Successful Implantation of Transveneous Biventricular Permarnent Pacemaker for Refractory Congestive Heart Failure : The First Case-Report in Thailand

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Abstract

Biventricular pacemaker is a pacemaker that can pace both the right and left ventricle at the same time. There have been progression in the development of biventricular pacemaker from thoracotomy system to fully transveneous system. The benefit in improving quality of life in selected medical refractory congestive heartfailure patients of this device had been shown in randomized controlled trials. The authors reported successful implantation fully transveneous biventricular pacemaker in Thailand.

Key word : Biventricular Pacemaker, Refractory Congestive Heart Failure

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The biventricular pacemaker is a novel implantable device with the capability of pacing both right and left ventricles. The system was first implanted *via* thoracotomy and epicardial pacing[1,2]. Later fully transveneous permarnent biventricular pacemaker was reported[3]. Prospective controlled trials have shown the benefit of this treatment modality in advanced congestive heart failure with intraventricular conduction delay in improving quality of life and reduction in hospitalization[4-6]. Lately, a permanent biventricular pacemaker has been cooperated into the international cardiac pacemakers and antiarrhythmia devices guidelines for refractory class III-IV systolic congestive heart failure with intraventricular conduc-

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tion delay[7]. The authors report two patients with fully transveneous permanent biventricular pacemaker in Thailand.

CASE REPORTS

Case 1

The patient was a 75 year old female who presented with refractory congestive heart failure. Three years previously, the patient had symptoms of congestive heart failure, subsequent investigation showed no obstrucftive coronary artery and decreased ejection fraction of 30 per cent.

Her congestive heart failure had been getting worse gradually. She was eventually admitted to the hospital for class IV heart failure which was refractory to standard medical treatment. She stayed in the intensive care unit with periodic IV dobutamine for heart failure exacerbation. Repeated echocardiogram showed dilated left ventricle (7.2 cm) and decreased left ventricular systolic function with estimated left ventricular ejection fraction around 20 per cent. Her surface electrocardiogram showed normal sinus rhythm with left bundle branch block (QRS duradtion of 180 ms) (Fig. 1).

Transveneous biventricular permanent pacemaker was implanted after two months of hospitalization for heart failure. The implantation was done in the fasting state using local anesthesia. The left

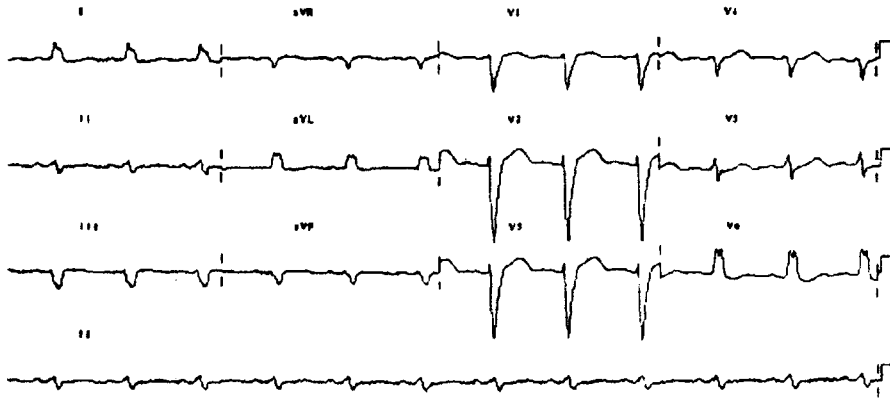

Fig. 1. Baseline electrocardiography before biventricular pacing showed normal sinus rhythm (NSR) with left bundle branch block (LBBB).

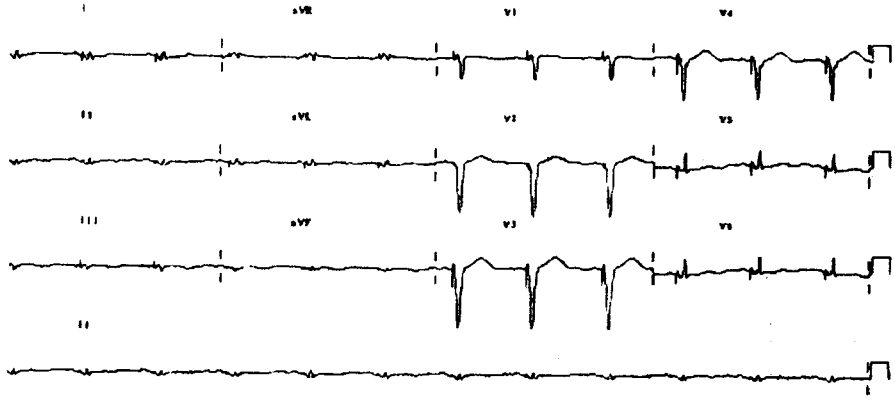

Fig. 2. Electrocardiography with biventricular pacing.

