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Venous Obstruction Following Pacemaker or Implantable Cardioverter-Defibrillator Implantation, Mini Review

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Abstract

Venous obstruction is relatively frequent following permanent pacemaker or implantable cardioverter-defibrillator (ICD) implantation. However, most of them are asymptomatic. Although the exact risk factor for this complication is not known, number of leads, heart failure and infection may prone the patient to this complication. The goal standard for detection of vein stenosis is venography; however, ultrasound sonography has an acceptable accuracy. Anticoagulant therapy may be considered for symptomatic patients. For device upgrading, non-functional leads removal, venoplasty and rarely surgical treatment may be indicated.

INTRODUCTION

With the growing numbers of pacemaker and implantable cardioverter defibrillator (ICD) implantations, obstruction of the access vein is detected more in these patients. Development of thrombosis and obstruction is a multifactorial process. Ligation of the access vein during cut-down approach, slowing of the flow in the vein due to decreased luminal area by the leads, and endothelial trauma caused by pacemaker leads, cause prothrombotic and inflammatory responses which may cause thrombus formation and subsequent scarring that lead to obstruction [1].

In view of the diagnosis of lead-related thrombosis, two types of obstructions can be distinguished; few patients develop clinically manifest obstructions with overt symptoms and signs, such as pain, tenderness, edema, warmth, paresthesia or bluish discoloration of ipsilateral arm. Pulmonary embolism and superior vena cava (SVC) syndrome are the two major but rare complications of lead-related venous thrombosis in this group [2]. However, most of the patients have subclinical obstructions and in the absence of signs or symptoms, they are detected at follow-up procedures such as system revision and lead extraction or during screening diagnostic imagines (Fig 1) [2].

It shows implantable cardioverter defibrillator lead fracture and totally obstruction of the left subclavian vein with collateral formation in a 48 years old lady, 4 years after device implantation.

In prospective and retrospective studies, the incidence of significant venous obstruction was reported as 13.7-45% following endocardial lead insertion. However, clinically manifested obstruction is relatively rare (1-3%) [3-5].

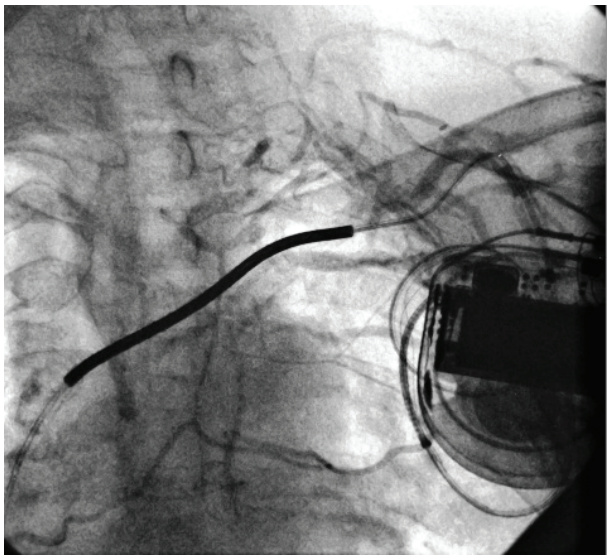

Figure 1: Fluoroscopy and venography in AP View

RISK FACTORS

Data about risk factors of venous obstruction after pacemaker implantation are conflicting and show many discrepancies. These conflicts may be due to different imaging modalities used for the detection of obstruction, length of their follow-ups and different portions of each type of cardiac rhythm management device (PPM, ICD or CRT). In almost all the investigations, age, gender, smoking, lead size and cephalic

vs. subclavian approach were not found as risk factors for venous obstruction. Some studies determined number of leads, heart failure, female hormone use, personal history of venous thrombosis, and infection as risk factors. However, some other studies did not approve these correlations [3, 6, 7]. Prophylaxis warfarin and antiplatelet consumption may lower the probability of venous stenosis [8].

DIAGNOSIS

Venography

Contrast venography is recognized as the standard method for diagnosis and is mostly performed before upgrading procedures. This method requires the use of ionizing radiation [9]. It can be performed by the injection of contrast medium through a large peripheral intravenous line [3].

Ultrasound Sonography

Ultrasound is most often used in patients with clinical signs or symptoms, because it is non-invasive, can easily be performed at the bedside, and the patient does not get exposed to contrast medium or radiation. Non-compressibility, direct visualization of thrombus in the venous lumen and evaluation of blood-flow can be used to establish the presence or absence of thrombosis in ultrasound sonography [10].

Computed Topography

Spiral computed topography (CT) venography is also an accurate diagnostic tool which can detect deep vein thrombosis and require lesser amount of contrast medium compared to conventional venography. However, CT scan has not been validated for central chest veins [1]. Nonetheless, there are some reports aiming that this imaging modality can be helpful [11-13].

Magnetic Resonance Angiography

Magnetic resonance angiography was only evaluated in few studies with small sample sizes [10]. It is a non-invasive imaging modality that has acceptable accuracy for the detection of thrombus in the central thoracic veins and does not require contrast medium. Unfortunately, it is relatively contraindicated in the presence of a pacemaker or ICD [14].

MANAGEMENT

The strategy for the management of these patients depends on their signs, symptoms and clinical statuses. Since most patients with occlusion of subclavian vein are asymptomatic, and also few of them will require lead revision, or an ipsilateral lead insertion in future, obstruction does not develop any problem and does not need any management. A short-term warfarin therapy for 3-6 months is used after acute episodes of upper extremity deep vein thrombosis; however, there is no current recommendation to use warfarin as a primary prevention after pacemaker leads implantation [1]. In the case of upgrade procedure, non-functional, old lead removal can restore the patency of previously occluded veins [15]. Successful venoplasty of SVC, innominate or subclavian veins that may allow subsequent lead insertion was also reported [16]. In a few case reports, surgical treatments of pacemaker-related SVC syndromes that did not respond to treatment with anticoagulation or had contraindications to endovascular procedure were performed successfully [17]. Surgical management requires thoracotomy and has high morbidity; so, should be considered as the last choice.

CONFLICTS OF INTEREST

There was no conflict of interests for the present study.

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