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USEFULNESS OF THE RIGHT VENTRICULAR ECHOGRAM : RECORDING TECHNIQUE AND ITS CLINICAL APPLICATION

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Abstract

In order to investigate the best way of recording the right ventricular wall (RVW) by echocardiography and to assess its clinical usefulness, the following study consisted of four parts were performed.

First, the best way of recording the RVW were investigated in 40 consecutive adult subjects with normal hearts and with various congenital and aquired cardiac disorders. The recordings of the RVW were taken in five ways, namely, anterior-supine approach with a 2.25 MHz or a 5.0 MHz transducer, subxiphoid approach with a 2.25 MHz transducer and anterior-sitting approach with a 2.25 MHz or a 5.0 MHz transducer. The highest successful recording rate (80%) was obtained by an anterior approach in supine position with a 5.0 MHz transducer.

In the second part of the study, the normal range of the RVW thickness by the best way was investigated in 25 out of another 32 normal adults. The normal thickness of the RVW was 2.4 ± 0.5 mm (mean $\pm$ 1 SD), and the RVW thickness index was 1.7 ± 0.2 mm/m^2 (mean $\pm$ 1 SD).

In the third, the validity of recording the RVW by the best way was assessed. The RVW thickness of another 21 patients with right ventricular overload ranged from 2.5 mm to 16 mm, and seemed to have a good correlation with pulmonary arterial systolic pressure ($r = +0.77$).

In the last part of the study, echocardiographic examination was performed in 15 patients with hypertrophic cardiomyopathy, 7 patients with severe hypertension, 15 patients with mild hypertension and 20 normal subjects, in order to find out the most useful indices in differentiating hypertrophic cardiomyopathy from hypertensive heart disease. The thickness of the left ventricular posterior wall (LVPW) and the interventricular septum (IVS) with a 2.25 MHz transducer, and of the right ventricular anterior wall (RVAW) with a 5.0 MHz

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transducer were measured at end-diastole. The ratio of IVS to LVPW, RVAW to LVPW and RVAW to IVS were also calculated. The thickness of RVAW was the most useful index in differentiating hypertrophic cardiomyopathy (4.5 ± 0.2 mm [1 SD]) from severe hypertension (2.8 ± 0.4 mm) and mild hypertension (2.7 ± 0.3 mm) ($p<0.01$).

Thus an anterior approach with a 5.0 MHz transducer would be the best way of recording the RVW, and be clinically quite useful.

INTRODUCTION

About twenty years have past since echocardiography was introduced to the field of cardiology. Recently the technique has become a major diagnostic tool in clinical cardiology. This rise in popularity is not only because the technique is non-invasive or not hazardous to the patient, but also because the examination provides information which is unique and is not available with any other examination.

Although a large number of informations[1-3] concerning the left ventricular echogram are available, there are many problems to be solved for the right ventricular echogram. The method and its usefulness of recording the right ventricular wall by a subxiphoid approach has been previously repored[4], but an anterior approach is not enough for the clear recording of the right ventricular wall.

It is well known that the higher the frequency of ultrasound, the clearer the recording of near-field[5]. A 5.0 MHz transducer, therefore, seems to be better for recording of the right ventricular wall[6,7], which lies near from the chest wall, than a 2.25 MHz transducer that is widely used for routine examination.

The purpose of this study is to justify a method of recording the right ventricular wall by an anterior approach with a 5.0 MHz transducer in adults[6], and to demonstrate its usefulness in clinical cardiology[8].

SUBJECTS AND METHODS

This study consisted of four parts.

The study first required to justify that the optimal method for recording the right ventricular wall was the one by anterior approach with a 5.0 MHz transducer. In the second part of the study, the normal value of the right ventricular anterior wall by this method was found out. In the third, the validity of this method was assessed using the patients with right ventricular overload. The last part of the study was to demonstrate the usefulness of this method in clinical cardiology.

I) *Optimal method of recording the right ventricular wall*

In order to justify that the optimal method for recording the right ventricular wall was the one by anterior approach with a 5.0 MHz transducer, 40 consecutive subjects who were comprised of 11 normal individuals and patients with various cardiac disorders were studied as shown in Table 1.

