Radiofrequency catheter ablation of idiopathic ventricular ectopy originating from the pulmonary artery trunk

Radiofrekvenčna katetrska ablacija idiopatske prekatne ektopije z izvorom iz debla pljučne arterije

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Abstract

Idiopathic ventricular ectopy with left bundle branch block morphology and inferior axis commonly originates from the right ventricular outflow tract. It is very unusual for this ectopy to originate from the pulmonary artery trunk. This unusual origin can be recognized by mapping above the pulmonary valve in search of endocardial signals that consist of the near field low amplitude multicomponent signal preceding the far field ventricular signal. Pacemapping is often unsuccessful in this setting.

Izvleček

Idiopatska prekatna ektopija z morfologijo levokračnega bloka in navzdol obrnjeno osjo navadno izvira iz iztočnega dela desnega prekata. Zelo nenavadno je, da takšna ektopična aktivnost izvira iz debla pljučne arterije. Ta nenavaden izvor lahko najdemo s kartografijo nad pulmonalno zaklopko, kjer iščemo značilne endokardialne električne signale, ki so sestavljeni iz začetnega nizko-amplitudnega večfaznega dela ter sledečega značilnega prekatnega signala. Kartografija s stimulacijo je na tem mestu pogosto neučinkovita.

Introduction

Ventricular extrasystoles or tachycardia with left bundle branch block morphology and inferior axis usually indicate that the origin of the ectopy is in the right ventricular outflow tract (RVOT). Although specific sites within the RVOT have been associated with typical electrocardiographic (ECG) patterns, localization of the ectopy above the pulmonary valve is more challenging.[1-3] Although pulmonary artery trunk was previously considered a rare origin of ventricular ectopy, in selected studies it has been described to occur in up to 10 and 25 % in patients refered for the ablation of the ventricular ectopy presumably originating within the RVOT.[4,5]

We present a case of a patient with idiopathic ventricular ectopy with ECG characteristics corresponding to RVOT origin with subsequent successful ablation in the pulmonary artery trunk.

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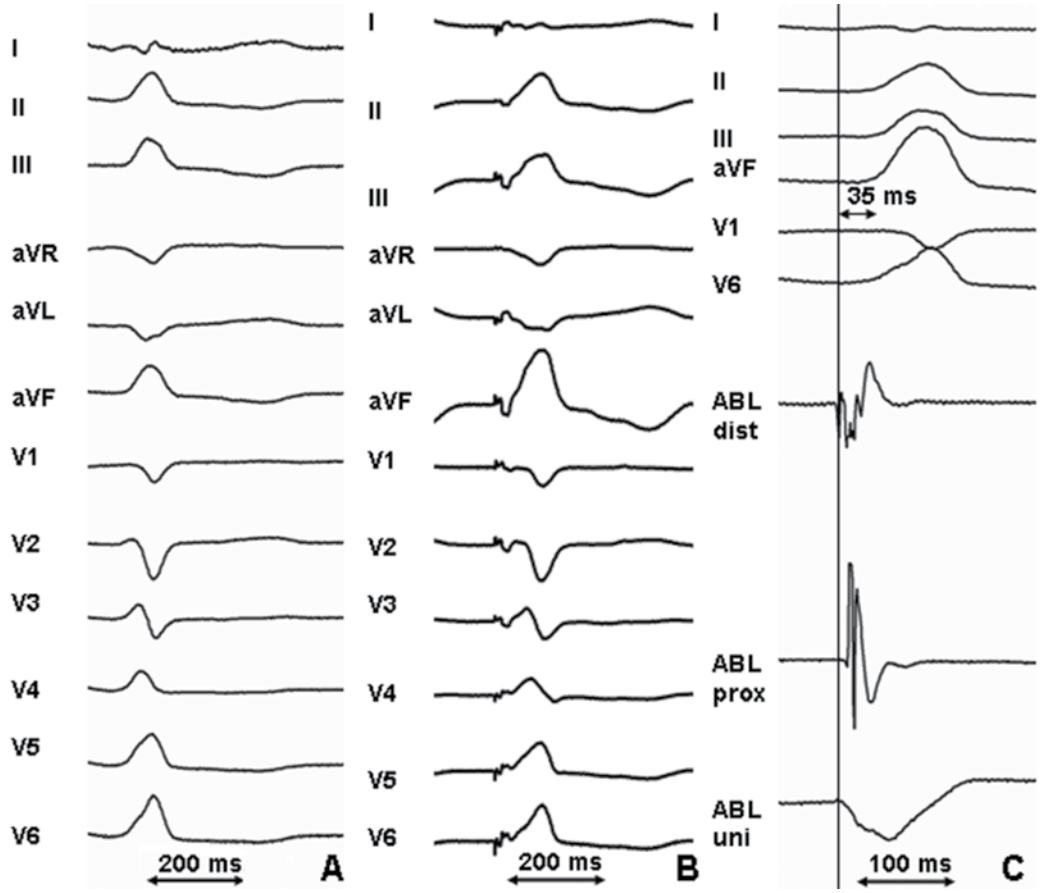

