

## Pacing via a patent foramen ovale: computed tomographic identification of unusual lead positioning

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This case describes the identification with cardiac computed tomography (CT) of an unusual atrial pacing lead position in a patient with a persistent left-sided superior vena cava. It illustrates that satisfactory pacing can be achieved despite abnormal lead placement and highlights the usefulness of CT to assess both unusual anatomy and device placement.

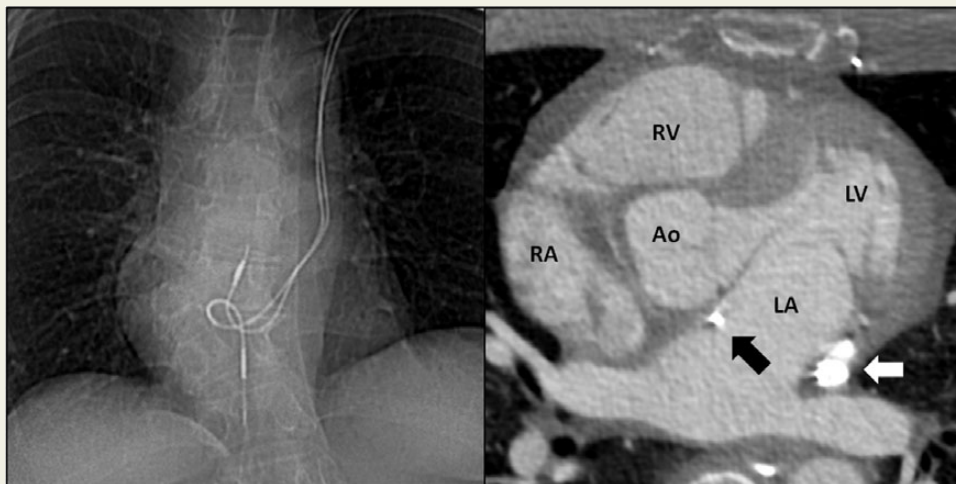
A 55-year-old woman attended for computed tomography (CT) coronary angiography for the investigation of atypical chest pain. Sixteen years ago she had undergone DDDR pacemaker insertion via a persistent left-sided superior vena cava (SVC) for Mobitz I with syncope. At implantation, acceptable pacing parameters had been recorded (acute capture threshold 1.0 V at 0.5 ms, impedance 526  $\Omega$ ), maintained in the chronic phase (threshold 1.2 V at 0.4 ms at 16 years).

The CT scout images demonstrated an unusual atrial lead position (*Figure 1*, left) and the low-dose, non-contrast acquisition used for cardiac scoring demonstrated a metal artefact in the left atrium. Contrast-enhanced cardiac CT subsequently confirmed the presence of the atrial lead tip in the left atrium, via a patent foramen ovale (PFO) (*Figure 1*, right).

Anatomical cardiac abnormalities are highly relevant in the implantation of cardiac devices. Although uncommon, access via a persistent left-sided SVC is well described and may be challenging.<sup>1</sup> Meanwhile, PFO have been utilized to obviate the need for transseptal puncture for left-sided cardiac access,<sup>2</sup> although here the presence of a PFO risked misplacement of the atrial lead. Computed tomography is an excellent modality for the delineation of anatomy and where the patients already have cardiac CT imaging prior to implantation, this can be useful to help guide the insertion of devices, particularly where it identifies unusual anatomy, or myocardial scar. Computed tomography may also be useful where procedural difficulties are encountered subsequently and recent work has even suggested a role for real-time CT guidance for complex device insertion.<sup>3</sup>

The long interval between implantation and identification of the atypical lead placement in this case illustrates that it has been of no clinical consequence. Satisfactory pacing has been achieved and, importantly, there have been no thromboembolic complications. Indeed, left atrial thrombus was excluded by the contrast CT study. Finally, the presence of a left-sided SVC and the migration of a pacing lead into the left atrium raises the possibility of an unroofed coronary sinus. These are commonly associated and would provide direct access from the vena cava to the left atrium. This pathology can be readily excluded with CT.

The imaging findings highlight the ability of cardiac CT to accurately evaluate both patient anatomy and the device system in three dimensions. This usefulness may be of particular interest in procedural planning, where satisfactory placement has proven challenging, or as a post-implantation troubleshooting tool.



**Figure 1** Left: CT 'scout' view demonstrating unusual positioning of the atrial pacing lead. Right: axial CT image demonstrating the bright tip of the pacing lead protruding into the left atrium (black arrow). The descending pacing leads can also be seen in the persistent left-sided SVC (white arrow). The cardiac chambers and the ascending aorta are marked.

**Conflict of interest:** none declared.

## References

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