Case report

The potential role of scar mapping in assessing of paroxysmal atrial fibrillation recurrence after cryoballoon application

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ARTICLE INFO

Article history:
Received 6 May 2016
Received in revised form 7 June 2016
Accepted 10 June 2016
Available online 23 June 2016

Keywords:
Atrial fibrillation
Mapping
Ablation
Cryoballoon
Radiofrequency

ABSTRACT

Cryoballoon ablation for atrial fibrillation (AF) has become a frequently used therapy after failure of at least one antiarrhythmic drug. The main target of AF ablation has been durable pulmonary vein isolation. However, it is unclear if ablation strategies need to be modified after recurrence. Herein, we presented a female patient undergoing successful pulmonary vein re-connection ablation after left atrial scar mapping. In electroanatomical mapping, gray area shows intense scar tissue. Gray, red, and purple areas indicate atrial potentials <0.5 mV, 0.5–1.5 mV, and >1.5 mV, respectively. Please note that there is a non-scar area in the bottom of right inferior pulmonary vein (arrow).

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Introduction

At this time, pulmonary vein isolation (PVI) is the recommended treatment for patients with drug-resistant paroxysmal atrial fibrillation (PAF). Cryoballoon ablation may be used as an alternative to radiofrequency (RF) ablation with similar success rates in patients with PAF. In nearly all cases in which AF recurs after PVI, 1 or more of the pulmonary veins (PVs) is found to have re-established electrical connection to the atria.1–3 Gaps in the line of ablations4 or failure to produce completely transmural lesions5 are thought to be the main responsible mechanism of PV reconnection. If the actual mechanism of electrical reconnection is understood, it may increase to ratio of more durable PVI or may cause modification of current ablation approach. To discuss possible mechanisms of PV reconnection, we presented a female patient in whom left atrial scar mapping was performed to define cause of PV re-connection.

Case

A 64 year old female patient had undergone PVI with cryoballoon in our center 14 months ago. The patient was being followed as part of a research project. The patient was asymptomatic and Holter monitoring showed no new episode during 1, 3, 6 and 12 months follow-up visits. During previous cryoballoon application, PV potentials had been detected in each of the 4 pulmonary veins and isolated successfully. She admitted to our emergency department with haemodynamically intolerable palpitation two weeks ago. Atrial fibrillation with high ventricular response was detected on her admission ECG. Restoration of sinus rhythm was achieved by electrical cardioversion with 150 J biphasic shock. Due to previous ablation procedure, we decided to perform new procedure to define and treat the arrhythmia. Transthoracic echocardiography showed that left atrial diameter is 4.5 cm and left ventricular EF is 55%. To determine recurrence probability of new ablation procedure, we decided to define left atrial scar by using Ensite Velocity scar mapping system. The atrial potentials which are smaller than 0.5 mV accepted as intense scar on sinus rhythm. As expected, wide atrial scar area was detected due to previous cryoapplication (Figs. 1 and 2). However, there was only one region demonstrating atrial potentials greater than 1 mV in the bottom of right inferior PV (Figs. 1 and 2). Not surprisingly, intracardiac recordings showed re-connection only in this region. Intense scar tissue was not detected in the rest of the left atrium and the other 3 pulmonary vein still seems isolated. So, we decided to perform RF ablation in only that site. After ablation and at 3 months follow-up, no further tachycardia was noted.

Discussion

In the present case, we used scar mapping feature of electroanatomical mapping system to define the actual cause of recurrence. It has been known over longer time periods that there are some possible
mechanisms related with reconnection of PV conduction. Kowalski et al.6 demonstrated that scar tissue due to PVI may exhibit nuclear pyknosis and myocytolysis after the index ablation, suggesting that some of left atrial tissue may remain viable and capable of recovery over a prolonged period of time. However, recurrence of AF may occur despite of durable PVI. As a potential explanation, recurrent AF might be triggered and maintained by tissue outside the PVs in these patients.7,8 Surprisingly, reconnection of PVs may be seen even in patients without recurrent AF. So, clinical importance of reconnection remains uncertain.

It is well known that consistent PVI can be obtained if transmural and contiguous lesions are achieved. To indicate transmural damage, late gadolinium enhancement with magnetic resonance imaging may be used which can identify transmural level of scar tissue5 even also distinguish scar from edema.9 Although there are some contradictory thoughts, Kowalski et al.6 have provided objective pathological evidence supporting the hypothesis that PV reconnection may be caused by a failure to achieve a transmural lesion despite acute evidence for isolation.

In our case, we detected healthy tissue in the bottom of right inferior PV. When we investigated this site for PV potentials, we defined PV reconnection. So, we speculated that the main reason of PV re-connection may be non-transmural nature of previous ablation lesion. The evaluation of scar tissue by using electroanatomical mapping systems may show main responsible mechanism whether PV reconnection or ineffective lesion. In the relevant literature, scar mapping was used as a tool to assess overall extension of left atrial scarring. However, in our case, we used scar mapping to demonstrate nature and cause of gap in PV ablation line. This may be an important difference from previous studies.

For today, independently whether AF paroxysmal or persistent, quantity of left atrial scar tissue may determine clinical success rate of ablation procedure. Therefore, the determination of scar quantity by...
using scar mapping or magnetic resonance imaging must be kept in mind especially in patients presenting with recurrence after cryoballoon application.

References


