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Normal Value of the Interventricular Septal to Left Ventricular Posterior Wall Thickness Ratio Echocardiographic Determination in Normal Children and Adolescents

The Shimane Heart Study

(IVS/LVPW/echocardiography)

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Echocardiographic measurements of the interventricular septum (IVS) and left ventricular posterior wall (LVPW) thicknesses were performed and the IVS to LVPW thickness ratios (IVS/LVPW) were obtained in 613 normal subjects ranging from 4 to 18 years of age (318 boys and 295 girls) in the mass screening examination.

Means ± S.D. of IVS/LVPW were 1.02 ± 0.10, 1.00 ± 0.09, and 1.01 ± 0.09 for boys, girls and total subjects, respectively. We separated these groups according to body surface area (BSA) into 3 classes, i.e. <1.0 m^2, 1.0–1.5 m^2, and ≥ 1.5 m^2, and found no statistically significant differences between the sexes and classes.

Asymmetric septal hypertrophy is characteristic of hypertrophic cardiomyopathy which is genetically transmitted (1). Disproportionate thickening of the ventricular septum is also seen in other diseses (2). As we deal with these disorders in pediatrics, it is useful to acquire a basic knowledge of the IVS/LVPW in this period.

We now report the distribution of IVS/LVPW in a large population of normal children and adolescents.

MATERIALS AND METHODS

Mass screening examination of children and adolescents was performed in the spring of 1979 in Izumo, Shimane. Four facilities from kindergarten to senior high school participated. The anthropometric measurements were first made, then physical examination, blood pressure measurement, electrocardiography (ECG) of both standard 12 leads and Frank leads, and M-mode echocardiography were undertaken for each subject. Blood samples were also obtained.

Six hundred and thirteen children ranging from 4 to 18 years of age (318 boys and 295 girls) were included in the study. The echocardiograms were satisfactory for measurements of the IVS and LVPW thicknesses and there

was no evidence of cardiovascular disease, as based on the examinations above mentioned.

Echocardiograms were obtained with an Aloka 110S using a 5 or 2.25 MHz transducer. Tracings were recorded on an ECO-125S at a paper speed of 100mm/sec with the transducer placed at the third or fourth intercostal space.

The IVS and LVPW thicknesses were measured at the level of the chordae

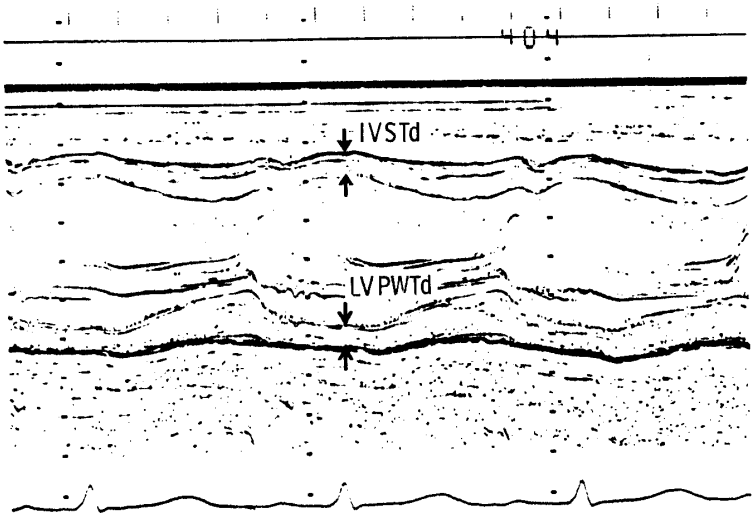

Fig. 1. An example of measuring the IVS and LVPW thicknesses. IVSTd : IVS thickness in end-diastole, LVPWTd : LVPW thickness in end-diastole.

of the mitral valve at the peak of the R wave of ECG (Fig. 1). The IVS/LVPW were calculated and the means±S. D. for boys, girls and total subjects were determined. The data of all groups were then separated and subdivided into three classes according to BSA. The mean and S. D. for each was calculated for comparison. Statistical analyses were made using Student's t-test.

RESULTS

Figs. 2 and 3 show the IVS and LVPW thicknesses in these children. These data were plotted with respect to BSA. The regression equations and correlation coefficients were also shown. Using these data, the individual values of IVS/LVPW were calculated and likewise displayed (Fig. 4). Details are summarized in Table I.

The mean ±S. D. of IVS/LVPW for all subjects was 1.01±0.09. The ratio ranged from 0.66 to 1.33 in boys (1.02±0.10) and from 0.66 to 1.28 in girls (1.00±0.09). There was no significant difference between these two values.

