JACC: CASE REPORTS VOL. 18, 2023

IMAGING VIGNETTE

INTERMEDIATE

ECG CHALLENGE

Wide Complex Tachycardia in a Right-Sided Heart

Diagnostic and Therapeutic Challenges

Aamina Shakir, MD,[a] Paari Dominic, MD,[b] Allen Amorn, MD,[c] Basel Kasabali, MD[d]

ABSTRACT

Dextroposition is a rare cardiac malformation defined as heart shift to right of midline. ECG findings vary with degree of displacement within the chest cavity. We report the second known case of dextroposition with accessory pathway (posteroseptal in our patient), presenting as pre-excited atrial tachycardia. Abnormal anatomy complicates pathway localization/ablation. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;18:101922) © 2023 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 50-year-old woman was hospitalized with respiratory distress from Epstein-Barr virus. Chest X-ray showed right-sided heart. At 1 month post discharge, she presented in wide-complex tachycardia, with a heart rate of 205 beats/min. She was cardioverted after only partially responding to procainamide and adenosine. Laboratory tests showed only mild transaminitis and improving thrombocytopenia, presumed to be caused by resolving Epstein-Barr virus infection. **Figure 1** shows precardioversion and postcardioversion electrocardiography (ECG) and X-ray.

What is the most likely diagnosis?

1. Incorrect lead placement
2. Accessory pathway with dextrocardia
3. Accessory pathway with dextroposition
4. Ventricular tachycardia with dextrocardia
5. Supraventricular tachycardia with right bundle branch block

DISCUSSION/RATIONALE

This patient was known from prior chest X-ray to have rightward heart displacement. Despite the radiographic findings and reversed R-wave progression in precordial leads, the presence of left axis deviation, initial negative deflection of QRS complex in aVR, and positive P-wave in I-II are inconsistent with dextrocardia. Furthermore, aVR has negative T and P waves, associated with levocardia. Together, these findings suggest

From the [a]Louisiana State University Health Sciences Center–Shreveport, Shreveport, Louisiana, USA; [b]University of Iowa Health Care, Iowa City, Iowa, USA; [c]Cincinnati VA Medical Center, Cincinnati, Ohio, USA; and the [d]Willis-Knighton Medical Center, Shreveport, Louisiana, USA.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received February 20, 2023; revised manuscript received April 18, 2023, accepted April 24, 2023.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2023.101922

ABBREVIATIONS AND ACRONYMS

AP = accessory pathway

AT = atrial tachycardia

ECG = electrocardiography

dextroposition. ECG changes are less predictable in dextroposition than in dextrocardia, because they vary based on the heart's rotation within the thorax, position along left-right axis, and lead positioning.

The baseline ECG demonstrates short PR interval and pre-excitation, confirming presence of accessory pathway (AP). However, the wide-complex tachycardia demonstrates identical morphology to baseline (same left axis deviation and R-wave progression), supporting atrial tachycardia (AT) with pre-excitation over atrioventricular re-entrant tachycardia. Both Millstein and Arruda criteria suggest posterolateral AP. However, it is unknown how dextroposition affects pathway localization by 12-lead ECG.

An electrophysiology study was performed. Eccentric ventriculoatrial conduction was noted with earliest activation at proximal coronary sinus, as expected. During isoproterenol infusion, the patient developed AT, with a cycle length of 420 ms. Using the Carto (3-dimensional) mapping system, multiple AT foci were identified, including at the right atrial appendage and tricuspid annulus. During attempted ablation of tricuspid annulus foci, the patient developed atrial fibrillation with pre-excited RR interval <250 ms, confirming high-risk AP. Given numerous AT foci and high-risk pathway, the decision was made to focus on the pathway rather than on tachycardia sites. The pathway was successfully ablated at the ostia of the coronary sinus and middle cardiac vein. Supplemental Figures 1 to 3 show an ablation map and postablation ECG.

Dextrocardia is a rare (incidence ~1/10,000-12,000) congenital malformation, defined as rightward base-axis cardiac orientation.[1] Dextroposition is rightward cardiac displacement with left-directed apex, with extracardiac causes.[2] It co-occurs with Poland syndrome, scimitar syndrome, and lung abnormalities. Comorbid AP and dextroposition is rare, and is therapeutically complex given the ill-defined relationship between ECG and anatomy. Literature review shows no data on AP localization criteria performance in dextrocardia/dextroposition. In this case, Arruda and Milstein criteria failed to localize the pathway correctly. Notably, the precordial transition at V_1 is unusual for a true posteroseptal pathway, and could result from rightward shift of the left ventricle.

Structural abnormalities pose individualized challenges during electrophysiological procedures. Only 1 prior case of AP ablation in dextroposition is reported.[3] This patient had a left lateral pathway and multiple congenital abnormalities including lung hypoplasia. Although our patient had multifocal AT, she had no known lung disease, nor radiographic pulmonary abnormalities.

ACKNOWLEDGMENTS The original ECGs were standardized and digitized using the PMcardio smartphone app, which can be downloaded at: https://bit.ly/pmcardio-pub. The authors wish to thank Dr Robert Herman (Department of Advanced Biomedical Sciences, University of Naples Frederico II, Naples, Italy; Cardiovascular Center, OLV Hospital, Aalst, Belgium; and Powerful Medical, Bratislava, Slovak Republic) for providing ECG digitization.

