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CLINICAL VIGNETTE

Dextrocardia in a Patient with Chest Pain

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Introduction

Dextrocardia has an incidence of 1 in 12,000 live births,¹ thus while uncommon, it can be seen in the context of routine primary care. Besides the notable finding of reversal of the heart's position on chest x-ray (CXR), electrocardiogram (ECG) changes that may appear concerning are readily understood once the diagnosis is known. Dextrocardia may be associated with Kartagener's triad; a ciliary disorder with situs inversus, bronchiectasis, and azoospermia.² Isolated dextrocardia has no clinical implications other than the caution needed when reading ECGs, evaluating patients for chest pain, and interpreting CXRs. We present the ECG of our 82-year-old patient with isolated dextrocardia in the setting of situs inversus (Figure 1).

Case and ECG Read

Our patient is an 82-year-old man with diabetes, hypertension, hyperlipidemia, chronic kidney disease stage IIIb and situs inversus. He was found to have situs inversus when he had symptoms from acute cholecystitis in his youth and his presentation was atypical relative to most cases. Today he presented to the office with a complaint of occasional heaviness in his shoulders with movement sometimes associated with shortness of breath. He did not note any pain with other types of exertion. While the etiology was suspected to be musculoskeletal, an ECG was obtained to ensure that no signs of ischemia were present. The ECG showed a downward deflection of the p-wave in leads I and aVL with the QRS showing incremental decrease in height from V1-V6 (Figure 1).

Discussion

The hallmarks of the ECG in patients with dextrocardia are inversion of p-waves in leads I and aVL and incremental decrease in QRS amplitude in the precordial leads as it progresses from V1-V6. As patients are asymptomatic from dextrocardia, they may not be aware of their anatomy until a medical emergency arises. Thus, clinical implications can be significant in patients with unknown dextrocardia presenting with ST-elevation myocardial infarction (STEMI). Chest pain may be localized to the right side or radiating to the right arm or neck, making triage difficult. ST elevation on ECG can also be difficult to diagnose as there may not be ST elevation in all leads, and further, localization of the culprit vessel may not be clear. This can be rectified by changing limb leads and adjusting the precordial leads to the right side of the chest in a mirror image

formation. Dextrocardia causes further challenges when these patients undergo cardiac catheterization as the traditional rotation of the C-arm of the fluoroscopic device must be reversed to properly diagnose and intervene with coronary disease.³

All patients with dextrocardia, whether or not they are presenting with Acute Coronary Syndrome will have p-waves that are inverted in I and aVL and the incremental height decrease of the QRS in the precordial leads. This can often be confused with limb lead exchange as in this case the p-wave inversions will be present but there will be normal R wave progression through the precordial leads.

Understanding why this occurs and how changing the limb leads affects the ECG requires understanding of the direction of the vector of the electrical signal through the heart. Lead I represents the conduction of electricity from the right arm-left arm. Lead II represents the conduction of electricity from the right arm-left leg. Lead III represents conduction from the left leg-left arm. As the p-wave represents contraction of the atrial muscle, this is stimulated by depolarization of the Sino-atrial node in the right atrium followed by conduction through the internodal pathways of the atria en route to the AV node. The ECG represents the graphic signal picked up through the skin of the conduction of this electrical activity. As the electrical activity moves towards a lead this causes an upward deflection. When the electrical activity moves away from a lead, this causes a downward deflection.⁴

When considering a patient with dextrocardia, the direction and height of the QRS in leads V1-6 represents the electrical vector across the precordium. In these patients, as the left ventricle is located in the right chest, it can be intuited that there will be decremental decrease in the QRS vector when the leads are placed in the traditional positions as the electrical signal is moving away from the leads placed. When the leads are placed in the mirror image direction on the right chest, the precordial portion of the ECG is "normalized". We performed an ECG on our patient with the mirror images of Leads V1-V6 placed on the right side of the chest while keeping the limb leads in the traditional positions. This is labeled as (Figure 2).