Figure 1: Panel A: initial ventricular ectopy, Panel B: a good pacemap, Panel C: early endocardial signal by -35 ms at the location of the good pacemap.

Case report

The patient was a 50-year-old woman, who besides a history of being a smoker had no additional risk factors for cardiovascular diseases. She was symptomatic for palpitations for three years with slow progression of symptoms over time. There was documented ventricular bigeminy originating from the RVOT on the ECG taken during palpitations. Treatment with metoprolol and propafenone was ineffective.

The 12-lead ECG with ectopy (Figure 1, Panel A) showed left bundle branch morphology with inferior axis, with notching in leads III and aVF, low voltage RSr in lead I, QS in leads V1, aVL and aVR, R/S transition in V3 and small R in V2. According to transthoracic echocardiographic examination, she had no obvious structural heart disease.

Endocardial electrograms were analyzed using the Cardiolab system (Prucka Engineering Inc., Houston, Texas, USA), Filter for endocardial electrograms was set to 30–500 Hz, paper speed was set to 200 mm/s. A 3D electroanatomic mapping system (EnSite NavX, St. Jude Medical, St. Paul, Minnesota, USA) was also used. Navistar ThermoCool, 7Fr, 3.5 mm irrigated tip catheter (Biosense Webster, Diamond Bar, CA, USA) was used for mapping and radiofrequency ablation. Radiofrequency ablation parameters were set to 25–30 W with an upper limit of temperature at 45 °C.

After introduction of the catheter via the right femoral vein, the procedure was started by creation of a 3D anatomical reconstruction of the right ventricle. Locations of the His bundle and the pulmonary valve were annotated according to endocardial electrograms (Figure 2). Ablation site was selected by a combination of activation mapping and pace mapping. Using this approach, the site with pacemap match 12/12 and the earliest endocardial bipolar signal (-35ms) was allocated into the anteroseptal part of the RVOT just below the pulmonary valve (Figure 1, Panel B and C). Ablation at that location did not result in termination of ventricular ectopy, however, there was a change in the morphology of the QRS (Figure 3, Panel A).

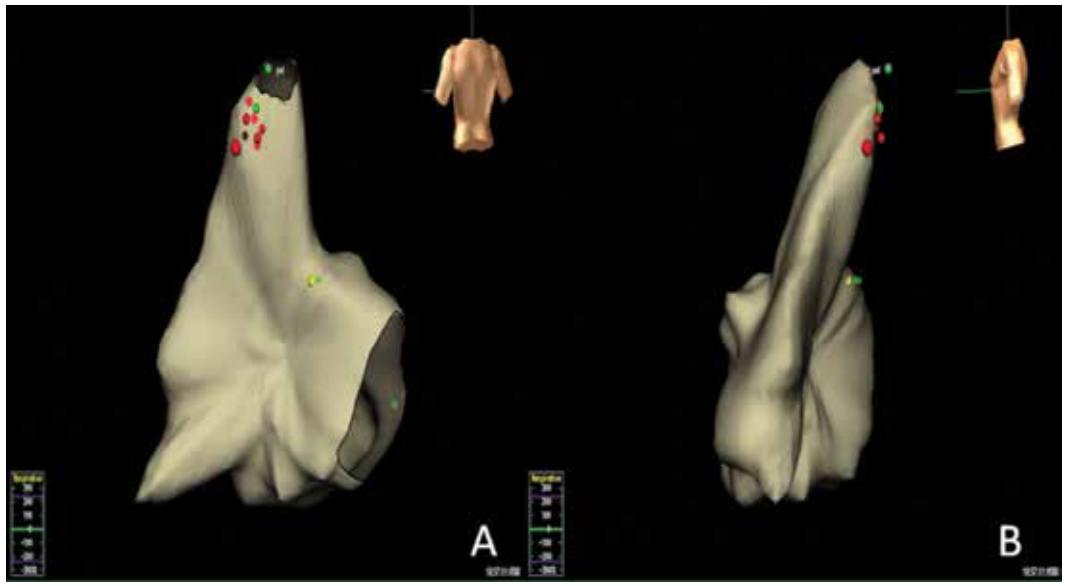

Figure 2: 3-D anatomical reconstruction of the right ventricle from posteroanterior (Panel A) and left lateral (Panel B) views showing the position of the pulmonary valve (uppermost border), the His bundle (yellow dot), ablation attempts in the RVOT (red dots), ablation attempt that resulted in the modified morphology of the ectopic beats (lower green dot), and successful ablation in the pulmonary artery trunk (upper green dot).

