

## **Left Ventricular Hypertrophy on Electrocardiography: Clinical Implication in Adult Congenital Heart Disease**

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Electrocardiography (ECG) is a cost-effective, non-invasive, and useful method in daily medical practice of adult congenital heart disease (ACHD). I talk about clinical implication of ECG in ACHD, with a focus on left ventricular hypertrophy (LVH).

High R-waves generally appear in left-sided leads I, aVL, and V<sub>4-6</sub> in LVH, and deep S-waves appear in right-sided leads III, aVR, V<sub>1-3</sub> as mirror images. Furthermore, in left-sided leads of typical LVH cases, volume overload induces high T-waves and deep Q-waves, and pressure overload induces shallow Q-waves and ST-segment depression with T-wave inversion, so-called strain pattern. Sokolow-Lyon, Cornell, and other criteria for LVH should be used with consideration for age, gender, race, and basic diseases, especially complex ACHD. Left axis deviation is not common in LVH, but provides clues to diagnose special diseases such as atrioventricular septal defect (AVSD), tricuspid atresia, corrected transposition of the great arteries, and Noonan syndrome.

Diseases with volume overload are left-to-right shunt and valve regurgitation. Left-to-right shunt is seen in unrepaired or postoperative residual ventricular septal defect (VSD), patent ductus arteriosus, and AVSD. Mitral valve regurgitation (MR) and aortic valve regurgitation (AR) are caused by isolated valve disease and accompanied by several ACHD; for example, MR by AVSD and AR by outlet VSD with coronary cusp prolapse. Diseases with pressure overload are unrepaired or postoperative aortic valve stenosis and coarctation of the aorta (COA), which sometimes progresses to re-stenosis or hypertension. LVH and AR also occurred in aortopathy, a new clinical entity associated with aortic pathophysiological abnormality, aortic dilation, and aorto-left ventricular interaction, in ACHD including Marfan syndrome, Turner syndrome, bicuspid aortic valve, COA, tetralogy of Fallot, transposition of the great arteries, and hypoplastic left heart syndrome.

ECG plays a major role for basic diagnosis and detection of hemodynamic changes, besides management of arrhythmia, in ACHD. However, the diagnostic criteria of ventricular hypertrophy and the effect on prognosis in ACHD remain unclear, thus should be investigated in the future.