CASES AND TRACES

ECG Response: Can You Make The Correct Morphology, Pathology, and Rhythm Diagnoses?

The patient is a 52-year-old male corporate executive who comes to the office as a new patient, having just been relocated by his company. He gives a history of smoking (1 pack per day for 25 years), hyperlipidemia, and hypertension, and he is currently taking a statin, an angiotensin receptor blocker, a β-blocker, and a daily aspirin. He denies any history of chest pain or dyspnea, other than 2 days of mild chest fullness with slight shortness of breath 2 months earlier during a vacation to Vail, Colorado, after a particularly stressful period at work. On return home, he saw his internist who told him, after obtaining a confirmatory echocardiogram, that he had experienced a myocardial infarction, but that his heart function was near normal. At that time, his medications were adjusted to his current regimen. He has no previous medical records with him, but denies any other recent or remote illnesses. An ECG is obtained and is shown (Figure 1: ECG #1). What is your interpretation?

The ECG has 2 notable abnormalities (Figure 1: ECG #1). The first is mirror-image dextrocardia, a congenital abnormality, as indicated by the frontal plane axis coupled with the precordial lead pattern. In isolation, dextrocardia with situs inversus confers no additional cardiac risk and has a prevalence of 1 to 2/10,000, whereas 3% to 10% have been reported to have concomitant congenital heart disease.1 Typical dextrocardia with situs inversus has a characteristic rightward axis with inverted P, QRS, and T waves in lead I and a tall R wave in lead AvR when uncorrected leads are used, and a lack of precordial R:S progression as well, plus a decrease in QRS voltage as the leads move from V1 to V6.2 Moreover, the pattern of lead V1 resembles a normal V2, and V2 resembles a normal V1.

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If only the limb leads are viewed, dextrocardia can be mimicked by just reversing the right and left arm leads, in which case the precordial leads will be unchanged. As with dextrocardia with uncorrected leads, reversal of the arm leads in an individual with normal cardiac position will cause the normal lead AvR and AvL configurations to appear to be reversed, as well as the configurations of leads II and III. ECG #2 (Figure 2) shows an example of such a right arm–left arm lead reversal in a patient with a normal cardiac position. Note that the limb lead pattern resembles that of dextrocardia; however, the precordial lead progression and amplitudes are normal. In addition, the inverted P waves in leads I and AvL could be misinterpreted as a left atrial rhythm, rather than sinus rhythm, if the mirror-image dextrocardia is not appreciated.
Second, ECG #1 also appears to show pathologic Q waves in leads I, II, AvF, and V₅, V₆ plus a tall R wave in V₁. These would appear to suggest an inferior-posterior-lateral infarction (if the dextrocardia were not recognized).

ECG #3 (Figure 3) is performed with the leads corrected. For this correction, the left arm lead is placed on the right arm, the right arm lead is placed on the left arm, and the precordial leads are placed across the right rather than the left precordium (with the V₁ lead now put in the left second interspace near the sternum, the V₂ lead now put in the right second interspace near the sternum, and V₃ through V₆ placed in the V₃R through V₆R positions).¹ With this corrected lead position, the P-, QRS-, and T-wave axes in lead I now appear normal, as does the precordial R:S progression. It is noteworthy, however, that evidence remains for an old inferior-posterior infarction (inferior Q waves with some residual ST elevation and a taller-than-normal R wave in lead V₂), but, with the lead correction, suggestion of a lateral infarction is no longer present. This pseudolateral infarction pattern is typical in mirror-image dextrocardia when uncorrected leads are used. The patient’s dextrocardia with situs inversus is confirmed by obtaining a chest x-ray (Figure 4).

Important lessons learned from this case include the facts that: (1) failure to recognize dextrocardia can lead to misinterpretation of ECG morphological abnormalities, rhythm abnormalities, and repolarization abnormalities; and (2) the use of corrected leads will make the ECG clearly interpretable in all respects.

REFERENCES

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Circulation. 2016;134:567-569
doi: 10.1161/CIRCULATIONAHA.116.024356
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2016 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/134/7/567

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