

CASE REPORT

An overlooked case of pacemaker-related heart failure

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Summary

This case describes an iatrogenic cause of heart failure: the pacemaker syndrome. The diagnosis was initially overlooked but in retrospect could have easily been made by reviewing the rhythm strip recorded during the echocardiogram. The patient eventually received the correct treatment to restore atrioventricular synchrony and experienced rapid resolution to her disabling symptoms.

Key Words

- ▶ cardiac pacing
- ▶ heart failure
- ▶ pacemaker
- ▶ echocardiographic quality

Learning points:

- New-onset heart failure following a pacemaker implant should be evaluated with an echocardiogram.
- Alongside pacing-induced left ventricular systolic dysfunction and pacing wire-related cardiac valve disruption, pacemaker syndrome should be considered.
- Interpreting a good-quality (showing both P waves and QRS complexes) rhythm strip can greatly aid in the diagnosis of pacemaker syndrome.

Background

Echocardiography is fundamental to the assessment of new-onset heart failure. A comprehensive study can assist the clinician with diagnosis and future steps in management. This case study brings to attention a case of new-onset heart failure, that had a delay in diagnosis (and hence appropriate treatment) but which retrospectively could have been identified at earlier stages, including during the echocardiogram.

Case presentation

An 82-year-old female presented with a history of syncope and was found to have symptomatic sinus pauses on an implantable loop recorder. She had a history of hypertension, type 2 diabetes and

paroxysmal atrial fibrillation. On echocardiography, she had a normal left ventricular ejection fraction, moderate functional mitral regurgitation, mild tricuspid regurgitation and a mildly dilated left atrium (33 mL/m²). She was referred for a pacemaker. A pre-procedure electrocardiogram showed the patient to be in atrial fibrillation with a ventricular rate of 121 beats per minute. She underwent an uneventful implant of single chamber device (lead to right ventricular apex). She was discharged the following day, and her beta-blocker was re-initiated.

A month after the implant, the patient developed shortness of breath on exertion and orthopnoea. Clinical examination revealed an elevated jugular venous pressure and peripheral oedema consistent with the heart failure syndrome.

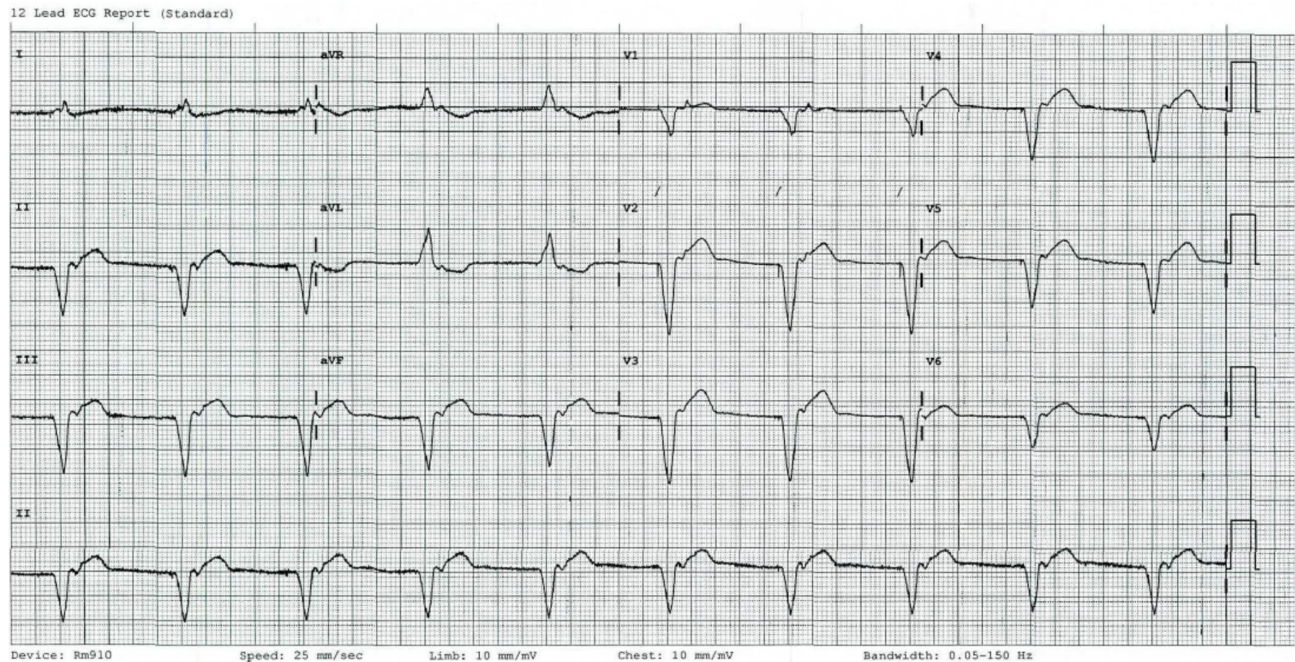


Figure 1

Twelve-lead electrocardiograph. There is a single chamber pacemaker *in situ* with a lead in the right ventricular apex.