With regard to the limb leads in dextrocardia, this can also be intuited. In the ECG labeled (Figure 3) we have kept the precordial leads in the traditional positions but exchanged the limb leads. As lead I represents conduction from the left arm to

the right arm, the “P” wave became upright and “normalized” when these two leads were switched. The precordial leads remained “abnormal” with decrease in QRS amplitude from V1-V6. In our final ECG (Figure 4), we exchanged the limb leads and placed the precordial leads on the right side of the chest, mirroring the traditional placement on the left chest. This essentially “normalized” the ECG, making it easier to interpret in the setting of Acute Coronary Syndrome and appearing like that of patient with traditional placement of the heart on the left side of the chest cavity.

Figures

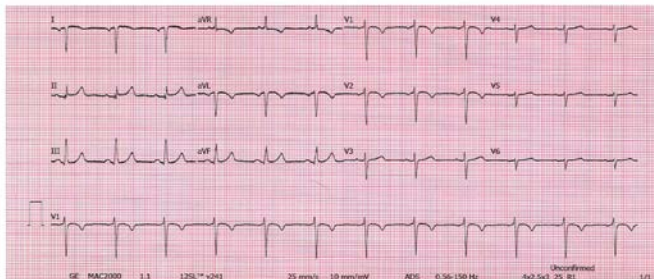


Figure 1: ECG of patient with dextrocardia.

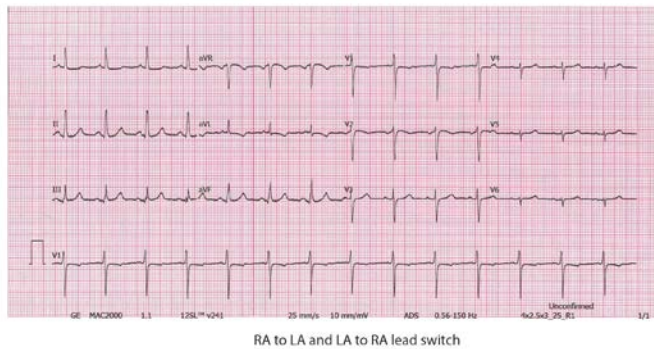


Figure 2: ECG of a patient with dextrocardia with exchange of limb leads and traditional placement of precordial leads.

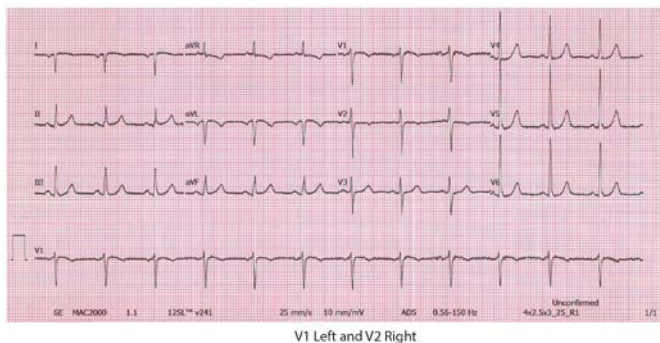


Figure 3: ECG of a patient with dextrocardia with mirror image placement of the precordial leads on the right chest and traditional placement of precordial leads.

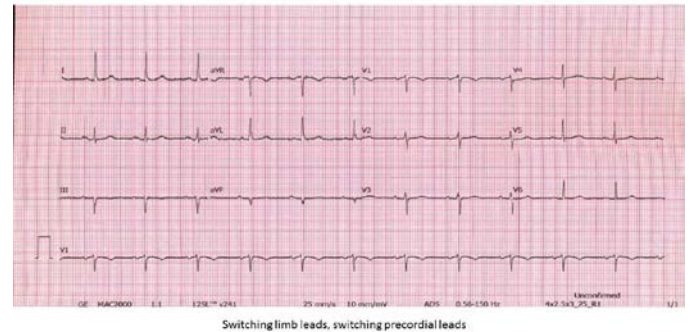


Figure 4: ECG of a patient with dextrocardia with mirror image placement of the precordial leads on the right chest and exchange of the limb leads.

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