Both groups were then subdivided into three classes with respect to BSA, as shown in Table I. There were no significant differences in the mean

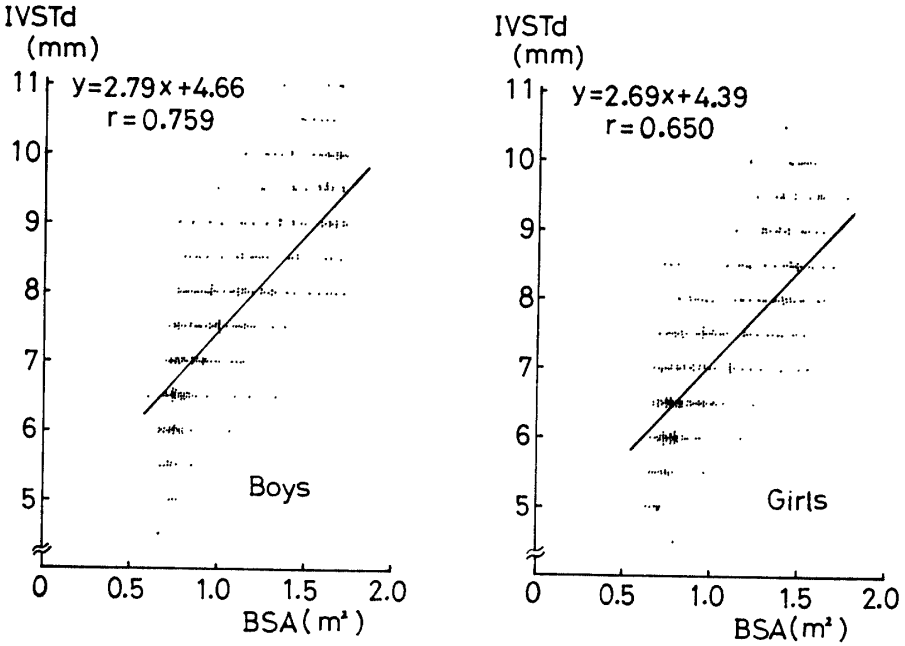

Fig. 2. The IVS thicknesses of boys and girls are displayed with regard to BSA. Abbreviation is the same as in Fig. 1.

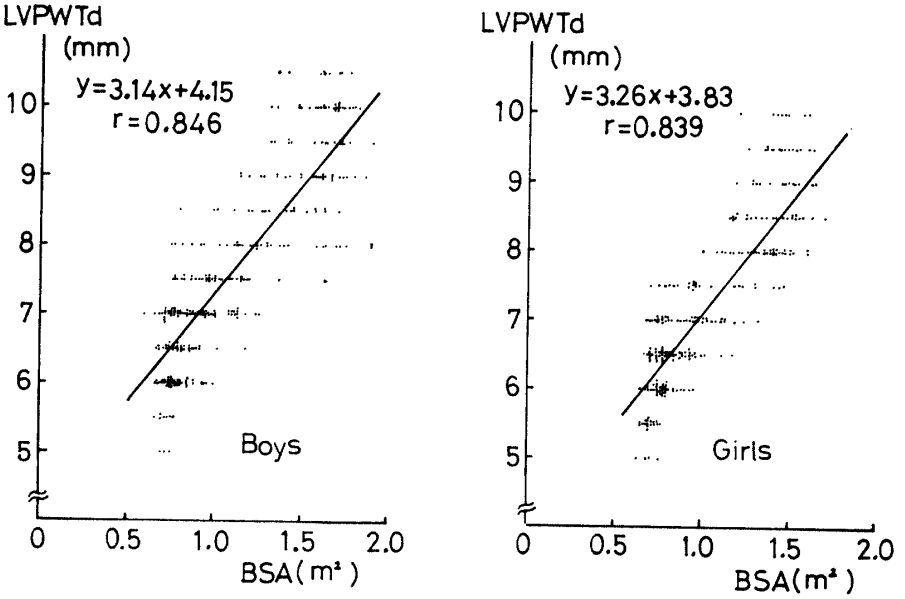

Fig. 3. The LVPW thicknesses of boys and girls are displayed with regard to BSA. Abbreviation is the same as in Fig. 1.