Investigation

The patient's B-type natriuretic peptide was elevated at 1252 pg/mL. A 12 lead electrocardiogram (ECG) was reported as sinus rhythm with a profound first-degree atrioventricular block (Fig. 1). A repeat echocardiogram showed preserved LV systolic function, however, the right ventricle was dilated with failure of coaption of the tricuspid valve leaflets (Fig. 2). The right ventricular lead was not interfering with tricuspid valve function.

A pacemaker check showed 100% right ventricle pacing with stable pacing thresholds and lead impedance.

Treatment and outcome

The patient was treated as heart failure with preserved ejection fraction with intravenous diuretics. She remained on warfarin (indication: stroke thromboprophylaxis) with international normalised ratios in the therapeutic range.

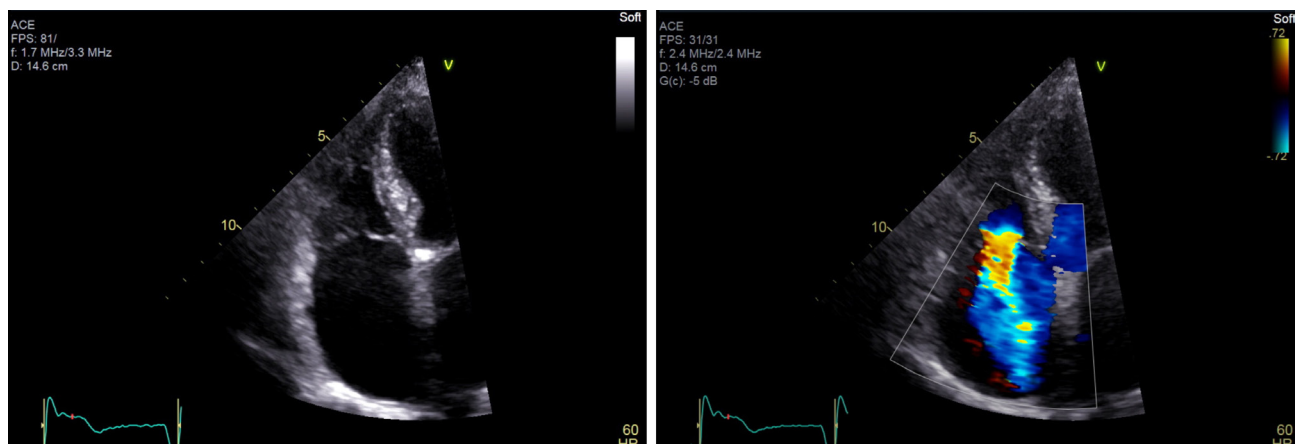


Figure 2

Apical four chamber view on transthoracic echo. There is failure of coaption of the tricuspid valve leaflets in systole (left), and this is associated with severe tricuspid regurgitation with a broad base (right).



Figure 3

Twelve-lead electrocardiograph (left) and echocardiogram rhythm strip (right) showing retrograde P waves following each right ventricular paced complex (arrows).

and hence pulmonary embolism was not considered likely. The patient was discharged home and in the subsequent two months had two further admissions with decompensated heart failure. The treating team began discussing palliative options but requested our second opinion.

On closer inspection of the previous 12 lead ECG (Fig. 3) and the rhythm strip of the transthoracic echocardiogram (Fig. 3), it was apparent that this patient had cardioverted into sinus rhythm and had developed atrioventricular (AV) dyssynchrony. Retrograde A waves are consistently seen following each right ventricle paced complex, resulting in a pacemaker syndrome. This could have been identified at the pacemaker check also. The patient underwent an upgrade to a dual chamber system with an addition of an atrial lead. Her heart failure symptoms disappeared. Her repeat echocardiogram showed that the right ventricle had remodelled and the tricuspid valve leaflets were now co-apting (Fig. 4). The trans-mitral pulse wave Doppler trace confirmed AV synchrony following the atrial lead upgrade (Fig. 5).

A repeat pacing check showed the right atrial pacing burden to be 54% and right ventricular pacing burden <1%.

Discussion

This case report emphasises the value of an adequate quality ECG trace when performing an echocardiogram and the significance of using all modalities available during a study to assess AV synchrony.

Iatrogenic causes of new-onset or progressive heart failure symptoms in patients implanted with cardiac rhythm management devices include: (1) pacing-induced left ventricular systolic dysfunction (this is most commonly observed in patients who predominately have a high burden of right ventricular pacing but may also be seen in patients with biventricular devices, particularly if the left ventricular lead is inappropriately pacing the apex of the heart); (2) pacemaker wire-related interference with tricuspid or rarely pulmonary valve function

