Kussmaul's sign due to right ventricular pacing completely disappeared after atrial pacing

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DESCRIPTION

A 72-year-old woman was hospitalised with a history of dyspnoea with mild exertion over the course of 2 months. Three years previously, she had undergone surgery for atrial septal defect repair, and a VVI pacemaker was implanted for symptomatic sinus bradycardia. Her blood pressure at admission was 102/70 mm Hg, and a heaving internal jugular vein was observed during systole, which was reflected by the V-wave. Kussmaul's sign,¹ which involves increased central venous pressure on inspiration, was observed ([video 1](#)). Echocardiography revealed a preserved left ventricular ejection fraction with moderate tricuspid regurgitation. Electrocardiography revealed no apparent P-wave with regular ventricular pacing of 80 bpm. An electrophysiological study was performed, showing sinus bradycardia at baseline with ventriculoatrial (VA) conduction during right ventricular pacing ([figure 1](#)). An additional atrial lead was inserted, leading to AAI pacing to improve haemodynamics. The prominent systolic jugular wave and Kussmaul's sign completely disappeared immediately after the procedure ([Video 2](#)). At the 1-year follow-up, the

Video 2 Complete disappearance of symptoms, such as the heaving internal jugular vein and Kussmaul's sign.

patient was free from dyspnoea even on moderate exertion.

Atrioventricular (AV) asynchrony is a major limitation of VVI pacing. For patients who have constant VA conduction, such as this patient, haemodynamic parameters may deteriorate because of simultaneous electrical and mechanical activation of the atria and ventricles against closed AV valves. This can result in reflux of blood into the neck veins. Similar to the pathomechanism during atrioventricular nodal reentrant tachycardia which manifests as the frog sign,² VVI pacing in the present case resulted in Kussmaul's sign. Kussmaul's sign is a known manifestation of heart failure.

VVI (leadless) pacemaker implantation offers a less invasive antibradycardic treatment option in the elderly and is increasingly being performed. Kussmaul's sign in VVI pacemaker recipients may indicate the presence of VA conduction

Video 1 Heaving internal jugular vein with Kussmaul's sign.

Figure 1 Electrophysiological study during ventricular pacing of 60 bpm. Ventriculoatrial conduction is clearly shown. The paper speed was 100 mm/s. V1 and V5 represent electrocardiograms. RA, right atrium.

Patient's perspective

It was a fantastic experience. After an additional lead was inserted, my physical examination indicated that my symptoms had improved.

Learning points

- ▶ Right ventricular pacing with ventriculoatrial (VA) conduction may cause heart failure.
- ▶ Kussmaul's sign disappears soon after improvement of symptoms associated with heart failure.
- ▶ Kussmaul's sign in VVI pacemaker recipients may indicate the presence of VA conduction and haemodynamic compromise.

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and haemodynamic compromise. Therefore, these patients should be considered for dual chamber pacing, enabling AV synchrony.

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