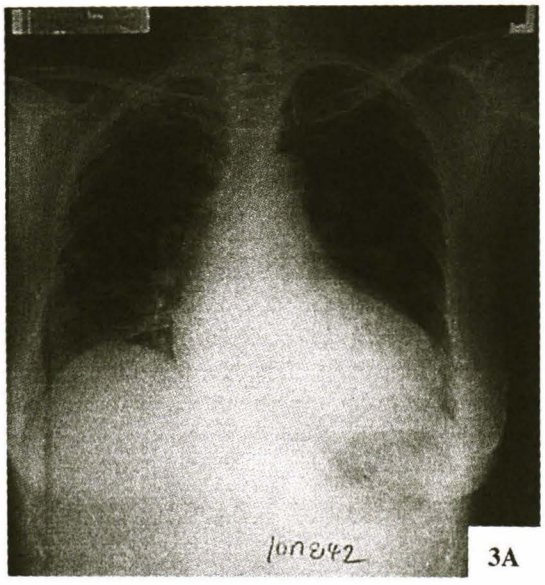

Fig. 3A. Chest X-ray 30 months before biventricular pacemaker.

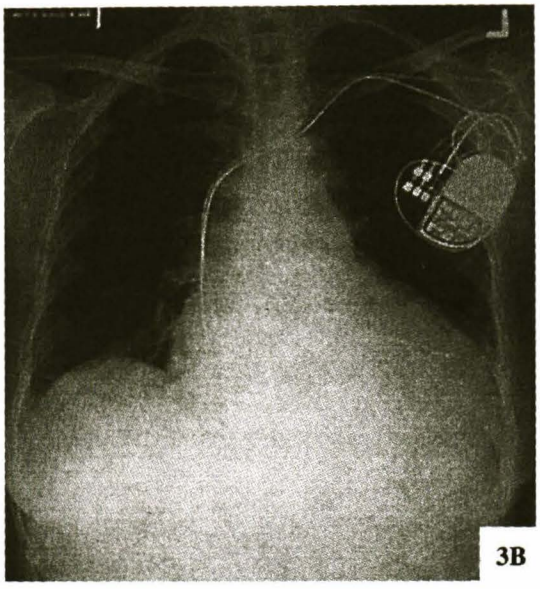

Fig. 3B. Chest X-ray at implantation.

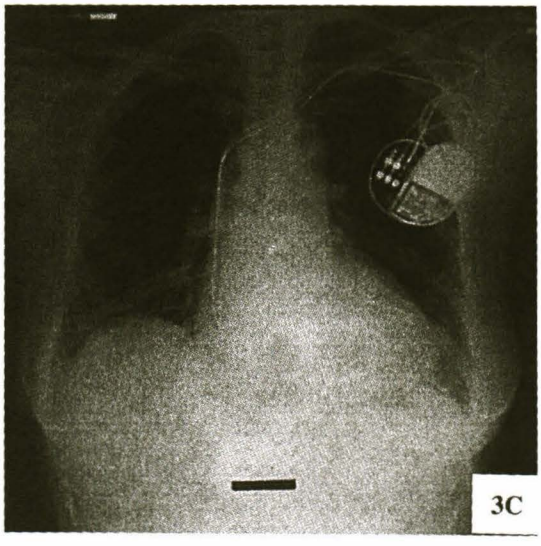

Fig. 3C. Chest X-ray at 6 months after implantation with reduction in cardiac shadow.

ventricular lead was implanted *via* left cephalic vein cut down and was positioned to the lateral vein of coronary sinus. The right atrium and right ventricular lead were positioned at the right atrium appendage and right ventricular apex *via* left subclavian approach. The capture thresholds were 2.0 V at o.5 ms at right atrium, 1.0 V at 0.5 ms at right ventricle and 1.1 V at 0.5 ms at leftventricle. P wave was 1.8 mV, R wave was 14 mV at right ventricle and 18 mV at left ventricular lead. There were changes of the surface electrocardiography (ECG) and QRS width after the pulse generator was connected to the leads. (Fig. 2). The procedure had no complication and the patient went home 8 days after implantation.

