C A S E   R E P O R T

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Transseptal approach to the implantation of cardiac resynchronization therapy

Transseptalni pristup implantacije resinhronizacione terapije srca

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Abstract

Introduction. In patients with cardiac resynchronization therapy left ventricular lead is usually placed through a tributary vein of the coronary sinus. However, when this approach failed, the atrial transseptal approach is mostly used for endovascular left ventricular lead placement, but it is quite difficult to perform. **Case report.** 59-years-old patient, male, was hospitalized due to endovascular left ventricular lead placement by atrial transseptal approach, after failed attempt via coronary sinus vein. Non-ischemic dilated cardiomiopathy was verified 1 year ago. Endoventricular lead was introduced by left subclavian approach and advanced through the previously punctured hole in the left atrium cavity and over mitral valve placed in posterolateral part of left ventricular. Both right ventricular defibrillator lead and atrial electrode were implanted routinely in the right ventricle septum and right atrial appendage. **Conclusion**. Left ventricular endocardial lead implantation by atrial transseptal approach is a feasible and safe in patients with previously failed implantation via tributary vein of the coronary sinus.

Key words:
cardiac resynchronization therapy; cardiac resynchronization therapy devices; treatment outcome.

Apstrakt

Uvod. Kod bolesnika sa resinhronizacionom terapijom srca elektroda za levu komoru se pretezno uvodi preko odgovarajuće grane koronarnog sinusa. Medjutim, u slučaju neuspeha, atrijalni transseptalni pristup je alternativa, ali je prilično zahtevan za izvodjenje. **Prikaz bolesnika.** Bolesnik star 59 godina, muškog pola, hospitalizovan je zbog implantacije srčane resinhronizacione terapije atrijalnim traneseptalnim pristupom zbog nemogućnosti uvodjenja elektrode preko grane koronarnog sinusa. Neishemijska dilatativna kardiomiopatija registrovana je unazad jednu godinu. Aktivno fiksirajuća elektroda je preko vene subklavije, interatrijalnog septuma odnosno mitralnog zaliska implantirana u posterolateralni deo leve komore. Defibrilatorska elektroda za desnu komoru, odnosno elektroda za desnu pretkomoru, su rutinski implantirane u septum desne komore, odnosno aurikulu desne pretkomore. **Zaključak.** Implantacija elektrode za levu komoru atrijalnim transseptalnim pristupom je izvodljiva i sigurna ukoliko se nije uspjelo preko grane koronarnog sinusa.

Ključne reči:
resinhronizaciona terapija srca; resinhronizaciona terapija srca, uređaji; lečenje, ishod.

Introduction

Left ventricular (LV) lead in patients with cardiac resynchronization therapy (CRT) is usually placed through a tributary vein of the coronary sinus (CS) [1]. However, this approach fails in approximately 10% of the cases, so surgical epicardial approach via lateral thoracotomy was used as the first choice [2–4].

In recent years, endocardial LV stimulation has been utilized as an alternative to epicardial approach via lateral thoracotomy due to increased risks, particularly in patients with advanced heart failure [5]. However, atrial transseptal approach is mostly used for endovascular LV lead placement, but it is quite difficult to perform.

We present our technique of LV lead implantation using atrial transseptal approach which is quite simple to perform.

Case report

A 59-years-old patient, male, was hospitalized due to endovascular LV lead placement by atrial transseptal approach, after failed attempt via coronary sinus vein (Figure 1).

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Fig. 1 – Stop the passage of contrast in the coronary sinus.

Non-ischemic dilated cardiomiopathy was verified 1 year ago. He has frequent palpitations during slight efforts accompanied by dyspnea, lightheadedness and syncope at a time. Electrocardiography (ECG) on admission showed sinus rhythm with left bundle branch block with QRS complex width of 180 msec (Figure 2). Echocardiography confirmed an enlarged left ventricle with strongly reduced ejection fraction (EF) of 20% as measured by Simpson method. The patient was categorized as the New York Heart Association (NYHA) functional class III.

After puncture of the right femoral vein were introduced both decapolar maping catheter, placed into the coronary sinus to facilitate the position of *fossa ovalis* and Brockenbrough (BRK) needle inserted via the steerable sheath and dilator was used for transseptal puncture (Figures 3 and 4). The sheath and dilator were withdrawn and exchanged with a tapered dilator. Then deflectable catheter sheath with a tapered dilator was withdrawn. Left subclavian vein was punctured and through the 7F inner lumen, flexible catheter sheath Medtronic 3630-69 active fixation endoventricular deflectable lead was introduced and advanced through the previously punctured hole in the left atrium cavity and over mitral valve implanted in posterolateral part of the left ventricle. Both active fixation right ventricular defibrillator

Fig. 2 – Electrocardiogram (ECG) showing the sinus rhythm with left bundle branch block with QRS complex width of 180 msec.

