

## EP CASE REPORT

# A Maze-ing crisscross interval plot: what is the diagnosis?

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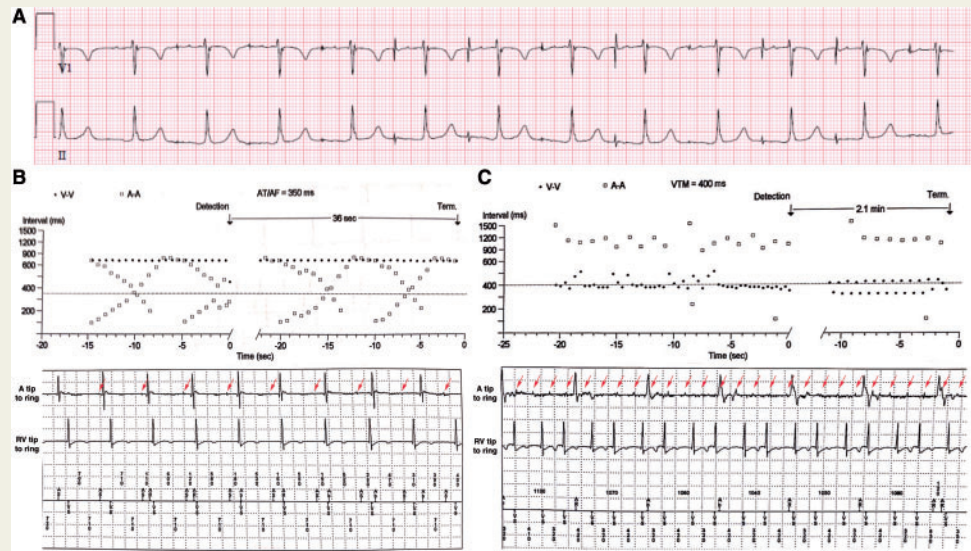
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The patient was a 65-year-old female with history of rheumatic heart disease, atrial fibrillation, bioprosthetic mitral valve replacement, left atrial appendage excision, and bi-atrial Cox-Maze IV in 2012. She underwent catheter ablation in 2015 for atypical flutter, characterized as macroreentrant involving the septum and right pulmonary veins; re-isolation of the pulmonary veins, roof line, and cavotricuspid isthmus line was performed. In 2016, a dual chamber Medtronic Advisa pacemaker was implanted for sinus node dysfunction where the 5076 CapSureFix Novus atrial lead

was positioned in the right atrial (RA) appendage. Due to prosthetic valve cuspal tear in 2019, she underwent redo bioprosthetic mitral valve replacement, tricuspid annuloplasty, and redo left atrial Maze with cryoablation. At clinic review 2 months following her redo cardiac surgery, electrocardiogram suggested sinus rhythm with tiny surface *p* waves and intermittent atrial pacing without capture (Figure 1A). On interrogation, the device was programmed managed ventricular pacing (MVP) 70–130 b.p.m. A tiny far field atrial signal, 0.1 mV amplitude was intermittently sensed together with a dissociated larger atrial signal on the bipolar channel, producing a distinctive crisscross interval plot, logged as atrial fibrillation (Figure 1B, red arrows). Ventricular activation was independent of the larger atrial signal, but the smaller atrial signal exhibited a fixed atrioventricular relationship. Asynchronous testing of atrial lead showed local but no global atrial capture at maximum output with bipolar pacing. During atypical atrial flutter, undersensed flutter signals were recorded, dissociated from the local larger atrial signal, conducting to the ventricle with 3:2 Wenckebach. This was logged as ventricular tachycardia with a tram-tracking interval plot (Figure 1C). Taken together, we deduce that the atrial lead tip was positioned in an isolated region of atrial myocardium with independent pacemaker activity exhibiting intra-atrial entry and exit block, likely consequent to bi-atrial Maze surgery.

The Cox-Maze IV lesion set typically includes two lateral RA lines; one from the tricuspid annulus at 10 o'clock (viewed from the atrium) to the lateral RA anterior to the sinus node, and another from 2 o'clock on the annulus to a line connecting the superior and inferior vena cava.<sup>1</sup> Part of the RA appendage is activated via a corridor posterior to the 10 o'clock line. Sinus node dysfunction can arise from this lesion set.<sup>2</sup> In our case, isolation of myocardium containing a lower portion of the sinus node or appendage pacemaker by surgical or endogenous scar may explain the findings. Review of previous device check and surface ECGs suggest that signs of intra-atrial block could be observed 1 year following pacemaker implantation, highlighting the importance of taking account of RA activation, and scar pattern in selection of atrial lead implantation sites. As the intrinsic atrial pacemakers were robust and atrioventricular synchrony was largely preserved with minimal ventricular pacing (3.5%) in MVP mode, device settings were left unchanged with atrial sensitivity level set at the minimum value. Device



**Figure 1** Surface electrocardiogram and arrhythmia episodes on device check.

clinic follow-up was arranged in 3 months. In conclusion, a crisscross atrial interval plot is an unusual pattern characteristic of intra-atrial block and two independent atrial pacemakers.

## Data availability

De-identified primary data is available upon reasonable request.

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**Conflict of interest:** none declared.

## References

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