FUNDING SOURCE AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Paari Dominic, University of Iowa Health Care, 4215 Roy Carver Pavilion, 200 Hawkins Drive, Iowa City, Iowa 52242, USA. E-mail: paari-dominicswaminathan@uiowa.edu. Twitter: @drpaari.

REFERENCES

1. Naaraayan A, Nimkar A, Acharya P, Pomerantz D, Jesmajian S. Dextrocardia: when right is wrong! *J Atr Fibrillation*. 2020;13(2):2222.

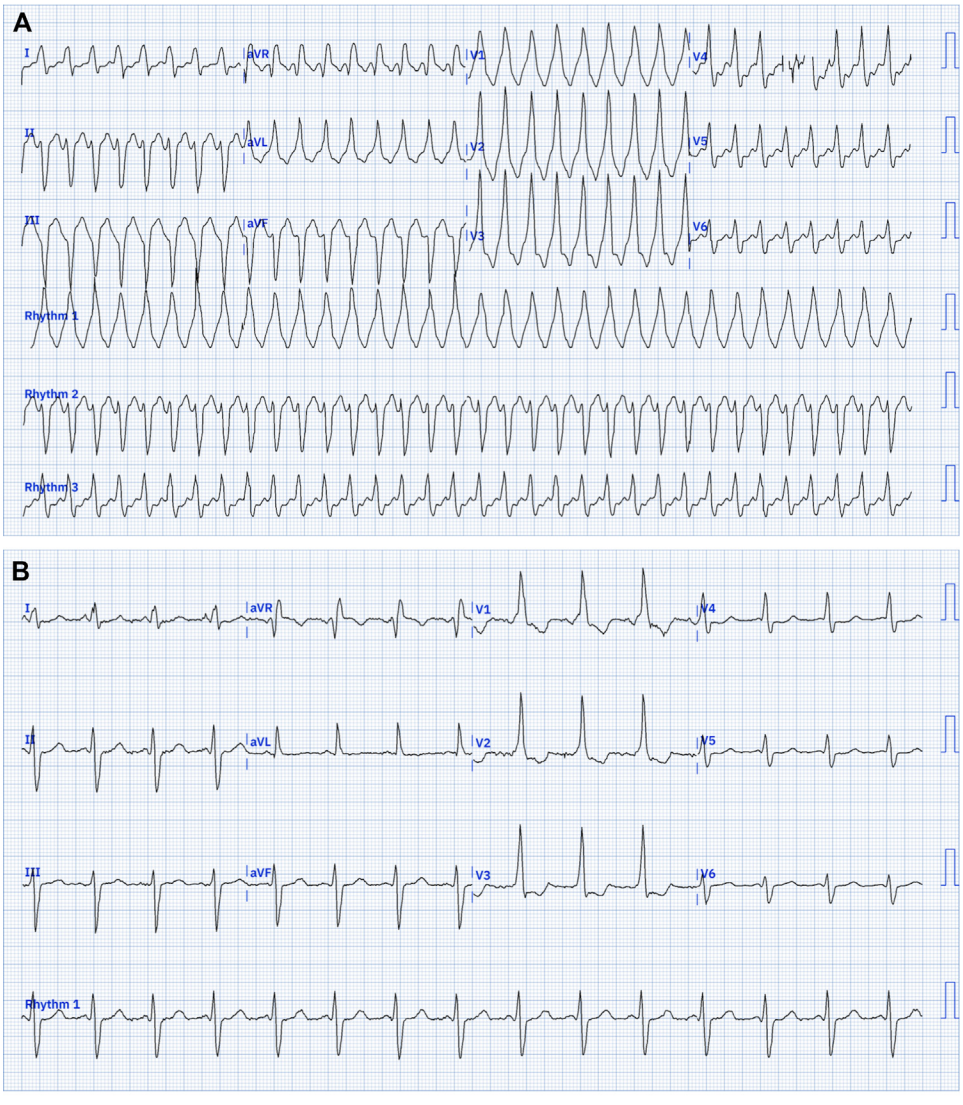
2. Ahmad J, Bawa D, Sethi S, Duddyala N, Jones R, Dominic P. Successful leadless pacemaker implantation in a patient with dextroposition of the heart. *Heart Rhythm Case Rep*. 2021;7(5):319–322.

3. Baranchuk A, Somani R, Simpson CS, Michael KA, Redfearn DP. Ablation of a left lateral accessory pathway in a patient with dextroposition of the heart. *Cardiol J*. 2012;19(4):439–440.

KEY WORDS accessory pathway, atrial tachycardia, dextrocardia, dextroposition, wide-complex tachycardia

APPENDIX For supplemental figures, please see the online version of this paper.

FIGURE 1 **Electrocardiographic and Radiographic Findings**



(A) 12-lead electrocardiogram obtained at time of admission, demonstrating the wide-complex tachycardia with which the patient presented. **(B)** 12-lead electrocardiogram obtained after cardioversion. **(C)** Chest x-ray demonstrating rightward displacement of the heart.