Total epicardial biventricular pacing and defibrillation- A case report

Sandesh Prabhu, Daljeet Kaur Saggu, Sridevi Chennapragada, G. Rama Subramanyam, Sachin Yalagudri, Calambur Narasimhan

CARE Hospital, The Institute of Medical Sciences, Hyderabad, India

1. Introduction

Cardiac resynchronization therapy (CRT) restores physiologic pattern of ventricular depolarization, resulting in reduction of mitral regurgitation and improvement of left ventricular (LV) systolic function. Among patients with moderate-to-severe heart failure (HF) and intraventricular conduction delay, CRT has demonstrated reduction in morbidity and mortality [1–3].

2. Case

A 66 year old lady with history of hypertension, diabetes presented with advanced HF. She was diagnosed to have carcinoma breast in the year 2006 and had undergone lumpectomy followed by chemotherapy and radiotherapy. She presented with severe LV dysfunction with LV ejection fraction (LVEF) of 35% (NYHA IV) with left bundle branch block (LBBB). Despite optimal medical therapy she was admitted twice for acute decompensated HF over one year period. Patient had diffuse lymphedema of right upper limb. In view of previous radiotherapy and lymphedema of right upper limb, left subclavian venogram was performed which revealed long segment occlusion of left subclavian vein. Attempts at percutaneous recanalization of the left subclavian vein was unsuccessful. As the patient had chronic lymphedema of the right upper limb and chronic left subclavian vein obstruction which was not amenable for recanalization, we planned a complete epicardial implantation.

3. Procedure

Procedure was performed under general anesthesia after written informed consent. Left anterolateral thoracotomy was performed along the fourth intercostal space under general anesthesia. Medtronic capsure epicardial lead (Medtronic 4968-60 cm LEN351043V, bipolar) was fixed at anterolateral wall of LV. Bipolar LV electrogram from the pacing lead was recorded at the terminal portion of QRS and pacing parameters were satisfactory. Right ventricular (RV) pace and sense lead (Medtronic 4968-60cm LEN357490, bipolar) was fixed at anterior wall of RV after confirming sensing and pacing parameters. Single coil active fixation defibrillator lead (Medtronic 6935-88cm TAU164270V, bipolar) was placed posterior to the LV via the transverse sinus. The tip of the lead was not screwed in, as the lead was properly secured in the narrow space behind the LV. The body of the lead was secured to the pericardium with prolene stitch on the sleeve. The atrial lead (Medtronic 4968-35 cm LEN359775V, bipolar) was fixed over left atrium (LA), after confirming sensing and pacing parameters. Leads were connected to pulse generator (PG) (Medtronic Protecta CRT-D, D364TRG). Pacemaker port of RV defibrillation lead was capped as separate RV pace sense lead was used for better sensing and pacing from RV (Fig. 1). This patient has completed 18 months of follow-up with adequate biventricular pacing (Fig. 2) and continues to be in NYHA class- II without any further admissions for heart failure.

4. Discussion

The technique of choice for left ventricular pacing in ventricular resynchronization is the insertion of a lead through the coronary sinus, into the posterolateral epicardial vein. In the MIRACLE study [5] the ventricular lead could not be implanted in 7.53% of patients, and early reimplantation and substitution was necessary in 3.78% and 1.8% of cases, respectively. In the MUSTIC study [4], the implantation technique failed in 8% of patients and there were 13.5% early displacements. Overall, the failure rate of left ventricular pacing via intravenous implantation ranges between 8% in the MIRACLE study and 12.5% in the MUSTIC study. At present, surgery is considered a salvage technique for patients in whom the
percutaneous procedure fails. Surgical approach to the LV for resynchronization can be carried out through small thoracotomy or with a minimally invasive technique via thoracoscopy. Intravenous and surgical lead implantation for resynchronization provides very similar acute and chronic pacing parameters. The presence of ischemic cardiomyopathy does not seem to influence the threshold obtained with epicardial pacing.

In our case, limited anterolateral thoracotomy was made as we had to implant all the leads surgically. Subclavian access was precluded from the right as the patient had significant lymphedema of right upper limb. Left subclavian access was not possible as left subclavian vein had a long segment chronic occlusion which could not be crossed. As the patient had undergone mastectomy and radiotherapy to the thoracic region, the subcutaneous defibrillator lead or array implantation was not considered. We used a bipolar screw-in lead for the LV epicardium. Active fixation single coil defibrillator lead was used for fixing the lead to the epicardial region. But, as the defibrillation lead was stuck behind the limited space of LV via the transverse sinus, there was no need to fix the screw (Fig. 1). Defibrillation lead on the posterior LV and the pulse generator on the left side of the anterior abdominal wall would provide a good defibrillating vector. However, we did not perform defibrillation threshold (DFT) on this patient as the patient was on ionotropes and was unstable during the procedure. We planned to perform DFT after stabilization. As reach to the right atrium was difficult via the minithoracotomy, the atrial lead was fixed on the left atrium.

Fig. 1. X-ray chest AP (A) and lateral (B) view showing the sites of all four leads implanted epicardially along with pulse generator on the left anterior abdominal wall.
1. Single coil defibrillator lead posterior to LV (Medtronic 6935).
2. Atrial lead on LA, (Medtronic 4968).
3. LV lead on anterolateral wall of LV (Medtronic 4968).
4. RV sense and pace lead (Medtronic 4968).
5. DF1 sense and pace port capped as separate pace and sense lead was secured to RV to ensure reliable sensing and pacing.
AP-Anteroposterior; LV-left ventricle; LA-left antrium; RV-right ventricle; DF1-defibrillator.

Fig. 2. A. Baseline ECG showing LBBB with QRS width 150 msec.
B. ECG after CRT-D implantation, QRS duration 90ms.
LBBB-left bundle branch block.

DF1-defibrillator.
5. Conclusion

The optimal pacing system implantation technique in the presence of limited venous access to the heart has not yet been defined. Our technique could be considered for patients with limited venous access to the heart who cannot have a typical transvenous biventricular pacing system.

Source of financial support

All Authors have none to declare.

References

[1] Abraham WT, Fisher WG, Smith AL, Delurgio DB, et al. Cardiac resynchronization in chronic heart failure. N Engl J Med 2002;346:1845–52.
[2] Cazeau S, Leclercq C, Lavergne T, et al. Effects of multisite biventricular pacing in patients with heart failure and intraventricular conduction delay. N Engl J Med 2001;344:873–80.
[3] Young JB, Abraham WT, Smith AL, et al. Combined cardiac resynchronization and implantable cardioversion defibrillation in advanced chronic heart failure. JAMA 2003;289:2685–94.
[4] Linde C, Leclercq C, Rex S, Garrigue S, Lavergne T, Cazeau S, et al. Long-term benefits of biventricular pacing in congestive heart failure: results from the MULTISITE STIMULATION in cardiomyopathy (MUSTIC) study. J Am Coll Cardiol 2002;40:111–8.
[5] St John Sutton MG, Flaggert T, Abraham WT, et al., Multicenter InSync Randomized Clinical Evaluation (MIRACLE) Study Group. Effect of cardiac resynchronization therapy on left ventricular size and function in chronic heart failure. Circulation 2003;107:1985–90.