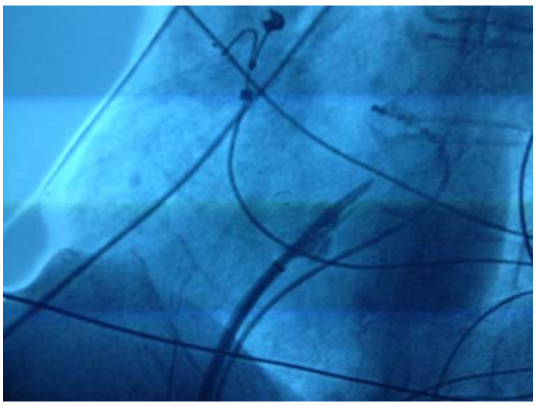

Fig. 3 – Transseptal puncture in left anterior oblique (LAO) view.

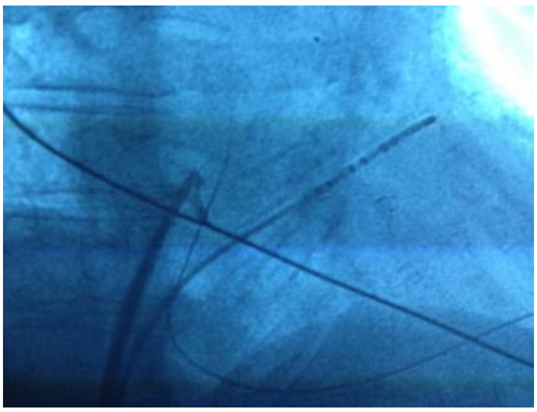

Fig. 4 – Transseptal puncture in right anterior oblique (RAO) view.

lead and non screw-in atrial electode were routinely implanted using also left subclavian approach in the right ventricle septum and right appendage (Figures 5 and 6). Optimal electronic parameters were obtained.

There were no other complications in the course of the procedure. After 1-year of follow- up patient improved NYHA functional class, sensing and capture threshold remained stable and ventricular pacing was more than 98%. ECG showed narrowing of QRS to 120 msec, LVEF was 40%, showing an excellent response to CRT-D (Figure 7).

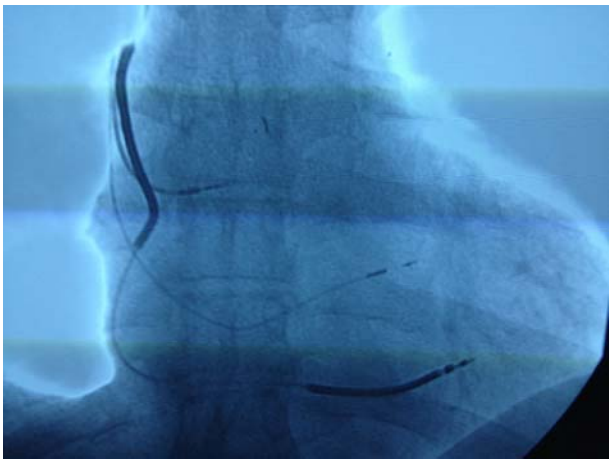

Fig. 5 – Lead position in posterior-anterior (PA) view.

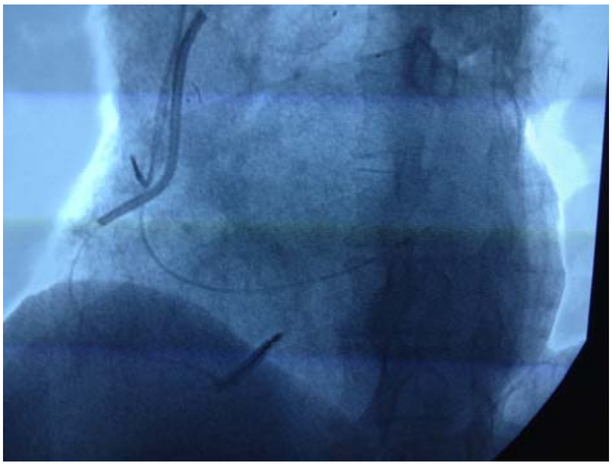

Fig. 6 – Lead position in left anterior oblique (LAO) view.

Discussion

In about 10% of patients, the LV lead cannot be implanted due to difficulties such as obstructing valves or coronary sinus dissection, tortuosities in the venous branches, phrenic nerve stimulation and areas of LV scar [1–4]. Suboptimal anatomical position of LV lead due to difficulties at the ideal site in 20–40% of CRT recipients may contribute to non-response [3, 6–8].

When a lead cannot be successfully delivered through the CS there are alternative routes.

Surgical placement of an epicardial lead can be performed, but it involves higher early morbidity and mortality as well as longer recovery period [5].

