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Review

Differential diagnosis between left ventricular hypertrophy and cardiomyopathy in childhood

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Abstract The sensitivity and specificity of the electrocardiogram for the diagnosis of left ventricular hypertrophy of different etiologies are described. The sensitivity of the electrocardiogram for detecting left ventricular pressure overload is substantially lower (<35%) than the sensitivity for detecting evidence of a cardiomyopathy (55% to around 87%). Attention is drawn to the finding that in many differing etiologies of left ventricular hypertrophy ST-T-wave changes commonly referred to as "strain"-pattern are a harbinger of an increased risk of malignant cardiac arrhythmias and sudden death.

In the most common pediatric cause of sudden death, hypertrophic cardiomyopathy, a described ECG risk score, which scores both voltage and repolarization abnormalities, is the most powerful predictor hitherto described for predicting the risk of sudden death in this diagnosis. A point score over 5 points gives a relative risk for sudden death of 24.3 with a sensitivity of 96% and a specificity of 78% in childhood.

Keywords: Cardiac hypertrophy; Electrocardiography; Repolarization abnormalities; Hypertrophic cardiomyopathy; Sudden death

Introduction

The ECG-diagnosis of suspected cardiac hypertrophy or cardiomyopathy is an increasingly important topic with the recommendation to include ECG-screening in the pre-participation screening of athletes [1]. That electrocardiographic voltages have a statistically significant relationship with the presence of cardiac hypertrophy has long been established in large population studies in adult hypertensive patients [2]. Various electrocardiographic indices have been proposed and validated for adults above 35 years of age [3]; this review has only brief reference values for childhood patients, and those given are from 1979 [1,3], and should not be used in childhood since new studies on 1912 normal children with modern digital equipment reveals significantly higher voltage measurements [4]. The pediatric field is however bedeviled by different national habits in pediatric lead placement, thus the study by Rijbeek et al documents age- and gender related normal values in individual leads such as V_{3R} and V_7, but not V_{4R} and V_3 and does not publish normal ranges for summation indexes [4]. The ECG-parameter with probably the best correlation with hypertrophy in adults is the 12-lead amplitude × duration product [2]. However, no suggested criteria for cut-off for hypertrophy based on data in normal children have been published.

It has also been recognized that it is possible to have "hypertrophy" on ECG criteria without having an increased cardiac mass, either on echocardiography or on post mortem cardiac weight, in the setting of some types of hypertrophic cardiomyopathy, notably some troponin T-mutations [5,6]. Indeed, in a study on children with hypertrophic cardiomyopathy increased ECG-voltages (quantified as 6-limb lead voltage sum) and echocardiographic degree of hypertrophy were found to be independent risk factors for sudden arrhythmia death [7]. Thus the relationship is far from close. Likewise, a review of studies of the relationship between the left ventricular strain pattern and left ventricular hypertrophy has found the sensitivity to be poor (3.8–50%) but the specificity to be better (89–100%) [8]. It thus makes sense to discuss the ECG features of left ventricular (LV) hypertrophy in relation to the causative diagnosis.

Review

Left ventricular hypertrophy secondary to pressure overload

Pressure overload of the left ventricle can be caused by either outflow obstruction from the left ventricle or conditions causing a systemic hypertension. The most common causes of LV hypertrophy in childhood are aortic stenosis and coarctation of the aorta, serious systemic

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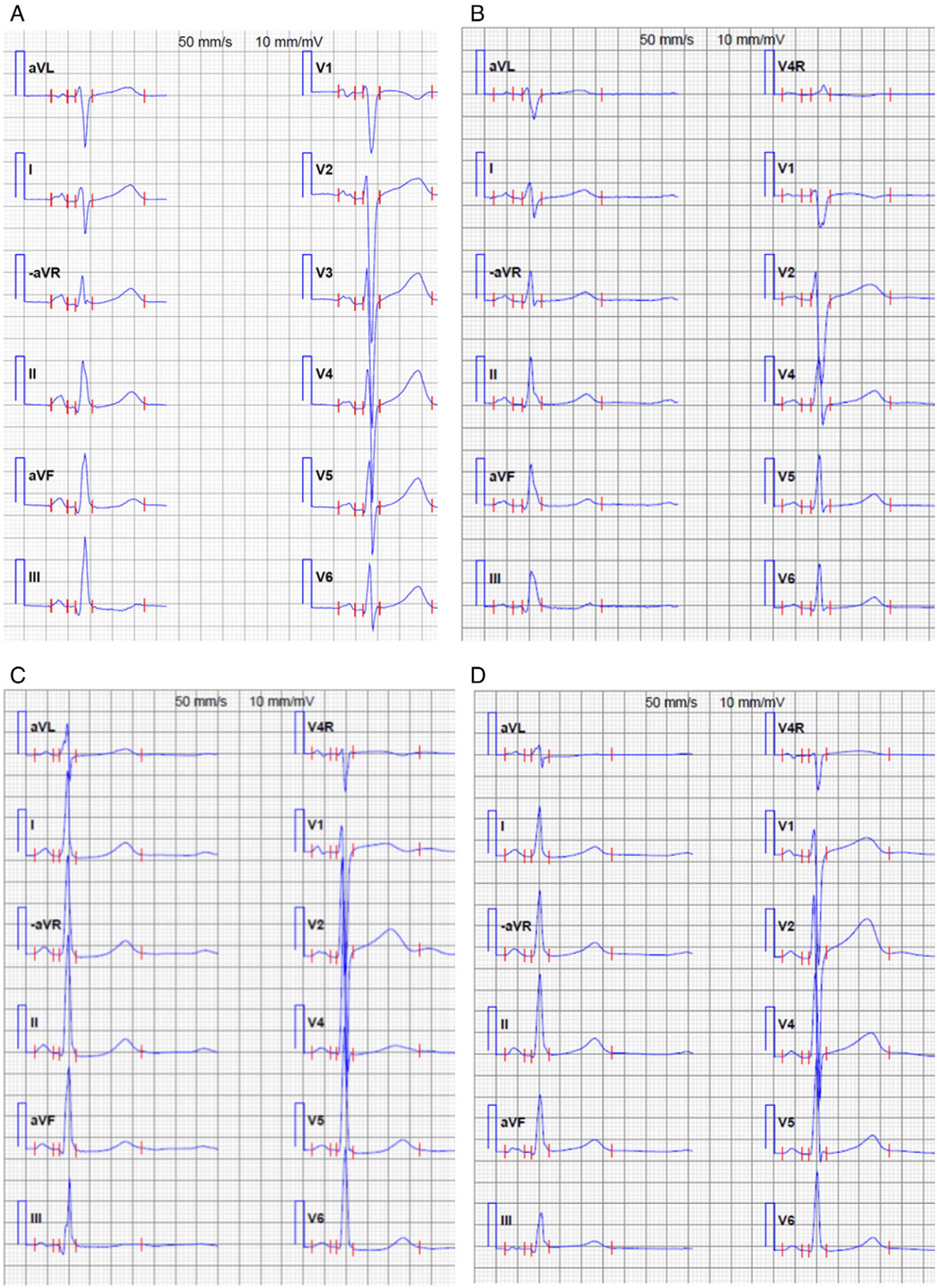
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