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Case Reports

Medial subclavicular musculotendinous complex and insulation break: Rare cause of late pacemaker lead malfunction

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ABSTRACT

Insulation break in a permanent pacemaker lead is a rare long-term complication. We describe an elderly male with a VVIR pacemaker, who presented with an episode of presyncope more than 3 years after the initial implantation procedure, attributed to insulation break possibly caused by lead entrapment in components of the *medial subclavicular musculotendinous complex* (MSMC) and repeated compressive damage over time during ipsilateral arm movement requiring lead replacement. The differential diagnosis of a clinical presentation when pacing stimuli are present with failure to capture and the role of the MSMC in causing lead damage late after implantation are discussed.

1. Case

A 77-year-old diabetic and hypertensive male, with bifascicular heart block (right bundle branch block and left posterior fascicular block) and history of recurrent syncope, had undergone implantation of a single-chamber pacemaker (VVIR, VERITY™, St Jude Medical, USA) in September, 2011. A tined lead (ISOFLEX™ S, St Jude Medical, 58 cm silicone with Fast-Pass™ coating) was introduced by conventional percutaneous left subclavian puncture and positioned in the right ventricular apex with good stability and satisfactory pacing parameters (threshold – 0.7 V, Impedance – 840 Ω). Pulse generator was placed in a subcutaneous pocket in the left infraclavicular region. Proximal end of the lead was secured with suture sleeve and the pocket was closed in two layers. The patient was discharged in a stable condition with a healthy wound after optimal course of antibiotics.

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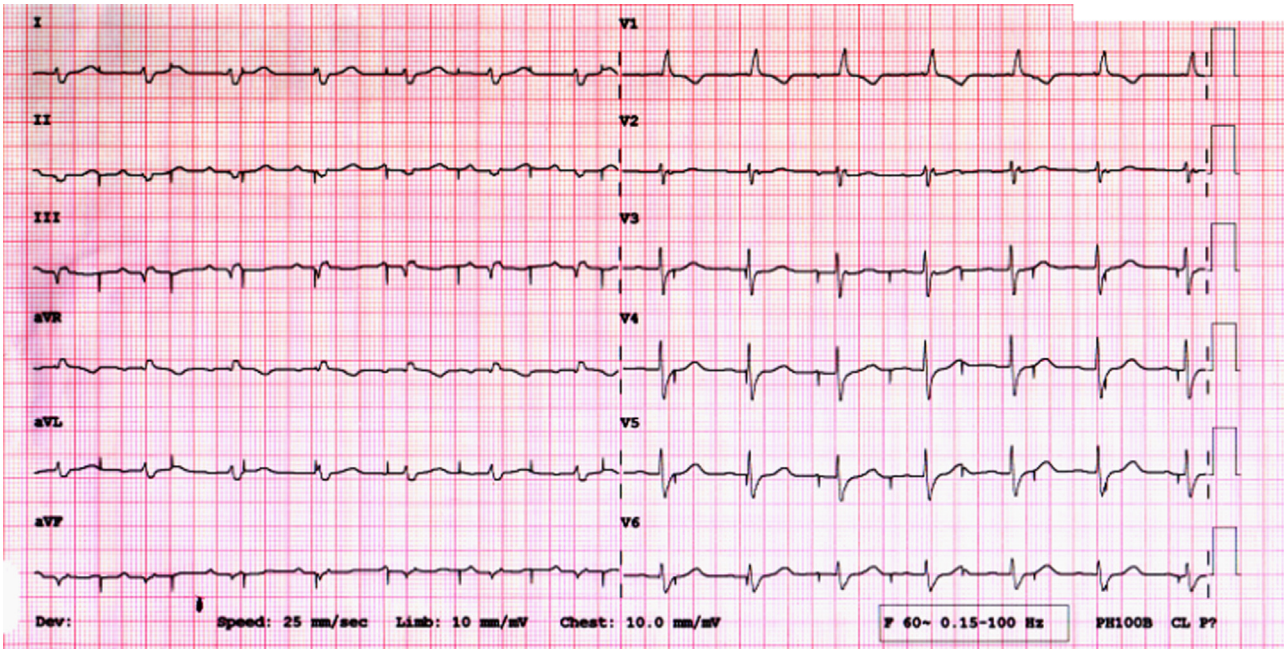

Fig. 1 – ECG more than 3 years after the initial implant procedure. Magnet application shows spike delivery but failure to capture.

