Successful elimination of recurrent ventricular tachycardia by epicardial ablation over coronary artery supplying postinfarction aneurysm

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Introduction

Ventricular tachycardias (VTs) in patients with structural heart disease are frequent targets for catheter radiofrequency (RF) ablation. However, in individual patients, this may be a challenging procedure owing to various reasons, such as intramural location of the substrate and/or its inaccessibility. For such scenarios, alternative methods have been introduced.1–5 Aside from these techniques, we report a novel technique of modification of arrhythmogenic substrate. We also introduce a sensitive method for visualization of a concealed thrombus within the left ventricle by means of intracardiac echocardiography (ICE).

Case report

A 78-year-old man with an old anterior myocardial infarction and an aneurysm at the left ventricular (LV) apex was referred for catheter ablation owing to VT storm. Arrhythmias recurred despite chronic treatment with beta-blockers and amiodarone (Figure 1A). Before the procedure, contrast transthoracic echocardiography (SonoVue, Bracco, France) was performed and no endocavitary thrombus was detected. The radiograph revealed a calcification at the LV apex (Figure 1B). During the first procedure, transseptal access for LV endocardial mapping with the irrigated 3.5-mm-tip catheter (ThermoCool Navi-Star, Biosense Webster, Diamond Bar, CA) and electroanatomical mapping system (Carto3, Biosense Webster) were used. A large area without local electrograms was identified within the LV apex (Figure 1C). This area could not be visualized with ICE catheter (AcuNav, Siemens Healthcare, Erlangen, Germany) by conventional views from the right ventricle. Therefore, the ICE probe was inserted into the LV via the transseptal access and an old laminar thrombus was clearly visualized within the LV aneurysm (Figure 1D, white arrowhead). The presence and extent of the thrombus were later confirmed by computed tomography angiography (Figure 1E). There was a large area around the thrombus where a long stimulus-QRS duration was observed. Despite extensive RF applications, only late termination of ongoing VT could be achieved and VT recurred after the procedure. Subsequently, epicardial subxiphoid access was obtained and electroanatomical mapping revealed a large scar area that corresponded to the calcified aneurysm (Figure 1F). Coronary angiography showed a small collateral branch from the right coronary artery to the left anterior descending artery feeding the region of the aneurysm (Figure 2A, black arrow). The ablation strategy was focused initially on circumferential ablation around the scar area with sparing the above collateral vessel.
Figure 1  Various modalities showing the left ventricle. A: A 12-lead electrocardiogram of the clinical ventricular tachycardia. B: Radiograph with a right anterior oblique (RAO) view showing calcification at the apex. C: Electroanatomical endocardial voltage map of the left ventricle with RAO view showing a scar area at the apex. D: Intracardiac echocardiography from the left ventricle (LV) cavity revealing a laminar thrombus at the apex (white arrowheads). E: Computed tomography angiography showing a thrombus beneath the calcified epicardium (white arrowheads). Ao = aorta; LA = left atrium. F: Electroanatomical epicardial voltage map showing a broad scar area at the apex. Electroanatomical map tag definition: gray = scar; red = ablation point; pink = fractionated potential.
However, owing to remaining inducibility of clinical VT, ablation was extended over the collateral branch (60 seconds with 30 watts). This resulted in its occlusion, as was subsequently verified by coronary angiography (Figure 2B, white arrowhead) and in noninducibility of VT. The patient was free of VT recurrences for 6 months of follow-up.

Discussion

Our case demonstrates successful elimination of VT in a difficult scenario of recurrent VT and old laminar thrombus covering the endocardial surface of the LV aneurysm. Although the presence of endocavitary thrombus may increase the thromboembolic risk, the thrombus in our case was apparently old and organized with no mobile structures, and persisted despite chronic anticoagulation therapy. We showed in our previous series that endocardial ablation under such circumstances is feasible and has a reasonable safety profile. However, in the current case the thrombus covered critical portions of the substrate for clinical VT and prevented effective endocardial ablation. By coincidence, the arrhythmogenic substrate was protected also from the epicardial side by calcifications, which made it inaccessible for conventional epicardial RF catheter ablation. For such cases, various alternative approaches have been introduced: (1) alcohol ablation of coronary vessel, (2) coil embolization of coronary artery, (3) bipolar RF ablation, (4) stereotactic ablative radiosurgery, and (5) intramural needle catheter ablation. Each approach has its advantages and limitations. In the current case, we aimed initially for both endocardial and epicardial circumferential ablation, but eventually succeeded only by closing a small branch of the right coronary artery that formed collateral for remnants of the left anterior descending artery.

In general, ablating <5 mm to the coronary artery is not recommended, as it increases risk of damage, resulting in myocardial infarction distal to the site of injury. In our case, the artery was ablated on purpose with the intent to modify underlying inaccessible substrate. The extent of resulting myocardial damage was estimated by coronary angiography before application. Alternatively, the participation of the perfused region in the arrhythmia mechanism could be verified by rapid ice-cold saline injection into the target vessel. If termination of ongoing VT would be achieved by this maneuver, it would strongly support the hypothesis that occlusion of the branch would abolish the arrhythmia. In our case we did not opt for this test, since the intervened branch was small, was difficult to cannulate, and clearly supplied the aneurysm. Besides the above-described strategies, surgical aneurysmectomy could be another therapeutic option; however, the patient was elderly with other comorbidities, which would increase the risk of open-chest surgery.

Epicardial calcifications have been reported in 8% of cases after myocardial infarction. Such a finding significantly impairs the ability of transthoracic echocardiography to detect intracardiac thrombi. In our case, the old laminar thrombus covering the inner surface of the aneurysm could not be detected even with the use of echocardiographic contrast. Besides contrast echocardiography, either multidetector computed tomography or magnetic resonance imaging may be considered as the gold standard for detection of intracardiac thrombus. However, both methods have certain limitations and contraindications. Under such circumstances, direct imaging of the LV endocardium from the LV cavity by ICE may provide even more detailed information. This requires either a transseptal puncture or the presence of a patent foramen ovale.
ovale. The former is theoretically more preferable, since it allows easier manipulation with the ICE catheter.

**Conclusions**

In the current case, we introduced 2 novel techniques for diagnostics of old organized laminary endocardial thrombus and for catheter modification of the otherwise inaccessible arrhythmia substrate. The efficacy and safety of these techniques must be proven in future studies.

**References**

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