

Right Pace, Wrong Place

Dear Editor,

We report a 61-year-old Chinese man with end-stage renal failure who was admitted for late stent thrombosis of the right coronary artery bare metal stent 5 months after the index percutaneous coronary intervention. Successful thrombectomy and balloon angioplasty was performed with intravascular ultrasound guidance. During his stay in the coronary care unit (CCU), he developed intermittent complete heart block and frequent runs of bradycardia-induced torsades de pointes which resulted in cardiogenic shock. Temporary pacing wire insertion was planned to prevent further episodes. Due to profound hypotension, it was deemed unsafe to transfer the patient to the fluoroscopy room. Instead a balloon-tipped temporary pacing wire was to be inserted at bedside. The 6 Fr vascular sheath was inserted under assisted ultrasound localisation of the right internal jugular vein, followed by the insertion of the pacing wire. The pacing threshold was noted to be high at 3 mV. The electrocardiogram (ECG) post pacing wire insertion is shown in Figure 1a.

The patient continued to recover haemodynamically over the next few days and had no further episodes of arrhythmia. A few days later, the pacing wire was removed, with the sheath left in situ, in case further emergent pacing was required over the next few days. The patient subsequently required a tunneled dialysis catheter. During the procedure for the dialysis catheter, it was noted on ultrasound that the 'internal jugular' venous sheath was in fact within the common carotid artery. A review of the chest X-ray and transthoracic echocardiogram earlier revealed the abnormal position of the pacing wire (Figs. 1b, c and d).

The sheath in the common carotid artery was eventually removed and bleeding stopped by compression under direct pressure. A cardiothoracic surgeon was on standby in case vascular repair was required. The patient was eventually discharged to a rehabilitation hospital after a protracted hospital stay complicated by nosocomial infection.

