Intracardiac echocardiography to guide catheter ablation of an accessory pathway in Ebstein's anomaly. A case report

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Abstract

We present the case of a 17-year-old girl with Ebstein anomaly and repeated episodes of reentrant tachycardia due to a right posterior accessory pathway. Catheter ablation was performed using intracardiac echocardiography. A ViewFlex Xtra probe was inserted and showed an abnormal tricuspid valve with elongated anterior leaflet and low insertion of the septal leaflet towards the apex. The anatomical annulus was identified by the course of the right coronary artery. RF application on the posterior annulus stopped the reentrant arrhythmia. After ablation, programmed stimulation showed absence of both antegrade and retrograde conduction through the accessory pathway.

Keywords: Ebstein's anomaly; tricuspid valve; intracardiac echocardiography; catheter ablation; accessory pathway

Introduction

Ebstein's anomaly is characterized by the apical displacement of the tricuspid valve with tricuspid regurgitation, enlarged right chambers, atrial septal defect in up to 75% of patients, and arrhythmias, in special atrial fibrillation. Patients with Ebstein's anomaly also have a high incidence of reentrant arrhythmias due to accessory pathways (AP) [1]. Most of the APs were demonstrated to be localized at the level of the anatomical tricuspid annulus in the atrialized right ventricle and not at the level of displaced valve (functional tricuspid valve) [2]. The success rate of catheter ablation for AP in Ebstein's anomaly approaches 76% compared to 95 % in patients with APs without Ebstein's anomaly [3]. We present the case of a

young girl with Ebstein's anomaly and recurrent episodes of supraventricular tachycardia treated with catheter ablation guided by intracardiac echocardiography.

Case report

A 17-year-old girl with Ebstein's anomaly (fig 1) was hospitalized for repeated episodes of paroxysmal supraventricular tachycardia that started 5 months before her presentation. She had been under treatment with Verapamil 40 mg for the last 4 months. The physical examination found a systolic murmur grade II, without any sign of left or right heart failure. Twelve-lead electrocardiography (ECG) showed sinus rhythm 70 beats per minute (bpm), with incomplete right bundle branch block (RBBB), normal PR interval, and no delta wave. The lab tests were normal.

During the electrophysiological study we identified an orthodromic reentrant tachycardia (ORT) with a cycle length of 320 msec. The accessory pathway had only retrograde conduction in the basal state or during stimulation. Anterograde conduction was present only after administration of 10 mg Adenosine and persisted for 6 seconds.

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Fig 1. Bidimensional four-chamber apical view, transthoracic echocardiography: a) distance between the insertion of the septal tricuspid valve and the mitral valve insertion is 35 mm (double arrow); b) the anterior tricuspid leaflet is elongated, but normally inserted (arrow).

Catheter mapping of the accessory pathway was performed under intracardiac echocardiography (ICE) guidance using the ViewFlex Xtra probe and ViewMate Zonare-Saint Jude Medical Intracardiac console. The probe was inserted through the right femoral vein, inside the right atrium. The tricuspid valve had an elongated anterior leaflet and a septal leaflet inserted towards the right ventricular apex (fig 2a,b). We identified both the anatomical and functional tricuspid annulus. The presence of the right coronary artery was used to identify the anatomical annulus and the insertion of the septal leaflet of the tricuspid valve was used to identify the functional annulus. Catheter ablation was performed at the level of anatomical annulus (fig 2c,d). During ORT we mapped the tricuspid annulus using a Halo catheter with 20 poles. We identified a spot in the posterior anatomical tricuspid annulus where the VA interval during ORT was 40 msec and A potential earlier than any other potential of the Halo catheter (fig 3). RF application at this level stopped the reentrant tachycardia with complete elimination of the accessory pathway. The periprocedural evolution was without any local femoral or cardiac complications. At 1 month follow-up the patient presented no more episodes of palpitation.

