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A 128-slice CT scanner helpful in localising coronary sinus ostium during CRT-D implantation – case report

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Summary

Background:

Cardiac resynchronization therapy (CRT) has become a successful treatment option for symptomatic heart failure in patients with poor left ventricular (LV) systolic function and broad QRS complex in the surface electrocardiogram (ECG).

Case Report:

In this report we present a case of a 70-year-old woman with advanced heart failure due to ischaemic heart disease who underwent an upgrade from VVIR stimulator (pacemaker, PM) to cardiac resynchronization therapy defibrillator (CRT-D). The first attempt was unsuccessful due to problems with inefficient cannulation of the orifice of the coronary sinus (CS). After performing a 3D reconstruction with a 128-slice CT scanner, it was possible to carry out the up-grade to CRT-D resulting in enormous clinical improvement.

Conclusions:

The case represents an example of the usefulness of 3D reconstruction with the 128-slice CT scanner used after failed CRT-D implantation due to difficulties with efficient cannulation of the coronary sinus orifice in a rare anatomical variant.

MeSH Keywords:

cardiac resynchronization therapy • cardioverter-defibrillator (CRT-D) • 128-slice CT scanner • coronary sinus

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Background

The cardiac resynchronization therapy (CRT) was introduced in 1994 by Cazeau as a treatment of advanced heart failure [1]. Nowadays CRT has become a successful treatment option for symptomatic heart failure with poor left ventricular (LV) systolic function and broad QRS complex in the surface ECG [2]. Typically, implantation of CRT requires retrograde lead insertion into the coronary sinus with advancing it into the venous tributary overlying the LV free wall.

However, in our daily practice we still encounter clinical situations in which the procedure appears to be a big challenge.

Case Report

A 70-year-old woman with chronic ischemic heart diseases (Coronary Artery Bypass Grafting – 1993) and systemic

hypertension underwent a VVIR pacemaker implantation in 2005 due to chronic atrial fibrillation and symptomatic bradycardia of 27 bpm (Medtronic Sigma SSR303, electrode Medtronic 5092-58 cm). After 5 years of follow-up, the LV ejection fraction decreased dramatically from an initial rate of 50% to 30%, the left ventricular end-diastolic diameter increased, as did the left atrial dimension. Because of unfavorable echocardiographic changes, deterioration of clinical symptoms (NYHA II/III) and increased percentage of right ventricular pacing (>90%), she was scheduled for the upgrade to CRT-D. In April 2010, an attempt of CRT-D implantation proved unsuccessful. We were unable to efficiently cannulate the orifice of the coronary sinus in order to introduce the LV electrode. The pacemaker was replaced with ICD-VR (Medtronic Maximo II VR D284VRC, Medtronic Sprint Quattro 6947-65 cm). The pacemaker electrode was cut, secured with a silicon cup and left in place. The total time of fluoroscopy/procedure was 40 min 15 s/140 min.

Figure 1. CT examination of the thorax, VRT reconstruction. Coronary sinus (*). Artifacts from ICD/PM electrodes (white arrow).

Figure 2. CT examination of the thorax, axial scan. Atypical course of the coronary sinus (*).

It was decided to perform a 128-slice CT scan and carry out a 3D reconstruction of the CS and branches of the heart. After obtaining the scan and performing the 3D reconstruction, it turned out that the course of the last few centimeters of the CS, just before entering the right atrium, was quite unexpected (Figures 1 and 2). The last section of the CS, instead of approaching the observer in RAO 30° view, spreads in the direction of the area between the vertebral column and the sternum (angle difference of approximately 80°). It was decided to try the second attempt. In September 2010 we performed a successful CRT-D implantation (Medtronic Maximo II CRT-D, Medtronic Attain Ability 4196-88 cm). During the procedure we asked for help a college from the Hemodynamic Laboratory to observe the venous phase of the coronary angiogram without a clear evidence of the orifice of the CS. The total time of fluoroscopy/procedure was 74 min 47 s/240 min.

Figure 3. Fluoroscopy. RAO 30°. Final position of the CRT-D system with atypical course of the distal part of the LV electrode within the CS.

Figure 4. PA radiogram. Final position of the CRT-D system with atypical course of the distal part of the LV electrode within the CS.

The final effect of CRT-D implantation can be observed on Figures 3 and 4.

Discussion

In the early days of CRT implantations, the success rates were as low as approximately 55–60%. After implementing the experiences from coronary angioplasty techniques, the rates surged to about 90%. The failure of the method during the initial attempts is reported in about 10% of procedures and the most often reason of the failure is the impossibility to penetrate or to advance into the orifice of the coronary sinus in about 5% of implantations [3]. The insertion of the lead into the coronary sinus can be hindered mainly by the Thebesian valve, present in 75% of patients, but other rare anatomical variants of the coronary sinus are possible as well. Knowledge of cardiac venous anatomy may facilitate the procedure.

Multi-slice computed tomography (MSCT) has become an important tool for noninvasive evaluation of cardiovascular structures and visualisation of the venous anatomy [4–6].

Conclusions

The case represents an exceptional example of the usefulness of 3D reconstruction with the 128-slice CT scanner

after failed CRT-D implantation due to difficulties with efficient cannulation of the coronary sinus orifice in a rare anatomical variant. We reached a conclusion that during the first attempt of CRT-D implantation, the operator did not even try to direct the electrophysiological catheter in the previously mentioned direction in order to avoid a heart wall perforation.

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