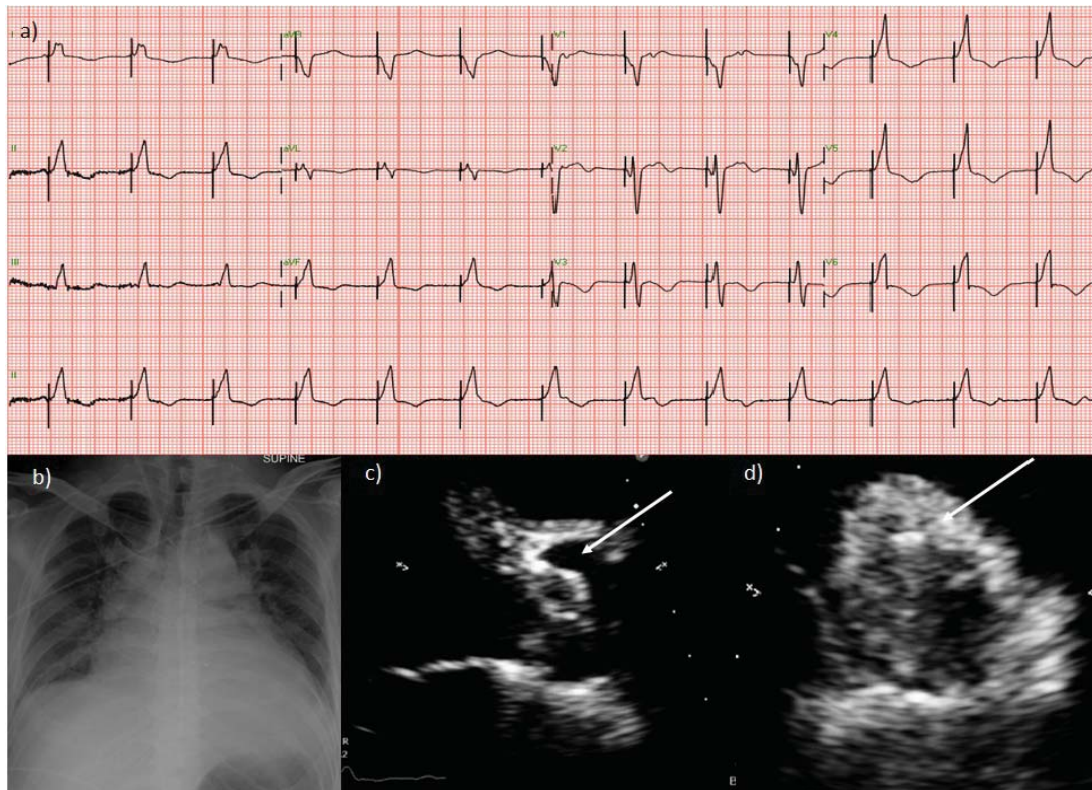


Fig. 1(a). ECG of our patient post pacing wire insertion. (b). Chest X-ray of our patient showing the atypical course of the pacing wire. (c) and (d). Transthoracic echocardiogram of our patient showing the wire in the ascending aorta, inserting into the right coronary cusp in the parasternal long axis and short axis respectively. (White arrow indicates echo-dense pacing wire tip.)

Discussion

Complications occur in 10% to 59% of temporary pacing wire insertion procedures.¹ The most common complications include failure of vascular access, failure of lead placement, sepsis, arterial puncture, lung or myocardium puncture and arrhythmias. Rare instances of malposition in the left ventricle occurred through a patent foramen ovale,² perforation of the interventricular septum³ or an anomalous vessel connecting the left subclavian vein and left atrium.⁴ These malpositions, however, were detected because of the abnormal right bundle branch block pattern on ECG.

During routine temporary pacing wire insertion, the wire tip typically rests in the apex of the right ventricle, resulting in a left bundle branch block (LBBB) pattern and a superior QRS axis (Fig. 2a). When implanting a permanent pacemaker system, operators often implant the ventricular lead in the right ventricular outflow tract, in a bid to achieve more physiologic pacing. This results in a LBBB with an inferior QRS axis (Fig. 2b). In our patient, the ECG post pacing wire insertion showed a LBBB pattern with an inferior QRS axis, indicating that the wire tip was likely near the right ventricular outflow tract. However, a transthoracic echocardiogram performed on this patient revealed the wire tip was in fact sited in the right coronary cusp, resulting in this ECG pattern. In 2002, Ouyang et al⁵ described the subtle differences between the surface ECGs of monomorphic ventricular tachycardias originating from the aortic cusp and those from the right ventricular outflow tract. Despite similar QRS morphologies, the indexes of

R-wave duration and R/S-wave amplitude were significantly lower in the superior septal right ventricular outflow tract when compared to the aortic sinus cusp patients. Our patient highlights an unusual complication of the pacing wire being inserted into the right coronary cusp producing an expected LBBB pattern and thus masquerading as correct placement within the right ventricle. The chest X-ray had also shown the atypical course of the pacing wire, which was not picked up by the attending resident. It would be important that all trainees attending to such patients be vigilant to such subtle abnormalities.

In emergent situations, in spite of assisted ultrasound localisation of the internal jugular vein, the common carotid artery can still be inadvertently cannulated, especially with their closely related anatomy and low blood pressure in a collapsed patient. Our case illustrates the importance of ultrasound guidance in the location of vascular access, and emphasises the fact that this may not be a fail-safe method, especially in a critically ill patient.

Identification before attempted removal of a pacing wire sheath is important to prevent complications. As the primary method for achieving haemostasis after sheath removal would be prolonged direct manual compression, it was also important to assess bilateral carotid arterial systems before attempted removal to prevent compromise to the cerebral circulation. Vascular surgical expertise on standby during the sheath removal as emergent vascular repair is crucial if haemostatic control is lost or neurological deficits occur.

