Subcutaneous implantable cardioverter-defibrillator (S-ICD) for secondary prevention of sudden cardiac death

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Submitted: 21 October 2014
Accepted: 22 January 2015

Arch Med Sci 2016; 12, 5: 1179–1180
DOI: 10.5114/aoms.2016.61921

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Implantation of a transvenous implantable cardioverter-defibrillator (ICD) is a recognized method of secondary prevention of sudden cardiac death [1]. In some patients with indications for such a device, circumstances may occur that render ICD implantation difficult or impossible. Implantation of a subcutaneous ICD (S-ICD), not requiring introduction of any elements into the cardiovascular system, might be a solution in such cases. Another feature that distinguishes the S-ICD from the ICD is the inability to terminate arrhythmias with antitachycardia pacing, but only with an electrical 80 J shock. Moreover, bradycardia pacing is limited only to the immediate post-shock period (50 bpm for 30 s). The S-ICD system consists of a 145 g can, placed subcutaneously over the 5th and 6th left intercostal space in the midaxillary line, and the lead, also placed in the subcutaneous tissue, along the left margin of the sternum. The battery life is approximately 5 years [2]. If correctly implanted, the device provides detection of ventricular arrhythmias with a sensitivity of nearly 100% and specificity of differentiation from supraventricular arrhythmias of 98%, which is more than in traditional transvenous systems [3]. Possible problems include sensing disturbances due to the oversensing of T-waves or myopotentials, which may lead to inadequate interventions. That problem may affect 5% to 16% of patients [4–6]. Due to that fact, S-ICD implantation is indicated only in patients with a positive screening test result, aimed to assess the amplitude and relation of R and T waves. Until recently, defibrillators of such kind had not been implanted in Poland. The reported case is one of the two first implantations in Poland.

A female patient, 57 years of age, with a history of acute myeloblastic leukemia, treated with allogenic hematopoietic stem cell transplant by a familial donor, was admitted to our clinic for an ICD implantation procedure, because of sudden cardiac arrest (SCA) due to ventricular fibrillation (VF) in August 2014. Complete cardiological work-up after the SCA event did not reveal any organic heart disease, and primary VF was diagnosed. The patient was qualified for a single-chamber ICD. Immediately before the planned procedure, venography of the venous drainage of the left arm was performed, and revealed complete occlusion of the left subclavian vein. Contralateral venography showed impaired drainage of the right subclavian vein. Post-thrombotic lesions, probably due to multiple central catheterization during hematological treatment, made transvenous ICD implantation impossible. As a consequence, we decided to implant an S-ICD system. Having obtained a positive result of screening aimed at confirming the appropriate ratio of R and T waves,

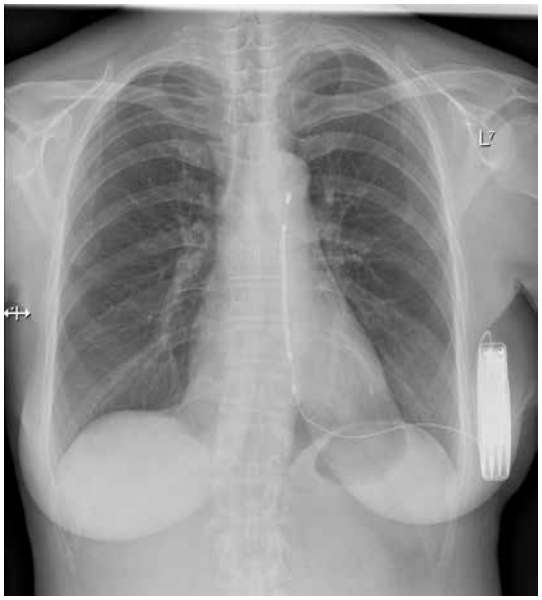

Figure 1. Postero-anterior chest radiograph from a patient following S-ICD implantation

on 23rd September 2014, under antibiotic prophylaxis and general anesthesia, the system was implanted. The pocket for the S-ICD can was made using skin incision in the left anterior axillary line over the 5th and 6th intercostal space. With a special tunneling tool, the lead was tunneled in the subcutaneous tissue towards the xyphoid process and along the left margin of the sternum. The lead was connected to the defibrillator (Cameron Health model 1010 SQ-RX), which was placed in the pocket (Figure 1). Wounds were closed typically. Fluoroscopic imaging was used twice during the procedure: in the initial phase to mark planned skin incision sites in relation to anatomical landmarks, and after the implantation to confirm the correct position of the lead and can. The total fluoroscopy time was 5 s. After the procedure, the VF defibrillation test was performed. VF was induced, detected and terminated by the device with a 65 J shock. The patient was observed for 3 days and discharged in a very good general condition. Sutures were removed 9 days after the procedure. During the follow-up visit after 3 and 8 weeks, correct wound healing was confirmed, as well as correct S-ICD function.

In conclusion, the reported case confirms that a subcutaneous defibrillation system is an alternative to typical transvenous systems and may be used instead in specific cases, when a transvenous system cannot be implanted. It is also an alternative to epicardial ICD systems, the implantation of which requires opening of the chest and is associated with a substantial risk of complications. Advantages also include an important reduction of fluoroscopy time, which is limited only to the initial assessment of anatomical landmarks, and postoperative control of system localization. One should bear in mind though the important limitations of such a system, which include lack of antitachycardia pacing and permanent cardiac pacing (and especially cardiac resynchronization therapy), which importantly limits the target patient population. Nonetheless, the method, introduced recently in Poland, is promising and may be performed in selected referral centers.

Conflict of interest

The authors declare no conflict of interest.

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