

## Myocardial infarction in a patient with mirror-image dextrocardia

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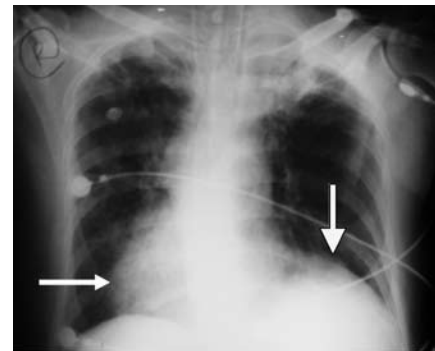
The incidence of coronary artery disease (CAD) in those with situs inversus (SI) is similar to that in the general population.<sup>1</sup> Dextrocardia with complete SI occurs in approximately one per 10,000 live births,<sup>2</sup> and is accompanied by congenital heart disease (usually transposition of the great vessels) in only 3-5% of cases.<sup>3</sup> Patient having this anomaly and presenting with myocardial infarction (MI) may pose difficulty to be diagnosed by routine electrocardiogram (ECG), provided the ECG is carried out with all the leads in reversed direction. Here, we describe a patient having anteroseptal MI with mirror image dextrocardia in the Intensive Care Unit (ICU) Department of King Faisal Hospital, Makkah, Kingdom of Saudi Arabia.

There are 2 types of dextrocardia; isolated dextrocardia, and mirror image dextrocardia. In isolated dextrocardia with SI (dextroversion), the body organs other than the heart are normal whereas in the mirror image dextrocardia with SI totalis, all the body organs are a mirror-image of the normal arrangement. Our objective is to provide physician's awareness on the extent of MI in such patient that may be underestimated unless dextrocardia is timely recognized, and ECG leads reversed. This means left and right limb leads should be swapped for both arms and legs, and the chest leads should run around the right side of the chest (using the same intercostal spacing locations) rather than the left.

A 55-year old male patient admitted to the Emergency Room (ER) with history of chest pain, and suddenly collapsed. The patient was connected to a mechanical ventilator and was brought to the ICU. Heart sounds were not clearly audible on the left side, but clear on the right side. The ECG from ER is shown in **Figures 1a & b**. The chest x-ray is shown in **Figure 2**. A second ECG with the leads in reversed direction was carried out in ICU (**Figure 1**), and showed abnormal Q waves in leads V1, V2 and V3. Poor R wave progression from V1-V4 with ST depression from V2-V5 was suggestive of anteroseptal MI. Transthoracic 2-dimensional echo was performed, which showed left ventricle on the right side and right ventricle on left side with basal to mid anteroseptal akinesia, basal to distal lateroseptal akinesia, basal to distal anterior wall akinesia, and apical akinesia. Subcostal view showed the inferior vena cava on the left side. The apical view showed the liver on the left side. The ejection fraction was 35%. Laboratory results showed that total creatinine kinase was 1959 units/L (normal range [NR]: 55-170 units/L), creatine



**Figure 1** - ECG showing a) leads in normal position shows right axis deviation, ST elevation only in V1 and mild ST depression in inferior leads. Positive complex in aVR and negative P in lead I and aVL. Low voltage in precordial leads from V4 to V6, b) leads in reversed direction shows abnormal Q waves in leads V1, V2 and V3. Poor R wave progression from V1 to V4 with ST depression from V2 to V5, suggestive of anteroseptal myocardial infarction. aVR - automated volt right, aVL - automated volt left



**Figure 2** - Chest x-ray showing cardiac apex to be on the right side (small arrow), and the left hemidiaphragm (big arrow) elevated compared to the right side suggesting dextrocardia.

kinase was 190 U/L (NR: 10-13 U/L), and troponin-T was 2.28 ng/mL (NR: <0.2 ng/ml). Then, we concluded that this patient had anteroseptal MI with a mirror image dextrocardia. The patient was referred to a higher center for coronary intervention. The most 2 characteristic features in an ECG of a dextrocardia are the p-wave axis, and the morphology of the QRS waves of the precordial leads. The p-wave signifies atrial depolarization, and the p-axis gives an indication of the site of the cardiac pacemaker. There is right axis deviation of P wave (negative in I and aVL) and QRS complexes. The lead aVR has positive QRS complex. Low voltage in precordial leads V4 through V6. In a normal ECG,

there is a gradual increase in the amplitude of the R wave over the mid and left precordial leads. This trend is reversed in dextrocardia, so that the QRS amplitudes of the right leads are prominent, and they diminish in size over the left precordial leads. The reverse placement (mirror-image) of the ECG precordial leads on the right chest at corresponding sites solves the problem.

Dextrocardia with SI is associated with Kartagener syndrome with an incidence of 15-20%.<sup>4</sup> Dextrocardia is due to failure of the cardiac loop to migrate from the right apex to left apex, which normally takes place during day 22-23 of fertilization.<sup>5</sup> With situs solitus and SI, the atrial situs always corresponds to the visceral situs. Furthermore, associated cardiac malformations include common atrioventricular canal, univentricular heart, transposition of the great arteries, and total anomalous pulmonary venous return. The mirror-image dextrocardia is always associated with situs inversus of the abdominal organs.<sup>6</sup> Some genetic factors involved in SI include zinc finger transcription factor, transforming growth factor B-related factor, human activin receptor type IIB, and cryptic.<sup>7</sup>

In conclusion, the extent of MI in such patients may be underestimated unless dextrocardia is timely recognized and ECG leads reversed. During coronary artery bypass graft, the right internal mammary artery can be taken as conduit to left anterior descending artery. During defibrillation for such patients the pads must be applied in opposite direction namely; upper right on upper left, and lower left on lower right. Central venous cannulation can be difficult from the right side, and it is better to perform it from the left side.

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