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Letter to the Editor

Pacing venous occlusion

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The use of implantable cardiac devices has increased in the last 30 years. The evolution of devices in serious cardiac rhythm pathology management has led progressively to the development of devices for the treatment of bradycardia, ventricular arrhythmia, and heart failure and for the prevention of sudden cardiac arrest leading to delivery of pacemakers, implantable cardioverter defibrillators (ICD)s and cardiac resynchronization therapy (CRT) plus ICD (CRT-D) [1–22] and to the recent subcutaneous implantable cardioverter-defibrillator (S-ICD) [23–27] and subcutaneous single-*finger* cardioverter-defibrillator (ICD) *system* [28]. Infectious complications leading also to endocarditis [1,8,29–37] and non-infectious complications [9,21,23,38–41] often necessitating removal [1,2,8,41–47] affect patients' wellbeing which also leads to psychological difficulty increase [48–54] in the emerging scenario of concomitant problems and diseases [55–79] and in patients that also need device revision and upgrade. In addition, the improved patients' survival, the progressively younger implanted population and the increase in device and procedure complexity have raised the risk of system component structural failures [80]. Occlusions or significant stenosis of great chest veins is a common permanent transvenous pacing consequence, with an incidence closer to 30%. Repetitive, chronic friction between the pacing lead and the endothelium can initiate the inflammatory process resulting in thrombosis and fibrosis. Compensatory dilatation and also stenosis/occlusion of the vein thus can occur [81]. Moreover added additional lead risk is significant [82] and both systemic and local infections are associated with increased risk of access vein occlusion [83]. A computational method studying pacing blood flow changes evidenced stasis increase at locations between the leads and along the surface of the vessels closest to the leads corresponding to regions at known thrombosis risk [84]. Central venous occlusion in pacing patients is often asymptomatic [81–85] due to development of an adequate venous collateral circulation but can cause more difficulties in patients needing of device revision/upgrade/extraction requiring advanced tools and more time [81–85]. Several pacing venous occlusions have also been described including superior vena cava (SVC) occlusion [86–88], subclavian vein occlusion [89,90], axillary vein occlusion [91], inferior vena cava (IVC) occlusion [92], subtotal innominate vein occlusion [93], and internal jugular vein occlusion [94]. Moreover permanent pacemaker-related upper extremity deep vein thrombosis has been found [95] having risk factors like diabetes, most frequently, followed by smoking, hypertension, obesity with body mass index ≥ 30, history of acute myocardial infarction, chronic obstructive pulmonary disease and history of congestive cardiac failure (15%) and responding to anticoagulation therapy while antiplatelets were not found protective [95]. Also atrial fibrillation, foreign body-type reaction, and hypercoagulability have been called in cause as possible mechanisms of pacing venous thrombosis [96]. Notably, ICD leads, after long dwell-time, have been found to be affected by fibrous adherences uniformly distributed along the lead course and careful lead selection is recommended at the time of implantation to prevent adherences [97]. We usually search to remove the preexisting electrodes with a percutaneous approach but if the adhesions between the leads and the venous wall cannot be gone over, in our mind, the surgical strategy is often mandatory. Pre-procedure venography to assess venous patency should be performed [85]. Spiral computed tomography (CT) venography is capable of detecting central vein thrombosis and chest CT helps to rule out other etiologies. Magnetic resonance angiography gives more detailed information about collaterals and anatomy [86]. Nowadays the need of cardiac rehabilitation in pacing venous occlusions is an increasing scenario and it represents a serious challenge as well its optimal management ranging among anticoagulation, percutaneous stenting in combination with angioplasty, thrombolytic treatment, and multimodality therapy involving catheter directed thrombectomy and thrombolysis with percutaneous angioplasty and short course of anticoagulation. Furthermore, perioperative lead extraction management varies between extraction centers, and no clinical guidelines [98] have focused on the need for anticoagulation nevertheless routine peri- and post-operative anticoagulation has been advocated as a means to prevent vein occlusions including pulmonary embolism [99,100]. The use of new oral anticoagulants in this scenario has also been proposed although its use requires always thorough evaluation

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Fig. 1. Panel A: the marked superficial venous network throughout the thoracic left area and the moderate mantle edema. Panel B: a thrombus attached to lead was also extracted.

regarding risks and benefits based on an in-depth understanding of each patient's comorbidities as well as its perioperative use requires further study [85]. Rehabilitation in pacing venous occlusions is a difficult work needing a collaborative vision of a multi-disciplinary treatment team. Patient-,complications-, and pacing-related factors should be considered as well as optimization of therapeutic strategies. Transvenous lead extraction is an effective and with few complication technique but it is fundamental that lessons learned from each patient treated can inform clinical decision making for the next patient for pacing patient's safety and complete prevention and rehabilitation [101, 102]. We present a case of venous occlusion in a 72-year-old Italian man with a *DDDR* pacemaker implanted anterior to left *pectoral* muscle by left subclavian vein entry-site approach on year 1999 and suffering from subclavian area pain with a marked weakness. He presented a marked superficial venous network throughout the thoracic left area and a moderate mantle edema (Fig. 1 Panel A). We proceeded with the complete system removal. A thrombus attached to lead was also extracted (Fig. 1 Panel B). Also this case focuses on the safety and effectiveness of transvenous lead extraction in pacing venous occlusions.

Conflict of interest

The authors report no relationships that could be construed as a conflict of interest.

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