Bi-Atrial Subxiphoid Epicardial Pacemaker in Superior Vena Cava Syndrome

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A patient with a bi-atrial-ventricular permanent pacemaker due to paroxystic atrial fibrillation associated to sinus bradycardia, in chronic use of oral anticoagulant, presented clinical signs of superior vena cava syndrome. Digital subtraction venography showed total obstruction of the right brachiocephalic venous trunk and severe stenosis of the connection of the left trunk to the superior vena cava. The therapeutic approach consisted of complete removal of transvenous system followed by re-implant of the bi-atrial-ventricular system using an epicardial subxiphoid access with fluoroscopic assistance.

The superior vena cava syndrome following transvenous pacemaker implantation is an uncommon complication. The therapeutic approach for the condition has been anticoagulation with or without thrombolysis, percutaneous venoplasty, or open-heart surgery.

The permanent multi-site atrial stimulation approach has shown consistent results in preventing atrial fibrillation in patients with sinus node disease, reducing the number of recidivating cases, and delaying the onset of permanent atrial fibrillation[6-9].

The objective of this report is to describe the case of a patient with sinus node disease and persistent atrial fibrillation that progressed to superior vena cava syndrome five years after bi-atrial-ventricular pacemaker implantation. Treatment included the complete removal of the transvenous system and its re-implantation by epimyocardial subxiphoid access.

Case Report

A 66-year-old male patient with fibrillation and drug-refractory atrial flutters who had undergone two previous attempts of catheter ablation. The patient had already suffered a previous ischemic cerebrovascular accident with transient visual disorders and was under treatment with warfarin and amiodarone.

In March 2001, he suffered a syncope associated with persistent sinus bradycardia, and had a permanent transvenous bi-atrial-ventricular pacemaker implanted. A *Medtronic* 4068 model electrode-cable for the right auricle and ventricle, and a 2188 model for the distal coronary sinus, were implanted by dissection of the cephalic vein and puncture of the right subclavian vein; the pulse generator was positioned in the subpectoral region. Warfarin administration was maintained, and amiodarone was replaced by sotalol due to hypothyroidism. The patient remained asymptomatic for five years, with a pacing rhythm and occasional episodes of atrial fibrillation detected by the diagnostic pulse generator counters.

In March 2005, three months after an elective replacement of the pulse generator, the patient developed edema and rubor in his face, neck, and right upper limb. Ultrasound and chest X-ray evaluation suggested obstruction of the superior vena cava. Digital subtraction venography with bilateral injection of contrast material showed thrombosis of the right brachiocephalic venous trunk with collateral circulation, and severe stenosis at the innominate vein-superior vena cava junction (Fig. 1).

The therapeutic approach adopted was the complete removal of the transvenous system followed by epimyocardial re-implantation. With the patient under general anesthesia, the following was performed: removal of the pulse generator, removal of the right atrial and ventricular cables by counter-traction, and removal of the left atrial cable by simple traction. Re-implantation was performed by a longitudinal incision, approximately 5 cm long, over the xiphoid appendage, and an inverted T-shape pericardiotomy. The *Medtronic* 4968 epimyocardial electrode-cable was implanted in the diaphragmatic wall of the right ventricle. With the aid of fluoroscopy, the Medtronic 5038 (A-V "*single lead*") electrode-cable was inserted through the same opening and passed through the pericardial space to the post-lateral region of the left ventricle until it reached, via the transversal sinus, the apex of the right atrium. The tip of the cable-electrode was positioned on the atrial epicardium, between the superior vena cava and the ascending aorta. The "fluctuating" poles of the 5038 electrode-cable were positioned in the left auricle, and were used for left atrial stimulation. The values obtained with the *Medtronic* 2090 analyzer were adequate for stimulation and sensitivity. No phrenic stimulation was observed. The *Biotronik Stratos LA*

Key words

Pacemaker artificial, bi-atrial pacemaker, superior vena cava syndrome, atrial fibrillation.

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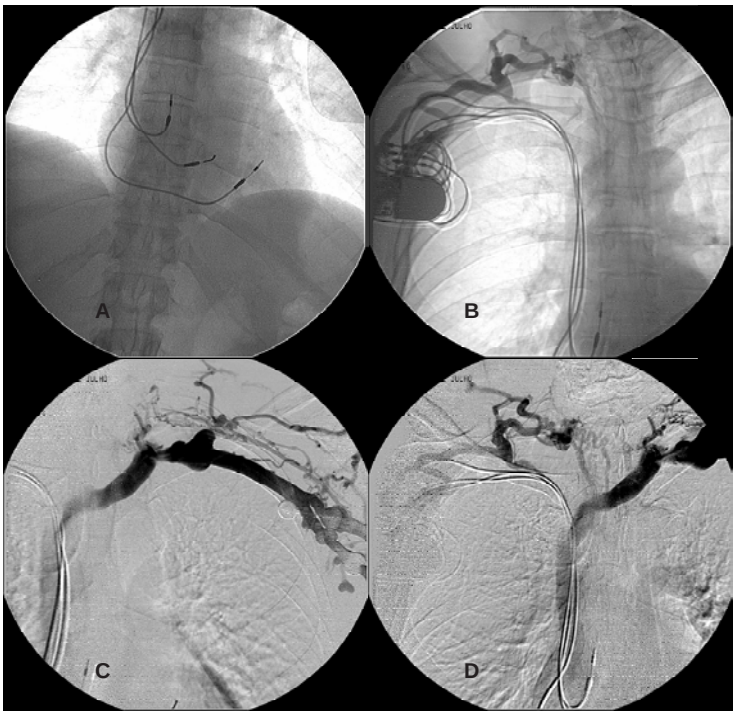