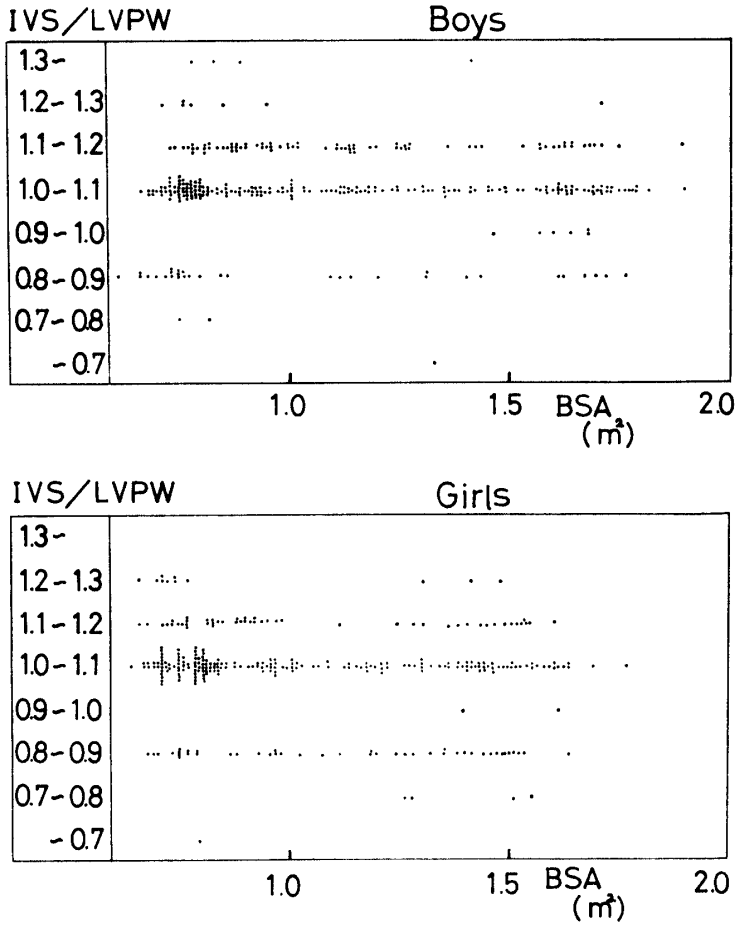

Fig. 4. The IVS/LVPW calculated for individual subjects are shown with respect to BSA. In the left-hand column, 1.2～1.3 means $1.2 \leqq < 1.3$, and the rest is the same.

TABLE I. *Values of IVS/LVPW Determined*

BSA(m^2)	Boys		Girls		Total	
	N	Mean±S.D.	N	Mean±S.D.	N	Mean±S.D.
～0.99	158	1.02±0.11	168	1.01±0.09	326	1.02±0.10
1.00～1.49	91	1.02±0.09	94	0.99±0.09	185	1.00±0.09
1.50～	69	1.00±0.08	33	0.98±0.09	102	1.00±0.09
Total	318	1.02±0.10	295	1.00±0.09	613	1.01±0.09

values of IVS/LVPW not only between the sexes but also between different BSA classes.

DISCUSSION

In healthy subjects, the IVS thickness was shown echocardiographically to be practically indentical with the LVPW thickness in both adults and children (3—5). Therefore, the IVS/LVPW was expected to be about 1.0. Some

workers actually evaluated the IVS/LVPW in normal adults and found that the mean value was almost 1.0 (6−10). Empirically, the same may be true in children. This should be confirmed and we evaluated the IVS/LVPW in healthy children and adolescents. The means ±S. D. were 1.02±0.10, 1.00 ±0.09, and 1.01±0.09 for boys, girls, and total subjects, with no statistical difference between both sexes. These values were fairly coincident with those of Henry *et al.*, as predicted from their regression equations in the same age range (9). Although the ratios tend to decrease with a larger BSA, as also expected from some reports (9, 11), these mean values of different BSA classes did not differ significantly. It was concluded that, in this period of life, the IVS/LVPW remains the same, irrespective of body size (BSA) or sex.

Echocardiograms should be taken with good visualization of both the right and left septal surfaces of the IVS, and the endocardial and epicardial surfaces of the LVPW (12). Measurements should be made using the thinnest continuous echo lines because minor differences in the septal or wall thicknesses, of which the absolute values are small in children may produce large deviations in the ratio (2).

Abnormal IVS/LVPW ($\geq$ 1.3) is characteristic of genetically transmitted hypertrophic cardiomyopathy (1, 6, 10, 13). Other various diseases may show secondary disproportionate septal thickening (DST) (1, 2, 8, 14−18). Included are pulmonary stenosis, primary pulmonary hypertension, Eisenmenger syndrome, coronary artery disease, systemic hypertension, etc. In some such cases, right ventricular pressure overload has been shown to be a strong stimulus for DST (8). Apart from such disorders, developing normal human hearts normally show DST, and infants and young children sometimes show the same findings (19, 20). These are age dependent DST.

Abnormal IVS/LVPW is defined as $\geq$ 1.3 (1,13) or $\geq$ 1.5 (6, 21, 22). The higher value increases specificity but decreases sensitivity (8). We examined four children (0.6%) with ratios over 1.3. These should be considered as the extreme end of normal continuous spectrum in this age range. Therefore, the same criterion as in adults can be used from childhood (preschool) to adolescence.

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