Discussions

APs are present in approximately 25% to 30% of patients with Ebstein's anomaly. The apical displacement of the septal leaflet is associated with a discontinuous annulus and myocardium can pass between the right atrium and right ventricle which constitutes an accessory connection responsible for the ventricular preexcitation. One-third of patients with Ebstein's anomaly have mini-

Fig 2. Intracardiac echocardiography: a) localization of the anatomical annulus (identified by the presence of the right coronary artery); b) localization of the functional annulus (identified by the presence of the septal leaflet of the tricuspid valve); c) during mapping, the ablation catheter is first inserted to the right ventricle apex where a high ventricular potential is present, and then (d) pulled-back at the level of the anatomical annulus, where a good electrogram was found on the posterior annulus with high amplitude ventricular and atrial potential. 1 – right coronary artery; 2 – anterior leaflet; 3 – septal leaflet; 4 – right ventricular apex; 5 – anatomical annulus; arrow – ablation catheter.

Fig 3. With the catheter ablation localized at the level of posterior tricuspid annulus, the local electrogram (ABLd – white color) shows a ventricular and atrial electrogram of high amplitude with a VA interval of approx. 40 msec. During RF ablation the VA interval prolongs (yellow arrow) with interruption of the ORT and passage in sinus rhythm. aVF, II – surface ECG; ABLd, ABLp – local electrograms of the ablation catheter distal and proximal; Halo – 20 poles catheter inserted along the tricuspid annulus; the earliest atrial potential during ORT being on poles 5-6 on the posterior annulus.

mal or absent preexcitation in spite of symptomatic episodes of tachyarrhythmias. Pedro et al demonstrated that the absence of RBBB in V1 is a strong predictor for the presence of an AP [4]. Our patient had incomplete RBBB

and preexcitation was present only after adenosine administration.

Wei et al reported the electrophysiological features of AP in 17 patients with Ebstein's anomaly during catheter ablation. They used right ventriculography to localize the anatomical tricuspid annulus and the APs were localized at this level in all the patients.

It has been demonstrated that catheter ablation of AP in Ebstein's anomaly should target the anatomical, not the functional tricuspid annulus. Some authors proposed the use of a guide wire inserted inside the right coronary artery for proper mapping of the accessory pathway along the tricuspid annulus; other authors suggested the use of intracardiac echocardiography [5-7] to define the anatomical tricuspid annulus identified by the presence the right coronary artery. Vukmirovic et al reported multiple accessory pathway ablation guided by electroanatomical mapping and intracardiac echocardiography in a patient with Ebstein's anomaly. They identified the anatomical tricuspid annulus by the course of the right coronary artery and the functional tricuspid annulus by the insertion of the septal valve [7].

To our knowledge only 2 cases of ICE guidance for AP ablation in Ebstein's anomaly have been reported. Both Shimane et al [8] and Vukmirovic et al [7] used a Biosense Webster catheter with longitudinal 90° sector images for intracardiac ultrasound in their patients. On the contrary, in our patient we used the ViewFlex Xtra catheter that has a large curvature radius with different steering angles from 0 to 120 degrees with a simple one-hand torsional control. The ViewMate Zonare console operates in different modes for high resolution 2D imaging of cardiac structures with intuitive on-screen menus for color, pulsed and continuous Doppler [9]. As the above mentioned authors did, we identified the anatomical tricuspid annulus with the help of ICE and ablated the accessory pathway using radiofrequency applications.

Although catheter ablation has become a routine procedure for patients with accessory pathways because of its high efficacy (over 95%), radiofrequency ablation in Ebstein's anomaly still remains difficult [10], the success rate being related to the accurate mapping of the anatomical tricuspid annulus, a region that is difficult to assess. ICE is superior to classical X-ray or angiography to define anatomical structures in the right atrium and ventricle [11]. The advantages of using ICE to guide catheter ablation are: 1) accurate identification of the anatomical and functional tricuspid annulus; 2) positioning of the coronary sinus catheter inside the ostium, a structure that is frequently distorted by the dysplastic valve; 3) identification of the His bundle, a region that should be

avoided during catheter ablation because of the high risk of a complete AV block; 4) a real-time monitoring of the contact between the tip of the catheter and the tricuspid annulus thereby permitting an accurate localization of the pathway and complete ablation [12]. Another important advantage for ICE imaging during catheter ablation is the possibility to identify procedure-related complications (pericardial effusion, damage valves or cusps, thrombus formation at the tip of the catheter) [13].

In conclusion, we reported for the first time the use of the ViewFlex Xtra probe for intracardiac ultrasound guidance of catheter ablation in a patient with a right posterior accessory pathway and Ebstein's anomaly.

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