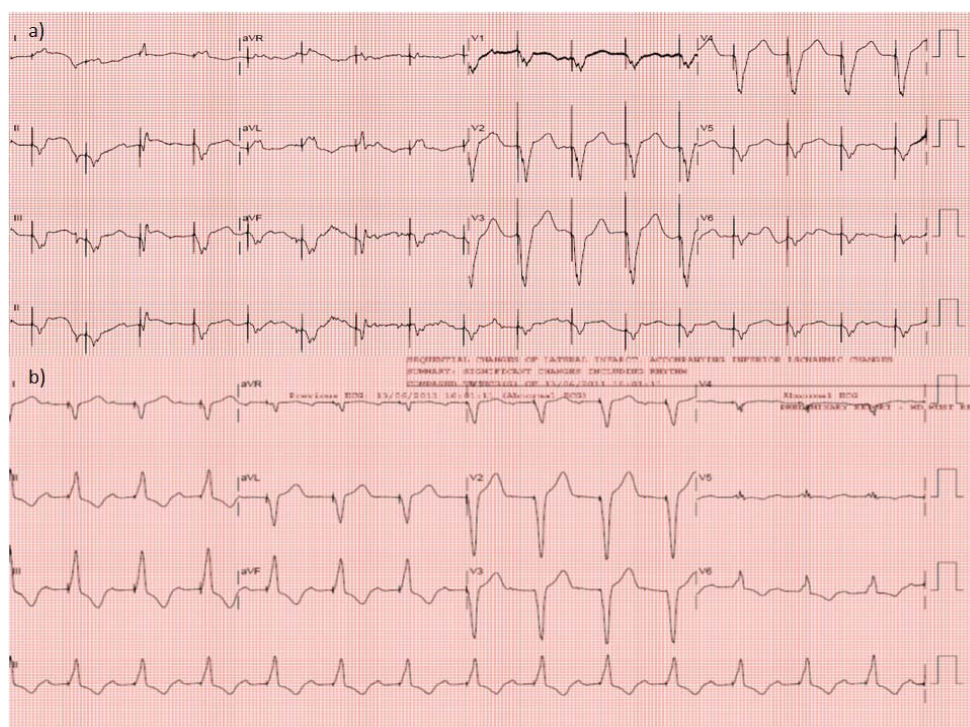


Fig. 2(a). Typical ECG of a patient with pacing wire inserted into the right ventricular apex. (b). Typical ECG of patient with the ventricular lead of a permanent pacemaker implanted in the right ventricular outflow tract.

Conclusion

Despite the relative simplicity of the procedure of a temporary pacing wire insertion, medical personnel attending to these patients must be aware of this rare complication, and be vigilant in detecting it. The case illustrates the importance of chest X-ray confirmation of lead placement and caution not just during the insertion, but also during the removal, of a pacing wire.

REFERENCES

1. Peter McCann. A review of temporary cardiac pacing wires. *Indian Pacing and Electrophysiol J* 2007;7:40-9.
2. Van Gelder BM, Bracke FA, Oto A, Yildirim A, Haas PC, Seger JJ, et al. Diagnosis and management of inadvertently placed pacing and ICD leads in the left ventricle: a multicenter experience and review of the literature. *Pacing Clin Electrophysiol* 2000;23:877-83.
3. Stillman MT, Richards AM. Perforation of the interventricular septum by transvenous pacemaker catheter. Diagnosis by change in pattern of depolarization on the electrocardiogram. *Am J Cardiol* 1969;24:269-73.
4. Gupta S, Annamalaisamy R, Coupe M. Misplacement of temporary pacing wire into the left ventricle via an anomalous vein. *Hellenic J Cardiol* 2010;51:175-7.
5. Ouyang F, Fotuhi P, Ho SY, Hebe J, Volkmer M, Goya M, et al. Repetitive monomorphic ventricular tachycardia originating from the aortic sinus cusp: electrocardiographic characterization for guiding catheter ablation. *J Am Coll Cardiol* 2002;39:500-8.

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