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Ventricular ectopy from the non-coronary cusp: Pathophysiological and anatomical considerations

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ABSTRACT

Non-coronary cusp (NCC) is a rare site for ventricular arrhythmias because it does not come into direct contact with the ventricular myocardium. Instead, the NCC comes in contact with the membranous septum near the His region. We describe a case of a young man with a ventricular ectopy who was successfully ablated in the NCC. In our case the much greater prematurity in the NCC than in the His region suggests that the arrhythmic site of origin is not in the peri-His area but most likely a myocardial extension adjoining the aortic root.

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1. Introduction

Aortic cusps are common sites of ectopic ventricular arrhythmias (VAs). The right and left coronary cusp are in direct vicinity to the adjacent ventricular myocardium of the left ventricular outflow tract and are common sites of successful ablation for VAs. On the contrary, the non-coronary cusp (NCC) is not in direct contact with ventricular myocardium, and thus VAs are rarely derived from this site [1].

1.1. Case report

We describe a 19-year-old man without structural heart disease who presented with high burden (>40,000/24h) of symptomatic ventricular ectopy in consecutive 24h Holter monitorings. Twelve-lead electrocardiogram showed sinus rhythm and frequent monomorphic premature ventricular contractions (PVC) with outflow tract morphology (Fig. 1). The patient was admitted for electrophysiological study and ablation.

An electrophysiological study was performed using standard techniques in a fasting state. A 6F standard quadripolar catheter was placed in the His bundle, and a 6F steerable decapolar catheter in the coronary sinus which was used as a reference catheter for the 3D mapping system (Ensite, Abbott). During sinus rhythm the AH interval and the HV were 62 ms and 40 ms respectively. The ventricular electrogram in the His bundle preceded the PVC onset by 12 ms. The mapping of the right ventricular outflow tract (RVOT) showed prematurity up to 20 ms of the ventricular electrogram in relation to the QRS onset, and consequently some unsuccessful radiofrequency (RF) applications were attempted. Thereafter, aortic root mapping has shown in NCC a characteristic high amplitude atrial electrogram and a fragmented, low amplitude ventricular electrogram preceding the QRS onset of the PVC by 50 ms (Fig. 2). Pace mapping could not be performed at this point because there was no capture. The RF application at this point with a standard 4mm irrigated tip catheter (Therapy - Cool Path, Abbott), a power of 30W, an upper temperature limit 40C°, saline irrigation flow 17ml/