The patient had improved at two months follow-up. She was in class II congestive heart failure and was able to perform her daily activities without shortness of breath. Pacemaker interrogation showed good pacing and sensing function of all chambers. The authors were able to reduce her diuretic dosage and add small amount of beta blocker. At six month's follow-up, she was still in class II heart failure and her chest X-ray (CXR) showed reduction in cardiac shadow compared to the time of biventricular permanent pacemaker implantation and 30 months before implantation. (Fig. 3)

Case 2

The patient was a 78 year old female who had been in congestive heart failure for four years.

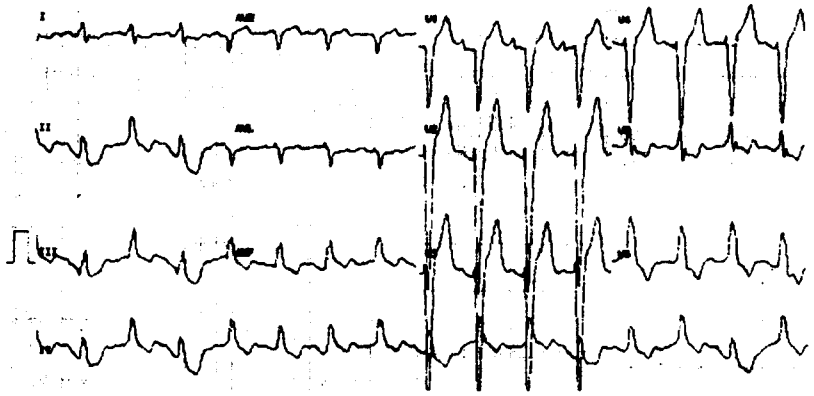

Fig. 4. Baseline electrocardiography without pacing.

Fig. 5. Electrocardiography with right ventricular pacing.

She was admitted to the hospital for congestive heart failure exacerbation and was put on IV dobutamine. Her heart failure improved with IV diuretic but IV dobutamine could not be discontinued. Repeated coronary angiogram showed non obstructive coronary artery. Echocardiogram showed marked left ventricular dilation of 7.5 cm and poor left ventricular ejection fraction of 20 per cent and moderate mitral regurgatation. ECG showed atrial fibrillation with ventricular rate around 80/min and left bundle branch block with QRS of 170 ms. She was in normal sinus rhythm 6 months prior to this admission.

Biventricular permanent pacemaker was successfully implanted. The left ventricular lead was position at the lateral vein of coronary sinus. The right atrial and right ventricular leads were positioned at right atrial appendage and right ventricular apex. The capture of the right atrial lead was not tested since she was in atrial fibrillation. The pacemaker was programmed to VVIR mode with the lower rate of 90/min to promote pacing activity. The patient had increase pulmonary congestion after implantation which resolved with IV diuretic. Intraveneous dobutamine was discontinued and the patient went home 7 days after implantation with oral anticoagulation.

At one month follow-up, her heart failure symptoms improved and she was put on oral amiodarone and low dose beta blocker. At two momth"s

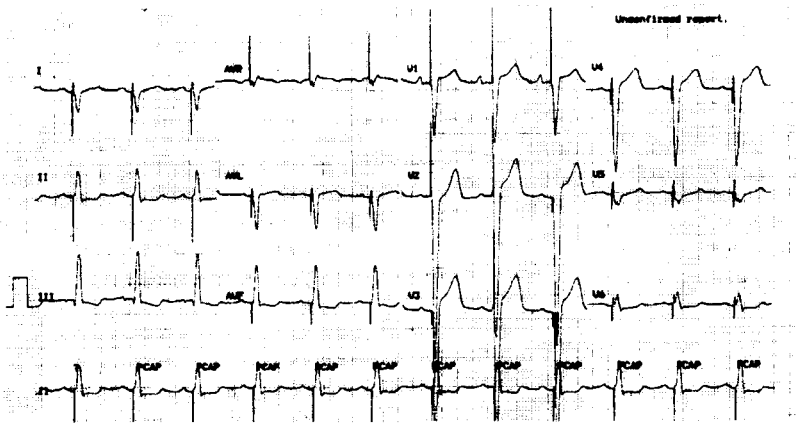

Fig. 6. Electrocardiography with biventricular ventricular pacing.

