Conduction variability at the mitral isthmus lesion; What is the mechanism?

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November 12, 2020

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Short title: Conduction variability at the mitral isthmus

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Conflicts of interest : none

Funding : none

Key words

Atrial fibrillation; mitral isthmus; Wenckebach conduction; ablation; conduction block

Case presentation

A 66-year-old man was referred for a third procedure for recurrent atrial fibrillation (AF) after two previous failed pulmonary vein isolations (PVIs). During the procedure, the right pulmonary vein was reconnected and re-isolated. The linear ablations targeting the left atrial roof, posterior mitral isthmus (MI), and cavotricuspid isthmus were also performed. After radiofrequency catheter ablation (RFCA) from the coronary sinus (CS), the atrial electrograms (EGMs) recorded in the CS changed to a proximal-to-distal activation sequence, and MI block was confirmed by the differential pacing maneuver (Figures 1A and 1B). During the observation period, the intervals between the stimulus and atrial activation sequence recorded in the CS varied during pacing from the left atrial appendage at a pacing cycle length (P-CL) of 600 ms (Figure 2). What is the mechanism of the conduction variability observed at the MI lesion?

Commentary

EGMs recorded in the distal part of the CS demonstrated double components. The first one was a low amplitude and frequency signal demonstrating a distal-to-proximal activation sequence, indicating the far-field left atrium (LA) EGMs. The second one was a high amplitude and frequency signal demonstrating both middle-to-distal and middle-to-proximal activation sequences, indicating the near-field CS EGMs. The interval between the stimulus and the first component recorded in the CS 1-2 to CS 5-6 gradually prolonged and shortened again, suggesting a Wenckebach periodicity at the endocardial MI lesion. This phenomenon was repeatedly observed. Consolidation RFCA was performed to the endocardial MI lesion, resulting in MI block again.

An incomplete MI block increases the risk of developing peri-mitral atrial flutter (PM-AFL), which is the most frequent post-AF ablation macro-reentrant tachycardia.[1]Considering that both slow conduction and unidirectional block contribute to initiate and maintain the reentrant tachycardia,[2]these phenomenon might be observed in the initiation of PM-AFL. However, that has rarely been observed in the initiation of PM-AFL. It is noteworthy that the present case described a Wenckebach periodicity at the endocardial posterior MI lesion presenting with gradual conduction delay, and subsequent conduction block and conduction recovery. Because these findings are useful to recognize an early reconnection of MI lesion, and to understand the underlying mechanisms of an arrhythmogenic substrate that can lead to development of reentrant tachycardia, that is, PM-AFL.

References

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Figure legends

Figure 1.

Electrograms (EGMs) during left atrial appendage (LAA) pacing at a pacing cycle length (P-CL) of 600 ms.

(Left panel) Atrial EGMs recorded in the coronary sinus (CS) demonstrate a distal-to-proximal activation sequence before achieving mitral isthmus (MI) block.

(Right panel) Atrial EGMs recorded in the CS demonstrate a proximal-to-distal activation sequence after achieving MI block. MAP is located at the endocardial MI lesion. The interval between the stimulus and EGM recorded on the MAP is 190 ms.

Figure 2.

Intracardiac EGMs during LAA pacing at a P-CL of 600 ms.

Figure 3.

Detailed description of the Figure 2.

Atrial EGMs recorded in the CS showing the reconnection of MI lesion. EGMs in the CS showing double components: far-field left atrium (LA) EGMs with low amplitude and frequency demonstrating a distal-to-proximal activation sequence (arrows) and the near-field CS EGMs with high amplitude and frequency demonstrating a middle-to-distal activation sequences of the CS (arrowheads). MI, mitral isthmus; S, stimulus. Note that the intervals between the stimulus and far-field LA EGMs recorded in the CS 1-2 to CS 5-6 gradually prolong and shorten again (numbers), indicating a Wenckebach periodicity at the posterior MI lesion.

Figures

Figure 1

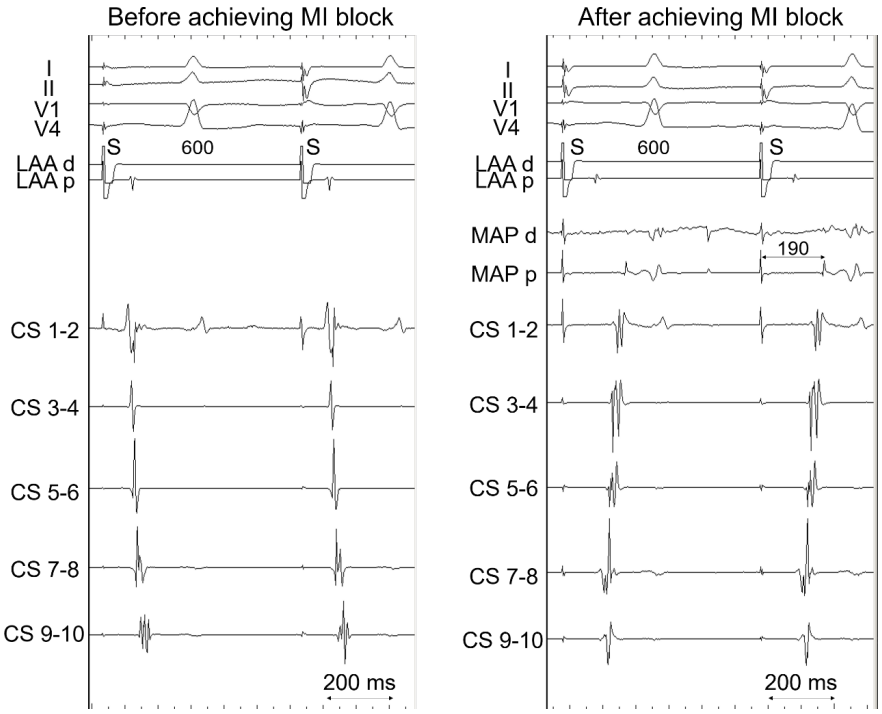

Figure 2

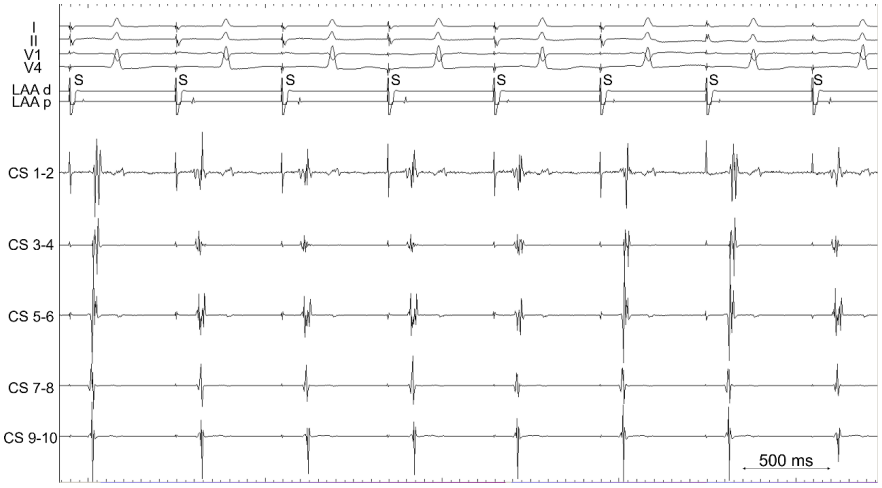

Figure 3