Mitral Regurgitation as the Cause of Atrial Tachycardia – 3-Dimensional Mapping and 3-Dimensional Transesophageal Echocardiography –

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Figure 1. Three-dimensional electro-anatomical mapping of left atrium merged with contrast-enhanced computed tomography (CT) during left atrium atrial tachycardia (LA-AT). (A) Voltage map: activation map during LA-AT. (B) Fractionated potentials recorded inside the low-voltage region and LA-AT terminated by linear ablation in this region. CL, cycle length.
An 83-year-old woman with a history of hypertension, but no past history of cardiac surgery or catheter ablation, had exertional palpitation for 2 years. She had left atrial dilatation (55 mm) and preserved left ventricular ejection fraction (55%) on transthoracic echocardiography, and atrial tachycardia (AT) with 1:1 to 2:1 atrioventricular conduction on 24-h Holter electrocardiography. We performed 3-dimensional (3-D) electroanatomical mapping merged with contrast-enhanced computed tomography during AT, and constructed an activation map and voltage map based on AT. The voltage map indicated localized dense scar (0.1–0.3 mV) between the left pulmonary vein and left atrial appendage. We changed the voltage scar definition to 0.05–0.1 mV to the left atrium, to show the localized dense scar in more detail. Lowering of the voltage scar definition also enabled identification of the channel of this dense scar area. The activation map indicated that this tachycardia cycle length was 394 ms and that the activation duration was >90% fulfilled in this dense scar area (Figure 1A). Fractionated potentials were recorded inside the low-voltage region and the activation map suggested that this site was the channel of this tachycardia. This AT was terminated by linear ablation crossing the abnormal low-voltage region (Figure 1B).

Finally, 3-D transesophageal echocardiogram indicated severe mitral regurgitation (MR), in which the turning flow of MR obviously hit the left atrial wall in the localized dense scar area (Figure 2).

To the best of our knowledge, this is the first report to show that left AT was caused by atrial scar due to MR flow, which could be clearly seen on merging 3-D electroanatomical mapping and 3-D transesophageal echocardiogram. Further, the lowering of the scar-definition voltage to 0.05–0.1 mV clearly identified the channel of AT.

MR increases left atrial volume, but it remains unclear as to how MR flow affects the left atrial muscles. In this case, the channel of the tachycardia was visualized on 3-D electroanatomical activation map, between the left pulmonary vein and left atrial appendage, where the localized dense scar area existed. The MR flow clearly hit this localized spot, which...
was identified on 3-D transesophageal echocardiogram. According to a previous report, lowering of scar-definition voltage is useful to identify the channel of ventricular tachycardia; therefore we applied this mapping to the atrium and defined it as 0.05–0.1 mV. It is well known that the main causes of AT are surgical repair of congenital heart disease, circumferential pulmonary vein ablation of atrial fibrillation and tachycardia-mediated cardiomyopathy. MR flow, however, has not previously been clearly demonstrated as the cause of AT, probably due to limited visualization power. Here we report unknown scar as a cause of AT induced by MR flow, which was visually detected using 3-D systems.

There are some limitations in this case. First, although it has been reported that endothelial damage can be observed in patients with MR or mitral stenosis, we have no direct evidence that the turning flow of MR caused the scar area in this case, which might have occurred coincidentally. Second, future studies are required to confirm that MR flow is able to directly cause localized dense scar in left atrium.

**Disclosures**

None.

**References**