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Tentative criteria of a combined RV3+SV3 voltage for early diagnosis of pediatric patients with hypertrophic cardiomyopathy

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Background: A high voltage in midprecordial leads, termed the Katz-Wachtel sign, is a surrogate marker of left- or bi-ventricular hypertrophy. Asymmetrical interventricular hypertrophy is a characteristic feature of hypertrophic cardiomyopathy (HCM). In Japan, a school-based electrocardiographic (ECG) screening program was developed for all 1st, 7th, and 10th graders. Our hypothesis is that a combined voltage of RV3+SV3 {V3(R+S)} is a marker to screen pediatric HCM.

Purpose: [1] To develop V3(R+S) voltage criteria in 1st, 7th, and 10th graders at the screening program and [2] to determine whether the criteria are useful for the early diagnosis of HCM.

Methods: [1] Overall, 48,401 digitally stored ECGs from 16,773 1st graders (6-year-olds), 18,126 7th graders (12-year-olds), and 13,502 10th graders (15-year-olds) were obtained after excluding ECGs of subjects with underlying diseases, arrhythmias, and ST/T changes. The prevalence of HCM in children is estimated at 2.9 per 100,000 (1/34,000). The screening points were assumed to be between 1/2,000 and 1/5,000 to exclude the possibility of false negatives. [2] In 12 HCM patients (males/females=10/2) who were diagnosed after 12 years of age (one case was diagnosed at 9 years of age), the ECGs at the screening program of their first grade (at 6 years of age) were retrospectively examined.

Results: [1] The V3(R+S) criteria were 6.0 mV, 6.0 mV, and 5.5 mV for 1st, 7th, and 10th grade males, and 5.0 mV, 4.5 mV, and 4.0 mV for 1st, 7th, and 10th grade females, respectively. The number of subjects (and prevalence in parentheses) selected by the criteria were 2 (1/4175), 3 (1/2981), and 1 (1/6477) for 1st, 7th, and 10th grade males, and 2 (1/4212), 3 (1/3061), and 1 (1/3513) for 1st, 7th, and 10th grade females, respectively. [2] Four of 12 cases fulfilled the criteria. Of these, one suddenly died at 18 years of age, one experienced out-of-hospital cardiac arrest at 16 years of age, and one already had an interventricular thickness of 19 mm at 12 years of age.

Conclusions: These tentative V3(R+S) voltage criteria may be useful for the early diagnosis of pediatric HCM patients, particularly severe patients. The children and adolescents who were screened can be followed at 2–3-year intervals with ECGs and echocardiography. Early diagnosis and intervention including lifestyle modification and medication may prevent them expiring from out-of-hospital cardiac arrest or sudden death. Finally, the criteria should be validated in clinical settings.