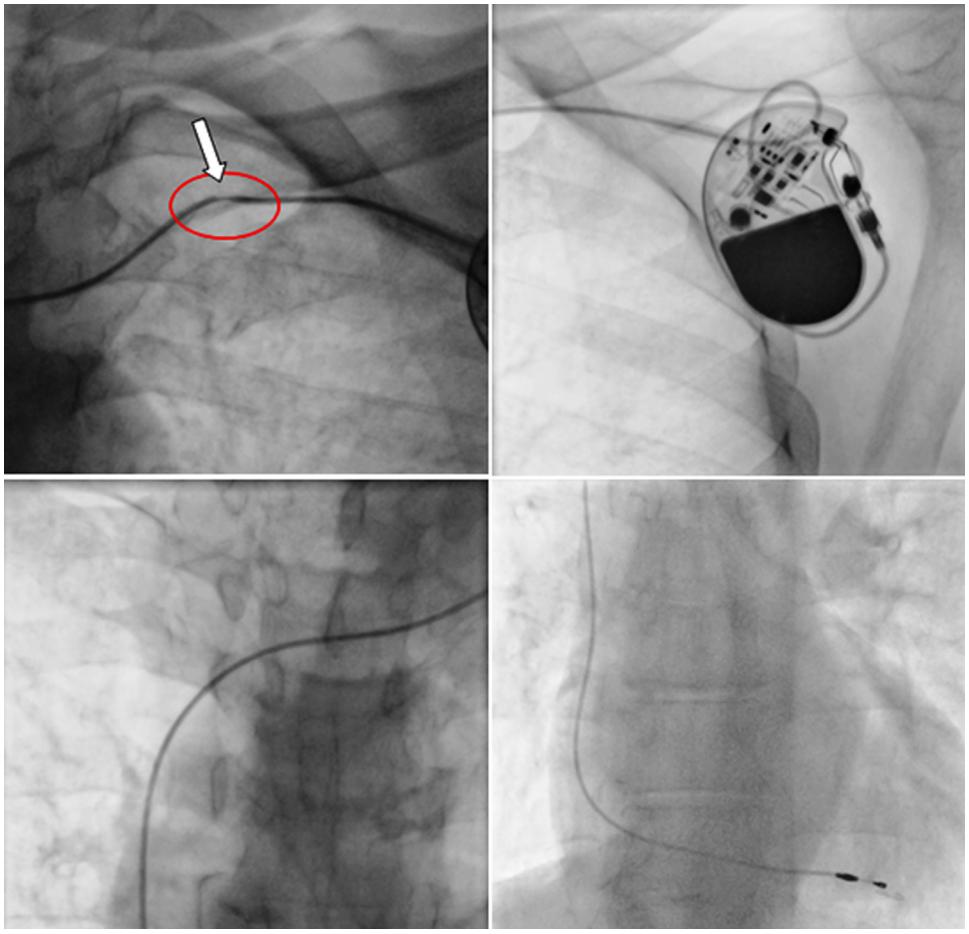

Fig. 2 – Fluoroscopic examination of the pacemaker system revealed defect of the pacemaker lead at the point where it crossed between the clavicle and first rib (arrow and circle) on its way to the subclavian vein. There was no evidence of loose setscrews or lead dislodgement.

After more than 3 years of the initial implantation, he presented with an episode of presyncope. His resting ECG showed spontaneous rhythm at the rate of 82 bpm, and magnet application revealed spike delivery but failure to capture (Fig. 1). Our patient was fortunate not to be completely dependent on the pacemaker. Pacemaker interrogation revealed an elevated pacing threshold of 6 V and decreased lead impedance to 260 Ω (a fall in lead impedance by more than 300 Ω). The cumulative ventricular pacing was 20%. On fluoroscopic screening of the pacemaker system in the Cath Lab, a defect in the pacemaker lead could be clearly appreciated at the point where it crossed between the clavicle and first rib on its way to the subclavian vein (Fig. 2). There was no evidence of loose setscrews or lead dislodgement. Therefore, considering the fluoroscopic observation combined with the clinical and telemetry data, a diagnosis of insulation break was established and the patient underwent definitive correction with replacement of the lead using a more lateral access to the left subclavian vein.

2. Discussion

The differential diagnosis of pacemaker stimuli present with failure to capture is limited and the timing of its occurrence after implantation is important in establishing a likely etiology. Lead dislodgement is most likely if loss of capture occurs within hours or days of the implant. Loss of capture occurring weeks to months after implantation is likely due to high capture thresholds resulting from lead maturation process. If the problem occurs many months to years after implantation, it is usually due to a mechanical or structural problem like damaged insulation or conductor fracture,[1] as evident in our case or due to an abnormality in the myocardium itself. Chronic lead impedance should not vary widely between follow-up visits. Lead insulation defect will cause elevated pacing threshold and decreased lead impedance, whereas, lead conductor fracture will cause both pacing threshold as well as lead impedance to be elevated. Lead dislodgement will show elevated pacing threshold with normal impedance whereas with loose setscrews, both pacing threshold and lead impedance will be increased. With battery depletion and functional noncapture, both pacing threshold and lead impedance will be normal.[2]

Lead insulation defect is a very rare late complication of pacemaker implantation reported in 0.4–0.5%[3,4] patients. Available literature suggests that approximately 93% of all pacemaker lead fractures or insulation breaks occur in the segment of the lead lateral to the venous entry, and costoclavicular compression has been implicated. However, cadaveric studies suggest that lead damage in that region is caused by soft tissue entrapment rather than bony contact. It has been noted that leads inserted by standard subclavian puncture techniques, as in this particular case, usually pass through the *medial subclavicular musculotendinous complex* (MSMC) before entering the vein. The MSMC comprises the subclavius muscle, the costoclavicular ligament, and the costocoracoid ligament. Entrapment of the lead by any of these structures could impose a static load upon the lead, and repeated flexing of leads about the point of entrapment during ipsilateral arm movements may be responsible for damage previously attributed to cyclic costoclavicular compression.[5] Therefore, it has been suggested that the use of cephalic vein cutdown or a more lateral percutaneous entry into the subclavian or axillary vein may help avoid lead compression and damage associated with the standard subclavian puncture technique.[6,7]

3. Conclusion

Lead failure due to insulation break is a rare but important cause of late pacemaker malfunction, requiring lead replacement. An abnormally low impedance with demonstrable lead malfunction is diagnostic for insulation break. Majority of pacemaker lead fractures or insulation breaks occur in the segment of the lead lateral to the venous entry. Lead entrapment by components of the MSMC has been suggested to contribute to pacemaker and ICD lead damage and pacemaker malfunction over time, especially those inserted using the standard subclavian puncture techniques. Novel approaches of lead introduction into the subclavian vein near the lateral border of the first rib avoids soft tissue entrapment and may extend the longevity of the leads.

Conflicts of interest

The authors have none to declare.

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