Complete Bidirectional Conduction Block of the Marshall Bundle-Left Atrium Connection Utilizing High-Resolution 3D mapping system.

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Introduction: Atrial tachycardia (AT) involving an epicardial connection of the Marshall bundle (MB) has been recently reported. We present a case in which the MB-left atrium (LA) connection was observed using a high-resolution 3D mapping system.

Methods: A 69-year-old man with AT was admitted for catheter ablation. He had a history of multiple catheter ablation procedures of bilateral extensive pulmonary vein isolation, complex fractionated atrial electrogram, roof and bottom lines, mitral isthmus block line, cavitricuspid isthmus line, and superior vena cava isolation. During the AT (cycle length 308 ms), an endocardial activation map in the LA was attempted with the Rhythmia mapping system using Orion mapping catheter (Boston Scientific, Marlborough, MA).

Result: The activation map revealed a macro-reentrant AT including the left atrial appendage (LAA), mitral annulus, and the scar tissue at the mitral isthmus in a counterclockwise direction. However, the local activation time did not fulfill the cycle length of the AT. Suspecting an involvement of epicardial connection of the vein of Marshall (VOM), a 2-Fr octapolar electrode catheter was inserted into the VOM through a coronary sinus, and electrograms on the VOM were recorded. The activation map involving the MB potentials completely fulfilled the entire reentrant circuit. The post-pacing interval at the VOM was equal to the tachycardia cycle length. Radiofrequency ablation was subsequently applied at the left atrial ridge targeting the VOM close to the potentials recorded in the 2Fr catheter, and the AT successfully terminated. Thereafter, both MB and local LA potentials were identified on the electrograms of the VOM during the LAA pacing. The activation sequence on the electrogram of the MB was distal to proximal, which indicated the residual connection of a distal MB-LA site. The high-resolution mapping during LAA pacing demonstrated an accurate site of the distal MB-LA connection. Immediately after ablation of the site, the first potentials (MB potentials) were markedly delayed and were not distinguishable from the second potentials (local LA potentials). It was assumed that only one connection (MB-CS) had been left conducting in this case. The differential pacing site method showed that the conduction time from the distal portion of the VOM to LAA (181 ms) was longer than that from the proximal portion of the VOM to LAA (155 ms), which confirmed complete bidirectional block of the MB-LA connections. No further ATs were induced after the procedure.
Conclusion: We illustrated the case in which a high-resolution mapping could identify the precise breakthrough site from epicardium to endocardium via the MB, facilitating spot ablation to terminate AT and to achieve bidirectional conduction block of the MB-LA.