follow-up, the patient underwent successful cardioversion. Interrogation of the pacemaker showed good capture in both right and left ventricle. (Fig. 4-6) The patient who was in class II heart failure could perform her daily activities by herself.

DISCUSSION

Despite considerable progress in the management of congestive heart failure, it remains a major health problem worldwide. The quality of life in patients with advanced heart failure is poor with frequent hospitalization and pump failure is a common cause of death[8]. Cardiac transplantation is restricted by the lack of available donors and other factors such as the patient's age[9]. Patients with advanced heart failure frequently have conduction delay that may worsen cardiac systolic function[10].

Studies have shown the benefit of biventricular permanent pacemaker in advanced heart failure with intraventricular conduction disturbance. The development of fully transveneous system and special designed left ventricular pacing lead *via* the coronary sinus system have increased the success rate of implantation and substantially decreased the morbidity of the procedure[10].

However, there is no definite data on mortality benefit of biventricular pacing in advanced heart failure. The improvement in quality of life of this treatment modality is substantial giving the "no other way" situation in medical refractory advanced congestive heart failure. This was the reason that placed the biventricular permanent pacemaker into the cardiac pacemakers and antiarrhythmia devices guidelines.

The limitation of the use in Thailand would be the cost of this device. However, with the use of appropriate adapters, a conventional dual chamber pacemaker may well be used as a biventricular pacemaker[11]. This modification will be beneficial to some selected heart failure patients in Thailand.

SUMMARY

The authors successfully performed transveneous biventricular permanent pacemaker in medical refractory advanced congestive hearfailure with intraventricular conduction delay. The device would be useful in selected cases.

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การใช้ Transveneous biventricular permanent pacemaker ในผู้ป่วยหัวใจล้มเหลวที่ไม่ตอบสนองต่อการรักษาด้วยยา

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Biventricular pacemaker เป็นเครื่องกระตุ้นหัวใจด้วยไฟฟ้าที่สามารถกระตุ้นหัวใจห้องล่างซ้ายและล่างขวาได้ในเวลาเดียวกัน มีการพัฒนาเครื่อง Biventricular pacemaker จากที่ต้องทำการผ่าตัดเปิดช่องอกในการติดตั้ง (thoracotomy implantation) มาเป็นเครื่องที่กระตุ้นหัวใจโดยผ่านทางระบบหลอดเลือดดำ (transveneous system) ซึ่งสามารถติดตั้งโดยไม่ต้องผ่าตัดเข้าช่องอก ทำให้ลดผลแทรกซ้อนจากการผ่าตัดเป็นอย่างมาก ต่อมามีการศึกษาถึงการใช้เครื่อง Biventricular pacemaker ในผู้ป่วยหัวใจล้มเหลวที่ไม่ตอบสนองด้วยการรักษาด้วยยาตามปกติ และความผิดปกติในการนำไฟฟ้าหัวใจช่องล่างโดยเฉพาะที่มีระยะ QRS มากกว่า 130 มิลลิวินาที พบว่า Biventricular pacemaker มีประโยชน์โดยสามารถเพิ่มคุณภาพชีวิตของผู้ป่วยหัวใจล้มเหลวในกลุ่มดังกล่าวได้ ผลการศึกษาวิจัยดังกล่าวทำให้ Biventricular pacemaker ได้รับการบรรจุเข้าในข้อบ่งชี้ของการรักษาภาวะหัวใจล้มเหลวที่ไม่ได้ผลด้วยยาและที่มีระยะ QRS กว้าง รายงานนี้เป็นรายงานแรกของการใช้เครื่อง Biventricular pacemaker ในประเทศไทย

คำสำคัญ : เครื่องกระตุ้นไฟฟ้าหัวใจห้องล่างทั้งสองห้อง, หัวใจล้มเหลวที่ดื้อต่อการรักษาด้วยยา

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