Fig. 1 - *Preoperative radiological aspect. a) posteroanterior view of the bi-atrioventricular transvenous stimulation system; b) digital phlebography of the right upper limb showing total obstruction of the right subclavian vein and of the venous brachiocephalic trunk; c) digital phlebography of the left upper limb showing stenosis at the innominate vein-superior vena cava junction; d) bilateral simultaneous phlebography showing collateral circulation.*

pulse generator was re-implanted in the submuscular region of the left hypochondrium (Fig. 2).

Total regression of vena cava obstruction signs was obtained after the immediate postoperative period and persisted through the last evaluation. Patient continues to receive warfarin and remains in atrial pacing with good atrial-ventricular pacemaker capture two months after the procedure.

Discussion

Since it is so infrequent, the treatment of superior vena cava syndrome following transvenous electrode-cable implantation has not yet been standardized. Anticoagulation, thrombolysis, and mechanical unclogging, with or without the removal of the stimulation system, have been employed. In this case, due to the sluggish flow from the innominate vein to the superior vena cava, it was decided to remove the transvenous system. The risks associated with the use of thrombolytic agents and the poor long-term results of venoplasty were important factors taken into consideration.

The multi-site atrial stimulation allowed maintenance of the patient's own rhythm for five years, with few episodes of self-limited atrial paroxysmal fibrillation, and therefore was preserved. Ventricular stimulation was also indicated, in case ablation at the atrial-ventricular junction is needed in the future.

The femoral vein and right thoracotomy through the atrial wall have been the preferred options for endocardial pacemaker implantation.Due to the severity of the thromboembolic condition even during oral anticoagulation, it was decided not to use the endocardial pathway for the re-implantation procedure. Based on the epicardial mapping and ablation approach described by Sosa e Scanavacca[10], and in an effort to avoid the trans-sternal thoracotomy to reach the right and left atria simultaneously, we decided to employ this access. The single-cable fluoroscopy-guided catheter, originally designed for atrioventricular stimulation, allowed performing left and right atrial stimulation with just one cable. The passage through the transversal sinus stabilized the position of the cable-electrode.

Mid-term follow-up showed the viability of this kind of approach for the bi-atrial implantation. The low risk of this minimally invasive procedure may help it become a good alternative for multi-site stimulation, provided reproducibility, safety, and accuracy of the technique are confirmed.

Potential Conflict of Interest

No potential conflict of interest relevant to this article was reported.

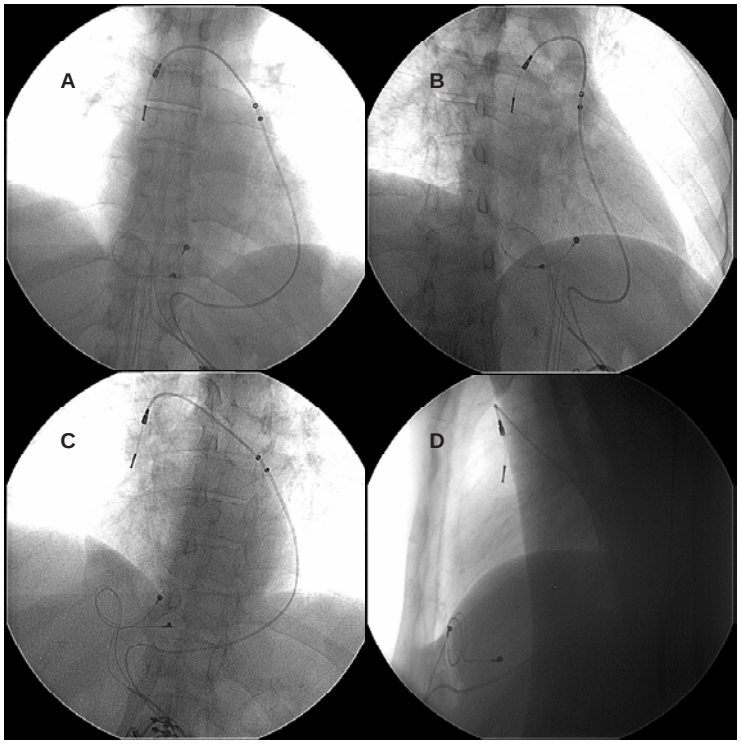

Fig. 2 - *Postoperative radiological aspect showing positioning of the bipolar epicardium electrodes in the right atrium, left atrium, and right ventricle, in four views: a) posteroanterior; b) right oblique; c) left oblique; d) profile.*

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