The R wave amplitude became larger in the inferior leads and R waves became more prominent in V2 and V3. After several additional unsuccessful ablation attempts within the RVOT, mapping was performed in the pulmonary artery trunk, where low-amplitude multicomponent signal preceeding the QRS complex by 53 ms during ventricular extrasystoles was found on the septal wall of the pulmonary artery trunk (Figure 3, Panel B). The pacemap was not performed due to inability to capture even with the highest pacing energy. Radiofrequency ablation at the site of the earliest low amplitude multicomponent signal resulted in immediate termination of the ventricular ectopy. Further ectopy was not inducible despite isoprenaline challenge.

Discussion

In the course of the described mapping and ablation procedure we found a distinct pattern of endocardial electrograms in the pulmonary artery trunk that were also described and studied by Yamashina et al.[5] These signals consist of the near field low amplitude multicomponent signal preceding the far field ventricular signal. These characteristic low amplitude multicomponent signals could be due to myocardial extensions in the pulmonary artery trunk that are probably the result of incomplete myocardial regression during the development of the heart and were discovered in humans and animals.[6-8] Yamashina et al. discovered that they were able to do a pace map in the pulmonary artery trunk in 5 of 8 studied patients, whereas Sekiguchi et al. could only perform pace mapping by high voltage pacing in 63 % of patients.[5,4] Thus, according to our own experience and the data from the literature it is reasonable to rely on the activation mapping and the specific endocardial electrogram pattern rather than on the pace mapping when attempting ablation of the ventricular ectopy in the pulmonary artery trunk. Thermal mapping might be useful, but was not yet tested in this setting.[9,10] We also found a change in the QRS morphology of ventricular extrasystoles after unsuccessful ablation in the RVOT. Similar observation was made by Timmermans et al.[11] A probable explanation for this phenomenon is that we initially ablated one of the exit points of the ectopy and that the following exit point was more cranial and posterior as indicated by higher amplitude of R waves in inferior leads and more prominent R waves in V2 and V3.

Conclusion

We conclude that in patients with idiopathic ventricular ectopy presumably originating in the RVOT it has to be kept in mind that the actual source of the ectopy might be in the pulmonary artery trunk. So, if initial ablation attempts in the RVOT prove to be unsuccessful, the next step should include