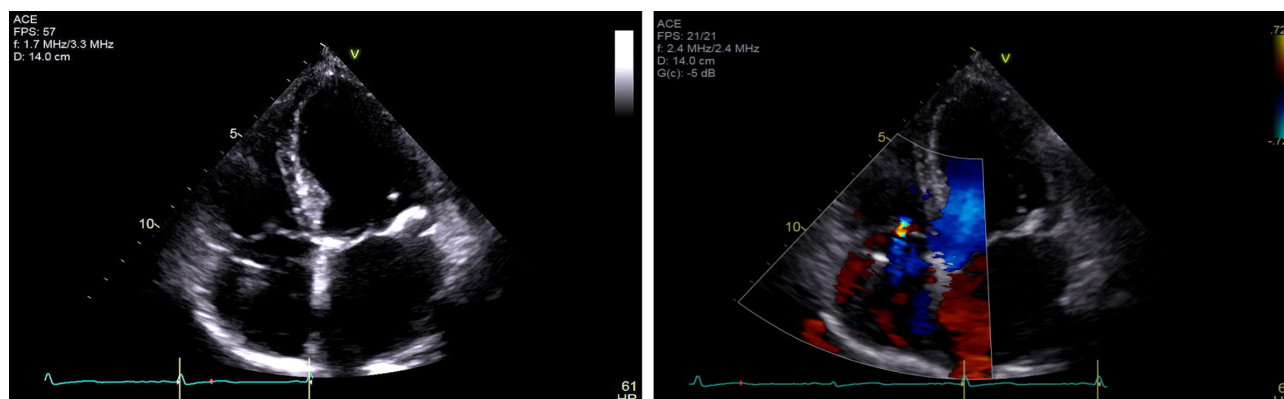


Figure 4

Apical four-chamber view on transthoracic echo following a right atrial lead upgrade. There is now coaption of the tricuspid valve leaflets in systole (left) and the tricuspid regurgitation is now only mild (right).

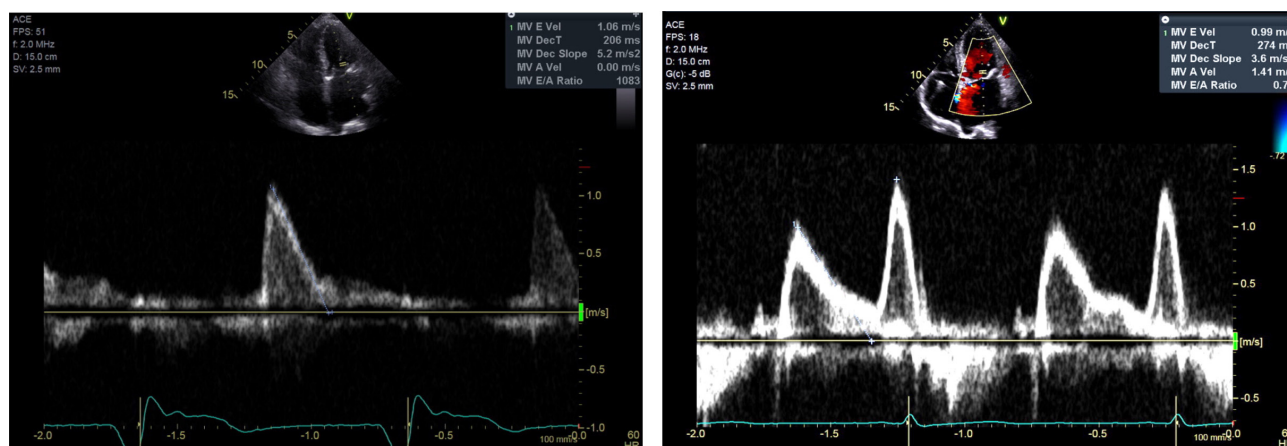


Figure 5

Transmitral pulse wave Doppler in the patient with initial single chamber device (left) and post dual chamber device (right).

and (3) pacemaker syndrome. All of these can be identified during a standard transthoracic echocardiogram. As it is pertinent to our presented case, we will focus on the latter cause.

A definition of pacemaker syndrome is not universally accepted but is considered when heart failure symptoms are associated with AV dyssynchrony. A fifth of patients with sinus node disease implanted with a single chamber pacemaker with a right ventricular lead go on to develop pacemaker syndrome (1). The true incidence is likely to be higher. In a randomised crossover clinical trial, 75% of patients who said they were satisfied with ventricular demand pacing (VVI) experience symptomatic and functional improvement when changed to dual chamber mode (DDD) (2). International guidelines advocate dual chamber pacing as a first choice in patients with intermittent and persistent sinus node disease (3).

Gross abnormalities on ECGs that raise the possibility of pacemaker syndrome are retrograde conduction, prolonged PR intervals (greater than 300ms), loss of atrial capture and nodal rhythms, which are faster than the atrial rate. Pacemaker syndrome is often underdiagnosed despite being so readily treatable. Careful review of an ECG or even a good-quality rhythm strip used during echocardiography can diagnose this condition and promote expedient treatment.

Declaration of interest

The authors declare that there is no conflict of interest that could be perceived as prejudicing the impartiality of this case report.

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Patient consent

Written informed consent has been obtained from the patient for publication of the submitted article and accompanying images.

Author contribution statement

H P wrote the initial draft. J M provided critical comments. H P and J M were involved in the patient's care.

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