The atrial transseptal approach to LV endocardial pacing was initially described by Jaïs et al. [9]. Modifications of the technique have been developed over the past decade but it remains quite complex, with a combined atrial trasseptal puncture from the femoral vein with balloon dilatation of the septum as a prelude to the introduction of LV lead from the subclavian vein [10, 11]. At first, balloon dilatation of the septum carries the risk of splitting the septum as well as hematoma formation with possible surgical intervention to solve this problem. Further, EN Snarew system (Angiotech, Medical Device Technologies Inc., Gainesville, FL, USA) comprising loop shape mechanism necessary for grasping the distal part of the guide wire introduced in the left atrium over the transseptal sheath by femoral vein which is pulled into the superior vena cava and further, out of the subclavian vein [12, 13]. Steerable sheath is advanced over the guide wire and after withdrawal, the guide wire exchanged with electrode.

In our case we performed atrial transseptal punction by femoral vein using BRK 98 cm needle inserted via the steerable sheath and dilator with a pressure line attached to the proximal end of it. An additional curve was added by manually bending the needle. Atrial septum puncture was performed using alternating left anterior oblique (LAO) and right anterior oblique (RAO) fluoroscopic views. The dilator and sheath were then advanced 10–15 mm into the left atrium over the needle. The needle was withdrawn and a 0.032 inch stiff 260 cm J guidewire was advanced through the sheath and dilator in the chamber cavity. The sheath and dilator were withdrawn and exchanged over the stiff guidewire for 91cm deflectable 8.5F inner lumen catheter sheath with a tapered dilator (Agilis©; St Jude Medical Inc, Minessota, USA) passed over a guidewire into the left atrium and it was advan-

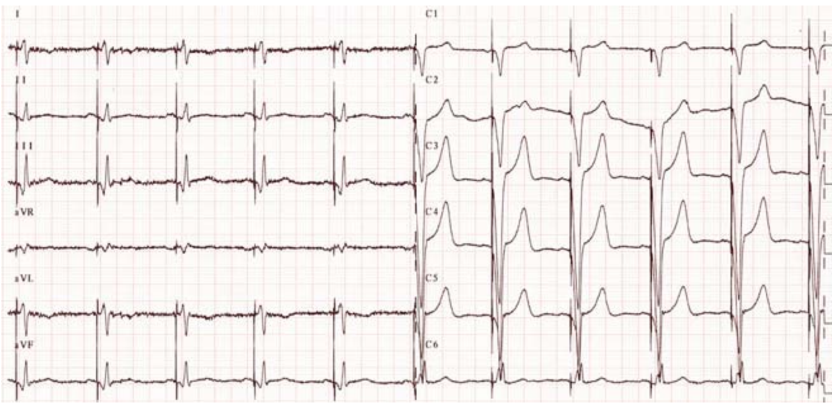

Fig. 7 – Electrocardiogram (ECG) showing biventricular pacing with narrowing of QRS to 120 msec.

ced and withdrawn over the interatrial septum three times to expand the hole of the interatrial septum and facilitate the introduction of the LV electrode. This maneuver is unique and useful to avoid balloon dilatation of the septum, not previously described in literature. Deflectable catheter sheath with a tapered dilator was withdrawn and Stiff J guidewire was left in the left atrium as a guide for the point of the puncture, which is also marked on the monitor by felt pen in both LAO and RAO position. Marked point is very simple but very useful guideline to the determination of the puncture hole. Introduction of Medtronic 3630-69 active fixation endoventricular deflectable lead was guided by described marked point in both LAO and RAO position which is greatly facilitated its introduction in the left atrium cavity and over mitral valve placement in posterolateral part of left ventricular. Movement of electrodes is easily enabled by turning of a rotating lever in a clockwise direction for introduction at left atrium and than in the opposite counterclockwise direction over the mitral valve. We also first described these maneuvers of lead introduction over the interatrial septum as well as mitral valve in the posterolateral part of left ventricule.

Direct puncture of the interventricular septum avoids manipulation across the mitral valve, potentially preventing worsening of mitral regurgitation and reducing the risk of mitral valve endocarditis [12, 13]. It is useful in patients with artificial mitral valve. Direct puncture interventricular septum directs the lead immediately towards the lateral LV, but left ventriculography in a right anterior oblique view is required to identify the LV borders [12, 13]. An angiogram of the left coronary arteries is also used in order to avoid the puncture of the major septal perforator vessel. The LV is a much larger cavity than the left atrium and has thicker muscle walls, potentially reducing the chance of inadvertent perforation and pericardial effusion, but this technique requires operator with experience and described additional procedures.

Conclusion

LV endocardial pacing through a ventricular septal puncture is a feasible and safe in patients with previously failed implantation via tributary vein of the coronary sinus. We present quite simple technique of LV lead implantation using atrial transseptal approach.

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