Functional maturity of tricuspid and mitral valves in school children evaluated by echocardiography

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The prevalence of valve regurgitation in healthy people has been previously examined by echocardiography. Pulmonary regurgitation or tricuspid regurgitation (TR) was common, mitral regurgitation (MR) was less common, and aortic regurgitation was generally undetectable. In addition, the prevalence of regurgitant signals varies with age or sex. Assuming that a low prevalence of regurgitant signals indicates functional maturity, examining changes in the prevalence and severity of these signals is useful for evaluating the functional development of the valves. In this study, we examined the prevalence and severity of TR and MR with colour Doppler echocardiography in school children and healthy adults.

METHODS
The committee for research in human subjects of the University of Yamanashi approved the protocol. We enrolled 253 children (84 junior school children with a mean (SD) age of 9.8 (0.3) years and 169 junior high school children aged 13.0 (0.3) years) and 45 healthy adult volunteers aged 38.5 (7.4) years in this study. All participants underwent ECG and a physical examination before the study. No findings were abnormal.

The colour Doppler examination was performed with an echocardiographic system (Sonos 2500; Hewlett Packard, Andover, Massachusetts, USA) with a 3.5 MHz transducer. All participants were continuously examined by a single skilled examiner over two days. Data were recorded on videotape and evaluated by two independent investigators who were blinded to the study design. Regurgitation was examined in the parasternal long axis and apical four chamber views. The Doppler colour gain was optimised by conventional methods. The severity of regurgitation was semi-quantitatively assessed on a five grade scale by determining the intrusion distance of the regurgitant signal from the tricuspid or mitral valve orifice in the apical four chamber view as follows: none (no signal); trivial (small amount of signal); mild (less than one third of the atrium); moderate (from one to two thirds of the atrium); and severe (more than two thirds of the atrium).

All data are presented as mean (SD). Data were analysed by the Spearman rank correlation, the Kruskal-Wallis test, and the Mann-Whitney U test. A probability value of \( p < 0.05 \) was considered to be significant.

RESULTS
TR and MR were detected in 88% and 26%, respectively, of school children. In the tricuspid valve, most regurgitations were classed as trivial. By contrast, in the mitral valve no signal was generally observed. Then, the prevalence decreased with severity. The overall severity of TR was significantly correlated to that of MR in school children (\( p < 0.001 \)). TR and MR were detected in 51% and 13%, respectively, of adults. In addition, TR was significantly more severe than MR (\( p < 0.001 \)). Furthermore, the severity of TR was correlated to that of MR (\( p < 0.001 \)). TR and MR did not differ significantly between sexes.

TR was significantly more severe and more common in school children than in adults (\( p < 0.001 \); fig 1). The prevalence and severity of TR and MR did not differ significantly between age groups or between sexes.

DISCUSSION
The prevalence of atrioventricular valve regurgitation varied from 2–45% in MR and from 6–78% in TR in previous reports. The large variation in these results is probably due to...
to differences in the methods and criteria. In the present study, the severity of the regurgitant signal was semiquantitatively assessed on a five grade scale. In addition, to minimise the intraobserver and interobserver variabilities, the same skilled examiner continuously recorded the echocardiograms of all participants over two days.

In the present study, TR and MR were detected in 88% and 26%, respectively, of school children. When apparent regurgitation was defined as greater than trivial, these prevalences were 36% and 5%, respectively.

The present study showed a significant difference between the functional maturity of the tricuspid and mitral valves: the mitral valve is morphologically robust towards regurgitation in childhood, whereas the tricuspid valve takes decades to mature functionally. Therefore, the prevalence and severity of both TR and MR with respect to aging should be considered.
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