Editorial: Positional Variations of the Heart and Its Component Chambers

Saroja Bharati, M.D. and Maurice Lev, M.D.

Congenitally abnormal hearts are often diagnosed by referring to the situs of the atria, the type of bulboventricular loop and the type of mutual relationships of the arterial trunks, as in the preceding paper by Dickinson et al. Often, authors will not state the direction of the base-apex axis of the heart, or will mention it only incidentally. We believe that this method is insufficient to indicate completely the position of the heart and its component chambers.

We should strive to indicate the position of the atria, ventricles and arterial trunks both from the standpoint of lateral and anteroposterior, and, if possible, cranio-caudal relationships, vis-a-vis the body of the patient (fig. 1). This approach could be useful in angiography, echocardiography and surgery.

The direction of the base-apex axis of the heart should first be determined. Does it point to the right or to the left, or does the heart point ventrally (fig. 1)? If this direction results from extraneous phenomena such as diaphragmatic hernia, agenesis of the lung, atelectasis or emphysema, levoposition, dextroposition or mesoposition may be diagnosed. Only then should the analysis proceed to the position of the atria, their venous connections, the atrioventricular connections, the position of the ventricles and their arterial connections, and the mutual positions of the arterial trunks.

A description of the situs of the atria is not sufficient; this indicates only laterality. It does not indicate anteroposterior or cranio-caudal relationships. Thus, in dextroversion (fig. 1), the atria are either side by side, with the morphologically right atrium to the right and the morphologically left atrium to the left, or the morphologically right atrium is to the right and posterior, and the morphologically left atrium is to the left and anterior. The term situs solitus for this relationship is confusing, for in situs solitus atria in levocardia, the morphologically right atrium is to the right and anterior and the morphologically left atrium is to the left and posterior. We prefer to use the term situs solitus, pivoted, for the atrial relationship in dextroversion, although other terms may be appropriate. Similarly, in one type of isolated levocardia, the morphologically right atrium is to the left and posterior and the morphologically left atrium is to the right and anterior. The term situs inversus for this relationship may be insufficient or confusing. For in situs inversus atria in dextrocardia, the right atrium is to the left and anterior and the left atrium is to the right and posterior. Therefore, we use the term "inversion of atria" or situs inversus, pivoted, for the relationship (fig. 1), in the above type of isolated levocardia. Some other term which expresses both the lateral and anteroposterior relationships would also be valid.

In mesocardia, it is not sufficient to indicate only the atrial situs (fig. 1). Here, the atria, lying side by side, are posterior to the ventricles whether they are in situs solitus or inversus, with the atrial septum in an anteroposterior plane. Likewise the ventricles are anterior, more or less side by side, whether there is a d- or l-loop. The position of the atrial and ventricular septa are obviously important in surgical repair of defects, especially in mesocardia.

The cranio-caudal relationship of the atria may also be important. Thus, in straddling tricuspid orifice and valve, and in criss-cross hearts, the right atrium is situated more caudally to the left atrium than normal.

In describing the atrioventricular connections, concordance and discordance are excellent terms which indicate the correct position of the ventricles by inference. However, the terms d- or l-loop are not, in our view, sufficient to indicate the position of ventricles. In a d-loop in levocardia (fig. 1), the right ventricle is anterior and to the right, and the left ventricle posterior and to the left. In a d-loop in dextrocardia, of the dextroversion type, the right ventricle is posterior and to the right, and the left ventricle is anterior and to the left. In an l-loop in levocardia, the right ventricle is posterior and to the left, or more directly to the left, while the left ventricle is anterior and to the right, or more directly to the right. In an l-loop in dextrocardia, of the mixed (discordant) or mirror-image type, the right ventricle is anterior and to the left, and the left ventricle is posterior and to the right.

In the ventricles, the cranio-caudal relationship of the chambers may be important, especially in criss-cross hearts, and in those hearts in which the ventricular septum is in a horizontal plane.

When describing ventriculoarterial trunk connections, the terms ventriculoarterial concordance or discordance may be useful. However, in describing the mutual positions of the arterial trunks, the base-apex axis of the heart is also important. Thus, in pure (concordant) levocardia with normally related arterial trunks, the aortic orifice is posterior and to the right of the pulmonary orifice. The pulmonary trunk swings directly posteriorly to reach its bifurcation. In dextrocardia of the dextroversion type without transposition or double outlet right ventricle, the aortic orifice is likewise situated posteriorly, but lies slightly to the
POSITIONAL VARIATIONS OF THE HEART / Bharati and Lev

LEVOCARDIA

Pure Levocardia; Normal position of heart with normal relationship of chambers

Mixed Levocardia, with Atrial Inversion

Mixed Levocardia, with Ventricular Inversion

Levoversion

MESOCARDIA

Mixed Mesocardia, with Atrial Inversion

Mixed Mesocardia, with Ventricular Inversion

Mesoverion

Type I

Type II

DEXTROCARDIA

Mirror-image

Mixed Dextrocardia; Atria in Mirror-image; Ventricles in Pivotal Position

Mixed Dextrocardia; Atria in Pivotal Position; Ventricles in Mirror-image

Dextroversion


left of or slightly to the right of the pulmonary trunk. The pulmonary trunk veers to the left, almost horizontally, and then dips posteriorly to the left of the ascending aorta to reach its bifurcation.

We believe the diagnosis of the situs of atria, with d- or l-loop without considering the base-apex, does not give us enough information about the position of the atria, ventricles and arterial trunks from the standpoint of not only lateral, but also anteroposterior and craniocaudal directions.

References


4. Lev M, Rowlatt UF: The pathologic anatomy of mixed levocardia; a review of thirteen cases of atrial or ventricular inversion with or without corrected transposition. Am J Cardiol 8: 216, 1961


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S Bharati and M Lev

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