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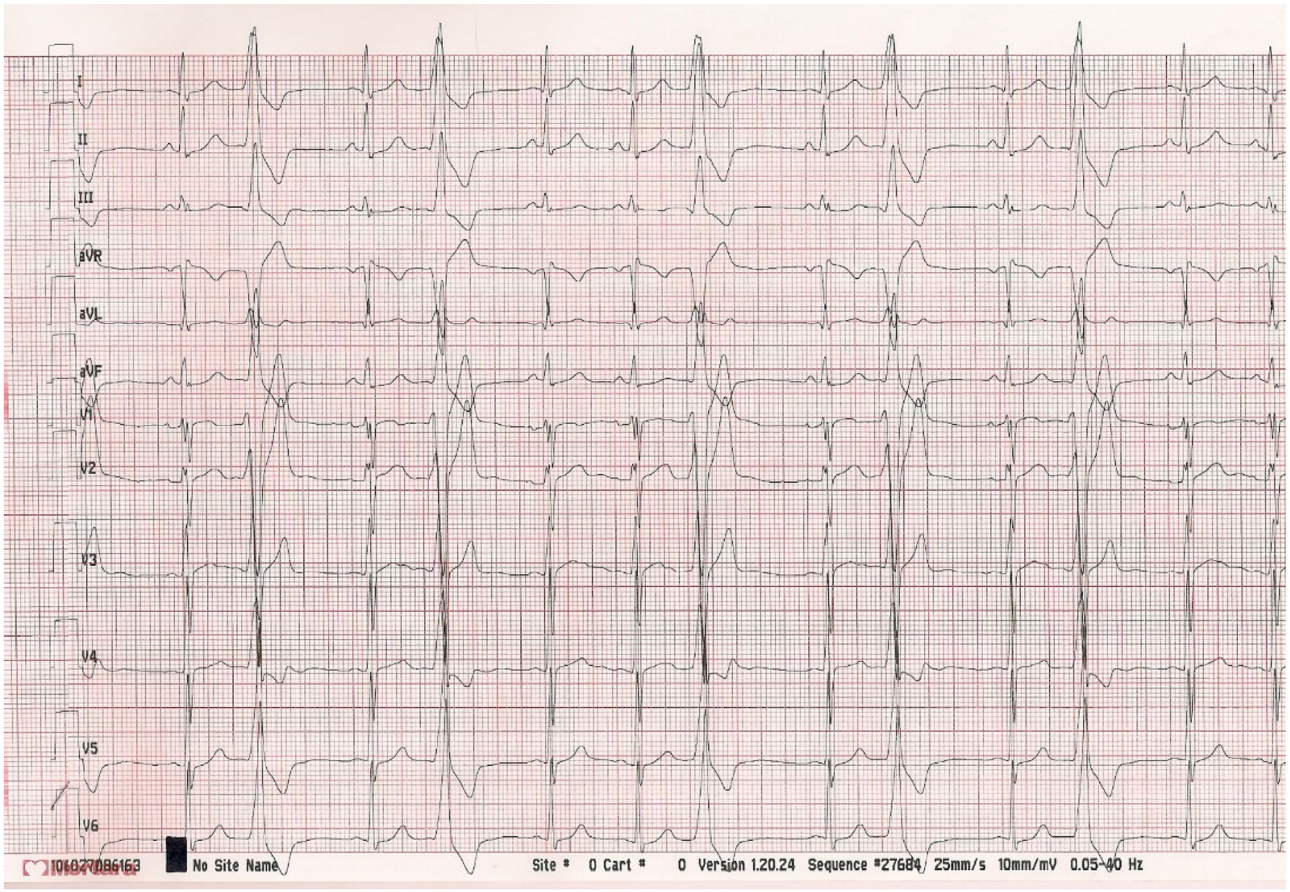

Fig. 1. The 12-lead electrocardiogram.

min, and 45s duration eliminated the VA within 2s from the start of application (Supplementary Figure). The patient remained without recurrence after 12 months of follow-up.

2. Discussion

The NCC contacts posteriorly the atrial myocardium and inferiorly the membranous interventricular septum, which is located just above the His bundle region. Thus, NCC is most commonly an ablation site for atrial arrhythmias or accessory pathways near the His region. Surprisingly, NCC is more common ablation site for aortic cusps VAs in younger (<21 years) individuals [2]. This probably reflects a different pathophysiology compared to VAs occurring in older patients, pointing out a developmental defect during the embryogenesis of the heart. The possible site of origin of VAs ablated from NCC is the peri-His region or myocardial extensions to the aortic trunk [3]. In most of the published cases it seems that arrhythmic origin is coming from the His bundle region as the recorded prematurity of the ventricular electrogram in His is approximately equal to that in the NCC [1,4,5]. In our case, we record a large difference between these two sites with 50 ms prematurity in NCC and only 12 ms in His bundle region. This fact is probably advocating the myocardial extension hypothesis. Furthermore, the slightly shorter prematurity in the His bundle (12 ms), which is anatomically closer to the NCC, in relation to RVOT (20 ms) can be explained by the particular course of these myocardial extensions.

3. Conclusion

The NCC is an unusual site of origin for ventricular arrhythmias as it is not directly related to ventricular myocardium, except the peri-His area. Given the significant difference in activation mapping between the peri-His area and the NCC, congenital variations such