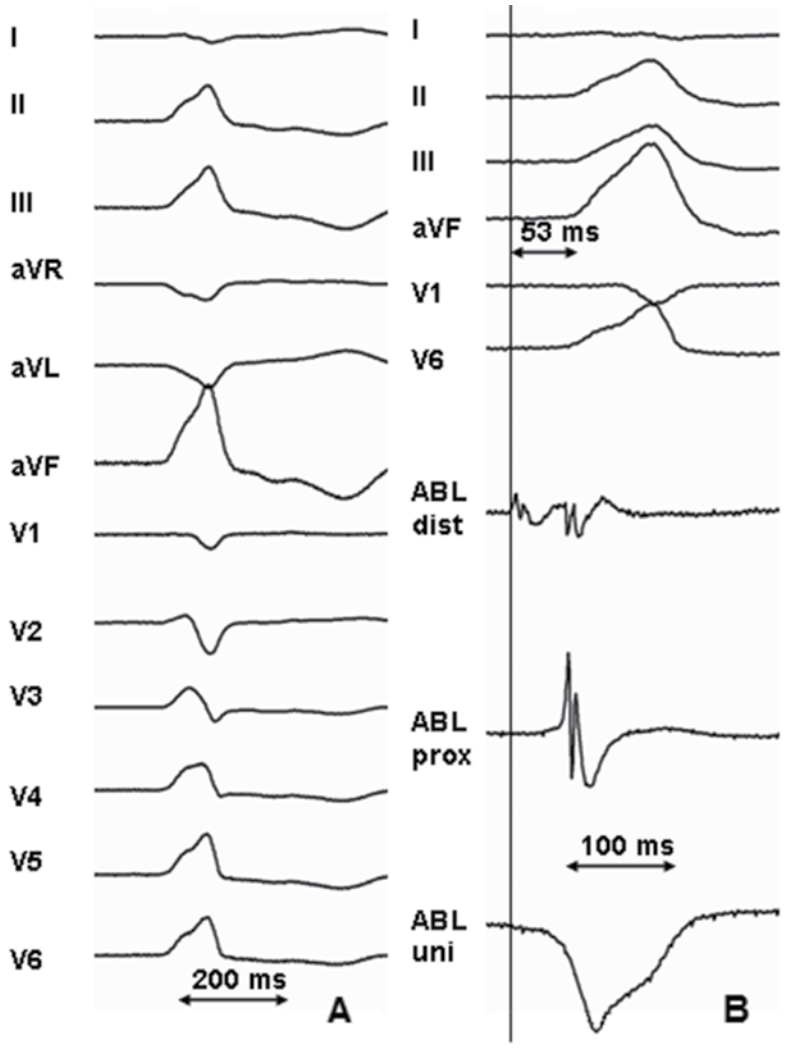

Figure 3: Panel A: modified morphology of the ectopic beats, Panel B: earliest endocardial activity by -53ms above the pulmonary valve.

mapping the area above the pulmonary valve in search for characteristic endocardial electrograms during the ectopy.

References

1. Lerman BB, Stein KM, Steven MM, Mittal S, Iwai S. Ventricular Tachycardia in Patients with Structurally Normal Hearts. In: Zipes DP, Jalife J, ed. Cardiac Electrophysiology: from Cell to Bedside, 4th ed. Philadelphia, PA: Saunders, 2004. p. 686–682.
2. Wilber DJ, Joshi S. Ablation of Idiopathic Right Ventricular Tachycardia. In: Wilber DJ, Packer DL, Stevenson WG, ed. Catheter Ablation of Cardiac Arrhythmias: Basic Concepts and Clinical Applications, 3rd ed. Malden, MA; Blackwell Futura, 2008. p. 279–297.
3. Arya A, Piorkowski C, Sommer P, Gerds-Li JH, Kottkamp H, Hindricks G. Idiopathic outflow tract tachycardias. Herz. 2007; 32(3): 218–25.
4. Sekiguchi Y, Aonuma K, Takahashi A, Yamauchi Y, Hachiya H, Yokoyama Y, Iesaka Y, Isobe M. Electrocardiographic and electrophysiologic characteristics of ventricular tachycardia originating within the pulmonary artery. J Am Coll Cardiol. 2005; 45(6): 887–95.
5. Yamashina Y, Yagi T, Namekawa A, Ishida A, Sato H, Nakagawa T, Sakuramoto M, Sato E, Yambe T. Clinical and electrophysiological difference between idiopathic right ventricular outflow arrhythmias and pulmonary artery arrhythmias. J Cardiovasc Electrophysiol. 2010; 21(2): 163–9.
6. Hasdemir C, Aktas S, Govsa F, Aktas EO, Kocak A, Bozkaya YT, Demirbas MI. Demonstration of ventricular myocardial extensions into the pulmonary artery and aorta beyond the ventriculo–arterial junction. Pacing Clin Electrophysiol. 2007; 30: 534–539.
7. Moorman AF, Christoffels VM. Cardiac chamber formation: Development, genes and evolution. Physiol Rev. 2003; 83: 1223–1267.
8. Ya J, van den Hoff M, de Boer P, Tesink-Taekema S, Franco D, Moorman A, Lamers W. Normal development of the outflow tract in the rat. Circ Res. 1998; 82: 464–472.
9. Clyne CA, Athar H, Shah A, Kahr R, Rentas A. Thermal mapping of right ventricular outflow tract tachycardia. Pacing Clin Electrophysiol. 2007; 30(3): 343–51.
10. Vokač D. Nonreentrant idiopathic ventricular tachycardia from the right ventricular outflow tract-local thermal induction and radiofrequency ablation of VT as a new mapping procedure. (abstract). Pacing Clin Electrophysiol. 1999; 22: A9.
11. Timmermans C, Rodriguez LM, Medeiros A, Crijns HJGM, Wellens HJJ. Radiofrequency catheter ablation of idiopathic ventricular tachycardia originating in the main stem of the pulmonary artery. J Cardiovasc Electrophysiol. 2002; 13: 281–284.