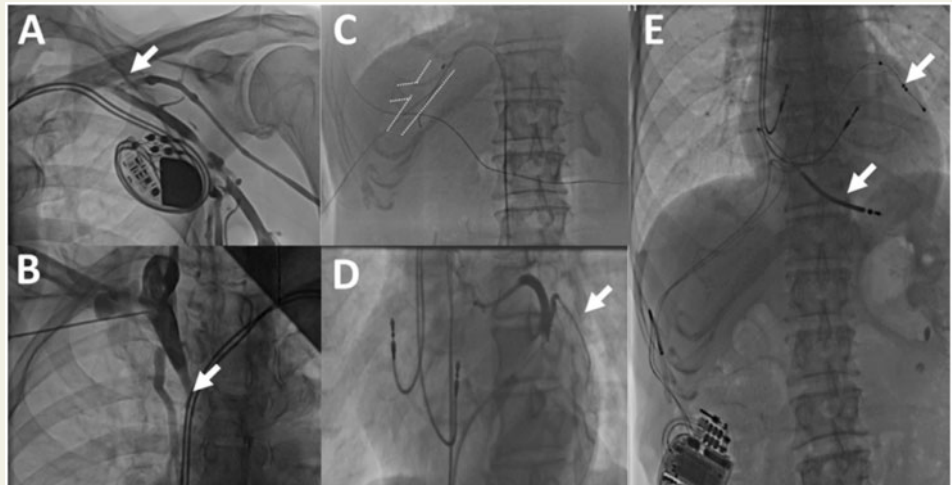


Figure 1 (A) Left subclavian vein occlusion. (B) Superior vena cava occlusion with collateral circulation formed. Right subclavian vein occlusion. (C) Percutaneous hepatic vein puncture (22 G, 15 cm percutaneous access set, Cook Medical). (D) Coronary sinus venography. (E) CRT-D pulse generator located on the right upper abdomen. Left ventricular electrode located in the coronary sinus left ventricular posterior-lateral vein. Right ventricular defibrillation electrode located at the right ventricle apex.

The superior vena cava was also occluded with collateral circulation. CRT-D implantation via superior vena cava route was inaccessible (Panels A and B).

In previous cases, we had performed successful VVI-ICD and DDD pacemaker implantation via the transhepatic route.^{1,2} Here, we decided to try the transhepatic route for CRT-D implantation. An angiography of the hepatic vein was performed via inferior vena cava (IVC). Then both the 6-Fr angiographic catheter and another 6-Fr bipolar pacing electrode were placed in the target vein chosen for lead access (Panel C). The purpose of this was to facilitate real-time display of the width of the hepatic vein even during respiratory movement. Percutaneous hepatic vein puncture was successfully performed under the real-time guidance of the catheter as described above. One guide wire was advanced into the right atrium via the hepatic vein and IVC. Along the guide wire, an 8-Fr peel-away sheath entered the hepatic vein. The second guide wire was advanced into the right atrium via this 8-Fr sheath. A 9-Fr peel-away sheath was introduced into the hepatic vein by the second guiding wire. The left ventricular electrode delivery system was introduced through 8-Fr sheath (sheath in sheath technique). We successfully performed coronary sinus venography and coronary sinus imaging using the left ventricular electrode delivery system (Panel D). A left ventricular pacing electrode was successfully implanted through an 8-Fr sheath and left ventricular electrode delivery system. The left ventricular electrode was located in the coronary sinus left ventricular posterior-lateral vein. The right ventricular defibrillation electrode was implanted through the 9-Fr sheath, and the distal end of the defibrillation electrode was located at the apex of the

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right ventricle. All leads were curved in the right atrium to prevent them from going taut. The CRT-D pulse generator was located on the right upper abdomen (*Panel E*). Before CRT-D implantation, the electrocardiogram QRS wave presented LBBB, indicating only right ventricular pacing. After CRT-D implantation, QRS electrocardiography presented right bundle branch block. This indicated that the left ventricular electrode was working well. At 2 months follow-up, the patient showed normal biventricular pacing, an increase in LVEF to 34%, and an increase in heart function to NYHA III.

To our knowledge, this could be the first report of CRT-D implantation via the transhepatic route. This case suggests that the transhepatic route can be taken into consideration if the superior vena cava is inaccessible due to subclavian occlusion or post-Glenn operation.

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