Mitral isthmus ablation: the importance of epicardial connections between the coronary sinus and Marshall bundle

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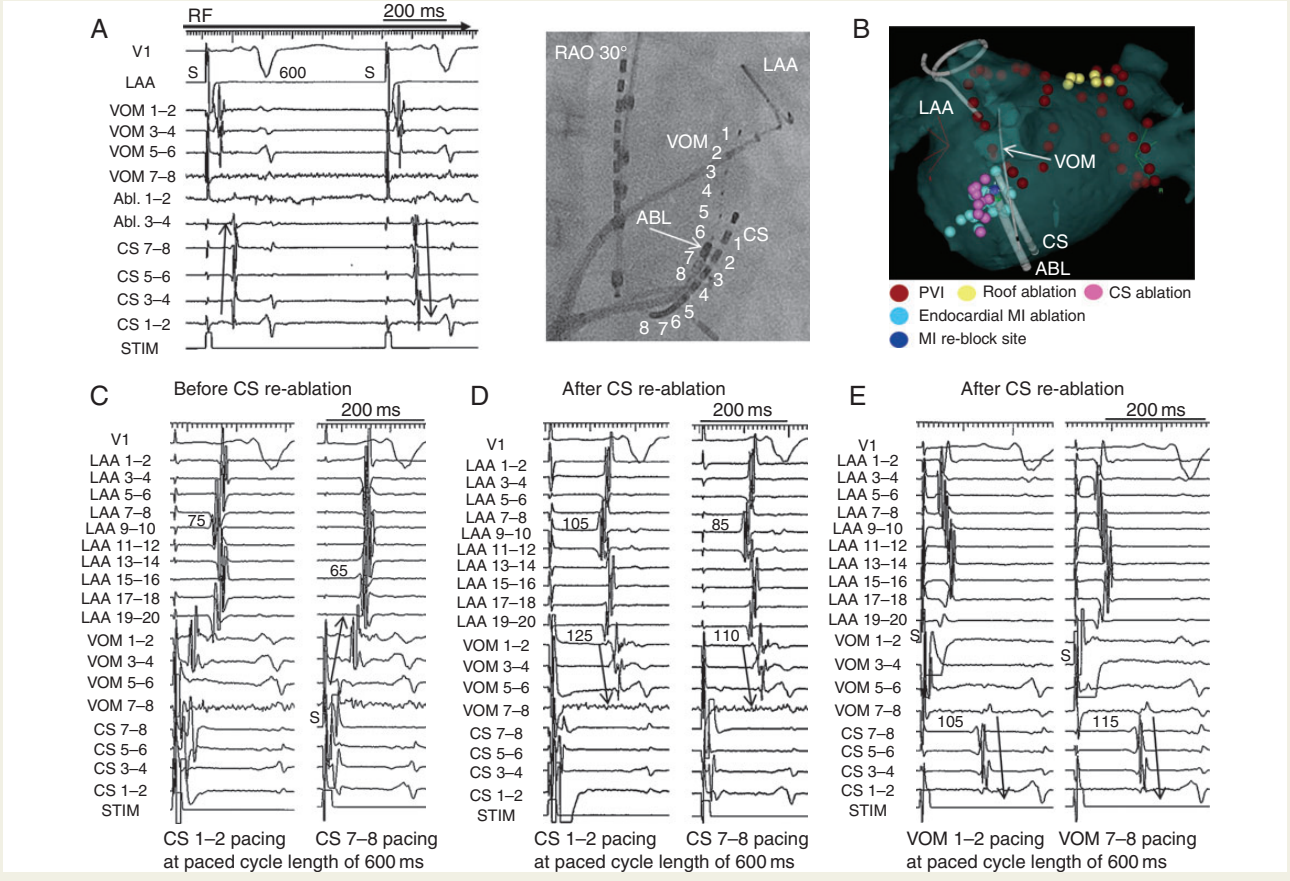
The ligament of Marshall is an epicardial vestigial fold that contains the vein of Marshall and a myocardial sleeve called the Marshall bundle (MB). If the MB epicardial connections bypassing endocardial mitral isthmus (MI) are present, it should be blocked to achieve a complete MI block. We report the first case to create the MB conduction block by disconnecting the coronary sinus–MB connections.

Case presentation

A 47-year-old man underwent ablation for persistent atrial fibrillation. Pulmonary vein isolation and linear ablation of the roof and mitral isthmus (MI) were performed. Coronary sinus (CS) activation sequence during left atrial appendage (LAA) pacing changed to proximal to distal during CS ablation to achieve MI block (see Supplementary material online). With differential pacing technique, the conduction time from CS 1–2 to LAA during CS 1–2 pacing was longer than that from CS 3–4 to the LAA during CS 3–4 pacing. However, the MI block was incomplete, because the LAA activation sequences during pacing from the 2 remote CS sites (CS 1–2 and CS 7–8) were different (see Supplementary material online).[1] An epicardial conduction pathway via a Marshall bundle (MB) bypassing endocardial MI was suspected, and a 2 Fr octapolar electrode catheter was inserted into the vein of Marshall (VOM). Twenty minutes after CS ablation, CS activation returned to the distal to proximal sequence during LAA pacing. Radiofrequency energy was again applied in CS, whereby the activation sequence successfully changed to proximal to distal (*Figure A* and *B*). The conduction time from CS 1–2 to LAA during CS 1–2 pacing was longer than that from CS 7–8 to LAA. The LAA activation sequences during CS 1–2 pacing were identical to those during CS 7–8 pacing (*Figure D*). These observations proved a complete MI block. Interestingly, VOM activation sequence during CS pacing changed from proximal to distal to distal to proximal after CS re-ablation (*Figure C* and *D*). The conduction time from CS 1–2 to VOM 1–2 during CS 1–2 pacing was longer than that from CS 7–8 to VOM 1–2 during CS 7–8 pacing. The conduction time from



VOM 3–4 to CS 7–8 during VOM 3–4 pacing was also longer than that from VOM 1–2 to CS 7–8 during VOM 1–2 pacing (*Figure E*). These findings indicated the complete bidirectional block of the CS–MB connections.

The ligament of Marshall is an epicardial vestigial fold that contains the VOM and a myocardial sleeve called the MB. Recent electrophysiological and histological studies have shown that connections between the MB and CS and/or left atrium are common.[2–4] If these connections bypass the MI, they need to be blocked in order to achieve complete MI block. Previous reports mentioned three methods to create a MB conduction block: ridge ablation to disconnect MB-left atrium connections, ablation within VOM, and ethanol infusion into VOM.[1,5] To our knowledge, ours is the first case to demonstrate the use of CS ablation during MI block creation for disconnecting CS–MB connections. Close attention should be paid to the presence of MB epicardial connections for MI ablation, whereby complete MI block may be successfully achieved without excess radiofrequency application.

Supplementary material

Supplementary material is available at *Europace* online.

Conflict of interest: None declared.

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