To replace or to abandon and implant a new lead? The conservative approach creates new challenges (and risks) for patients in future. Should we still wait for class 1 indications? Case report and discussion of the problem

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Abstract

The ideal situation for patients is to have as many active and properly placed leads as necessary. We report the case of a 69-year-old woman with multiple indications for lead extractions existing for 9 years but having class 2b. Doctors preferred a conservative option of dealing with numerous problems unnecessarily, ignoring long lead loops and deciding to implant an additional lead. After 9 years removal of the whole hardware was necessary in order to implant the new CRT-D pacing system. The performed TLE procedure

was difficult due to several complex technical problems but finally successful regardless of the complete venous occlusion. TLE performed 9 years earlier would have been much safer, easier and less dramatic. The conclusion is that it is much more advisable to perform the TLE immediately as regards patients with a long life prognosis than to prolong it. Furthermore, the conservative option of management of lead-related problems creates multiple obstacles in the future.

The growing number of patients treated with cardiac pacemakers and implantable cardioverter-defibrillators (ICD), limited service life of intracardiac leads and increasingly common device upgrades increase the number of subjects with multiple, frequently damaged or simply unnecessary leads in the heart.

The ideal situation for patients is to have as many active and properly placed leads as needed. In case of lead dysfunction, replacement is the optimal choice. Unfortunately, until 2006 access to transvenous lead extraction (TLE) in Poland was severely limited, and the 2000 guidelines provided a possibility of leaving in place the inactive lead and implanting a new one. Over the past 28 years there have been several studies with a short follow-up showing that lead abandonment did not affect the occurrence of hard clinical endpoints (cardiovascular mortality, all cause mortality, admission for heart failure or acute cardiovascular event (myocardial infarction, stroke)). Therefore, it appeared reasonable to many investigators to adopt such an approach. It was reflected in the 2009 HRS guidelines^[1], in which both approaches were considered equal. A few studies with a prolonged follow-up demonstrated that extraction of superfluous, previously abandoned leads was slightly more dangerous, i.e. associated with a higher rate of major complications. Very few research investigators emphasize the role of prophylaxis – not abandonment but replacement and extraction of redundant leads – at the time of a subsequent CIED-related procedure^[2]. The knowledge of experienced physicians who have observed their patients for decades seems to confirm this approach to lead abandonment. In recent years there have been several papers which demonstrated that non-functional leads left in place cause a lot of problems^[2,5,6].

In the new 2017 HRS guidelines class IIb indications for removal of superfluous or previously abandoned leads have been retained, although the class of indications should be higher in certain cases.

Another problem is a less obvious course of the leads in the superior vena cava (SVC). Only the 2009 guidelines contain a distinction between leads that pose an immediate threat if left in place and leads that may pose a potential future threat to the patient. The latter has class 2b indications as there are no studies showing a definite threat relating to the presence of excess lead loops in the heart. Such leads are more difficult to extract, and the rate of complications seems higher. Furthermore they contribute to the occurrence of intracardiac lead abrasion, creating a high-risk substrate for infective endocarditis^[2,4,6,11]. More leads in the SVC favor the development of venous obstruction. Venous insufficiency, especially bilateral and involving the superior vena cava, prevents device upgrade to CRT-D, if necessary. Implantation of another three leads on the contralateral side, even if possible, would be unacceptable, because the number of leads in the superior vena cava cannot exceed five^[1,2].

We report the case of a 69-year-old woman, after implantation of an aortic valve prosthesis in 2014, with arterial hypertension, diabetes mellitus type 2, and chronic renal disease, who was admitted for implantation of a DDD pacemaker due

to third-degree atrioventricular block on 6 April 2004. On 4 January 2010, the patient underwent pacemaker replacement due to normal battery depletion and placement of a new ventricular lead because of a high pacing threshold of the primary lead. On 7 January 2010 the newly implanted ventricular lead was repositioned due to a high pacing threshold. Later on, the patient was diagnosed with NYHA class III heart failure, 100% right ventricular pacing, her echocardiogram showed significant enlargement of cardiac chambers, decreased ejection fraction (EF) (28%), and one of the leads was pinned to the septal leaf of the tricuspid valve with concomitant tricuspid regurgitation. She was selected for transvenous lead extraction with regaining venous access and subsequent implantation of a CRT-D device.

The procedure was performed in the patient under general anesthesia in the hybrid operating room. Radiography of the chest before the procedure revealed three leads – two leads in the right ventricle and one atrial lead, excess loop leads (Figure 1A) and complete occlusion of the left subclavian vein (Figure 1B). To stabilize the leads during dissection locking stylets were used, but they were not able to pass through the lead loops.

Figure 1. Old DDD system with older abandoned lead. In all three leads unnecessary loop (overmuch of lead length in their heart route) consisting the “trap” in case of necessity of its extraction. Complete venous occlusion (A,B).

Uncomplicated extraction of younger ventricular lead (C); break of atrial and of older ventricular lead in right atrium. Both proximal endings of broken leads covered with connecting tissue scar not achievable for lasso catheter.

During lead extraction with mechanical telescoping sheaths (Byrd dilators) the inactive right ventricular lead and atrial lead, i.e. the leads with redundant loops, broke off. This complication significantly increased the level of difficulty and procedure-related risk, and markedly prolonged its duration. Initially, the proximal ends of the two leads torn at the level of the right atrium could not be captured with a lasso catheter (they were encapsulated in a layer of fibrotic connective tissue). They were liberated using a loop consisting of an angiographic guide wire, pig-tail catheter and lasso (Figure 2). Only then was it possible to catch the ends of the torn leads with a lasso

Figure 2. Some tips and tricks necessary for grasping and mechanical dilatation of broken lead fragments. Liberation of proximal ending of broken ventricular lead using the loop composed of guidewire and lasso catheter (A,B) and following grasping of both lead fragments with lasso inserted inside CS lead implantation dedicated catheter (Attain). In the next stage the CS sheath and lasso served as the rail for green Byrd dilators.

and remove them through the regained left subclavian vein using the technique described several years ago^[13,14], after advancing Byrd dilators over the lasso tipped with the catheter which is used for implantation of left ventricular leads^[13,14]. Finally it was possible to remove both fragments of the torn leads and a new CRT-D device was implanted through three regained accesses (Figure 3). The procedure lasting 99 minutes was successful.

Figure 3. All leads were removed, temporary electrode in RV. CS (coronary sinus) venography inclined as to use median heart vein for permanent LV pacing (A,B). The patient received full CRT-D pacing system (C). Abundant strong connective tissue scar visible on extracted lead.

The case illustrates technical challenges one may encounter during extraction of abandoned leads, with incorrect position in the venous system and cardiac cavities, and in the presence of complete venous occlusion.

In this patient lead extraction was performed to regain venous access (class 1 indication). But class 2b indications could apply at an earlier time. Lead abandonment considered as an equivalent therapeutic option carries a risk of a very complicated and difficult extraction procedure, especially if performed years later. Currently, superfluous leads are regarded as a potential source of complications at a later time. Extraction of the inactive lead 8 years earlier – in Poland TLE was already accessible for all patients in need – would have been much easier, less dangerous and with shorter duration of the procedure and fluoroscopy time. Perhaps it would have prevented lead-dependent tricuspid dysfunction. The replacement of the cardiac device might have prevented the development of significant venous obstruction. In selected patients class 2b indications deserve consideration.

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