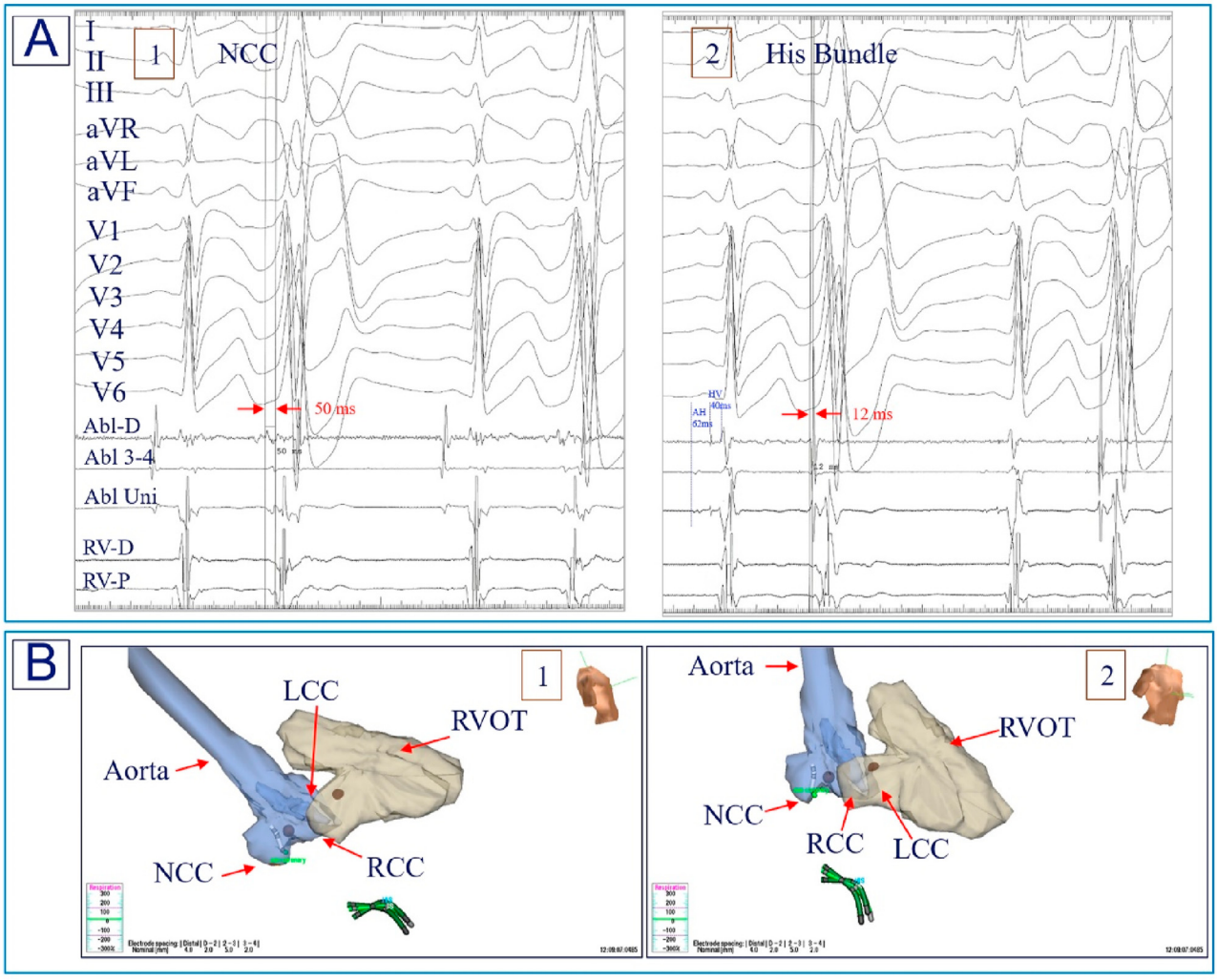

Fig. 2. A: The relative prematurity of the ventricular electrogram during PVC mapping in the NCC (A1), and the His bundle area (A2). At the successful ablation site (NCC) a fragmented, low amplitude ventricular electrogram precedes the QRS onset of the PVC by 50 ms. The initial deflection probably represents a mid-diastolic potential and the true systolic potential coincides with the beginning of the unipolar electrogram. B: The catheter position at the successful ablation site in NCC, in RL (B1) and RAO (B2) view. *PVC: Premature ventricular contraction, RVOT: Right ventricular outflow tract. NCC: Non-coronary cusp, RL: Right lateral, RAO: Right anterior oblique.*

as myocardial extensions to the aortic root may be a possible explanation. This fact probably interprets the higher incidence in younger patients that has been shown in the literature.

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Declaration of competing interest

The authors have no conflicts of interest relevant to this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ipej.2021.04.005.

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