TABLE 1. Subjects used for the study of transducer type and position

Clinical diagnosis			40 subjects
Normal			11
Mitral valve disease	MS	6	) 9
	MR	3	
Aortic valve disease			2
Coronary artery disease	old MI	2	) 5
	angina	3	
Hypertension			2
Cardiomyopathy			2
Congenital heart disease	ASD	2	) 3
	VSD	1	
Others			6

ASD=atrial septal defect, old MI=old myocardial infarction, MR=mitral regurgitation, MS=mitral stenosis, VSD=ventricular septal defect

At first, each subject was examined echocardiographically as a routine work, then the recording of the right ventricular wall was performed. The recordings of the right ventricular wall were taken in five ways, namely, with a 2.25 MHz and again with a 5.0 MHz transducers parasternally at the third or fourth intercostal space first in the supine or 15-degree left lateral decubitus position (anterior-supine approach) (Figure 1), and then with 2.25 MHz transducer through the subxiphoid area (subxiphoid approach) (Figure 2). Finally, the patients were raised passively to an approximately 80-degree sitting position, and the recordings were taken with a 2.25 MHz and a 5.0 MHz transducers from the left sternal border at the third or fourth intercostal space (anterior-sitting approach (Figure 3).

For the recordings of the right ventricular wall, the beam direction through which the maximal left ventricular transverse dimension could be recorded was chosen. When the right ventricular wall could not be recorded distinctly in this direction, the transducer was directed slightly towards the apex until the right ventricular wall endocardium became clear.

The measurement of the right ventricular wall thickness was made only at end-diastole, i.e., at the peak of the R wave on the electrocardiogram. The

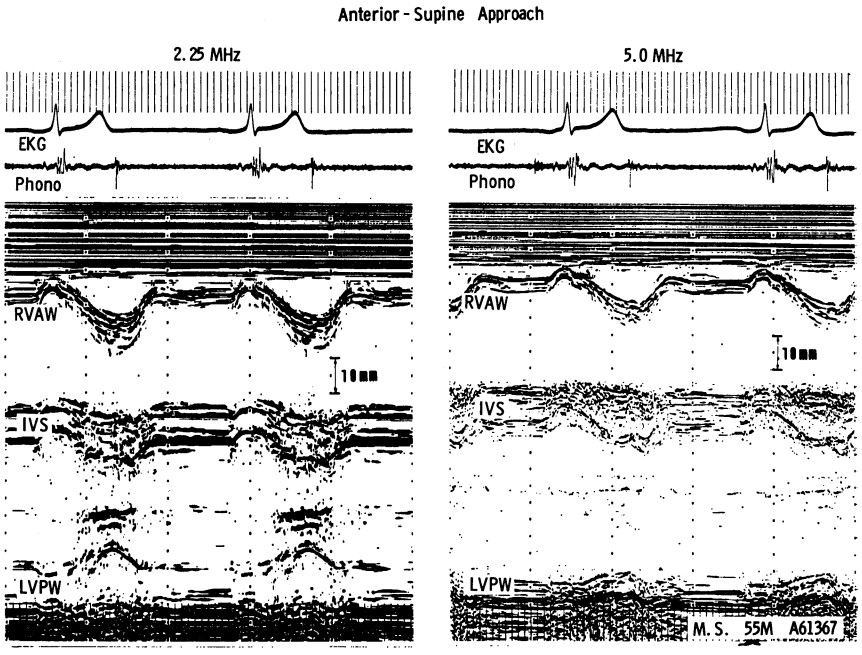

Fig. 1. Tracings obtained by an anterior-supine approach with 2.25 MHz (left panel) and 5.0 MHz (right panel) transducers. The scales between the right and left panels were different. Left ventricular posterior wall endocardium on the right panel was recorded poorly because ultrasound with higher frequency had greater absorption and scattering. IVS = interventricular septum, LV = left ventricle, LVPW = left ventricular posterior wall, RV = right ventricle, RVAW = right ventricular anterior wall.

quality of recording of the right ventricular wall was thought to be clear enough to estimate its thickness when the endocardium and the epicardium were recorded distinctly at the end of diastole even if the endocardium of the right ventricular wall could not be recorded continuously throughout all of systole and diastole. After the tracings were obtained by five recording methods, the percentage of those subjects whose right ventricular wall thickness could be measured by each method was calculated.

2) *Normal value of the right ventricular wall thickness*

In the second part of the study another 32 normal subjects, 28 males and 4 females with mean age of 50.4 years (ranger 30 to 75), were studied to establish the normal range of the right ventricular wall thickness.

These subjects visited our hospital for a health-check-up, and denied any

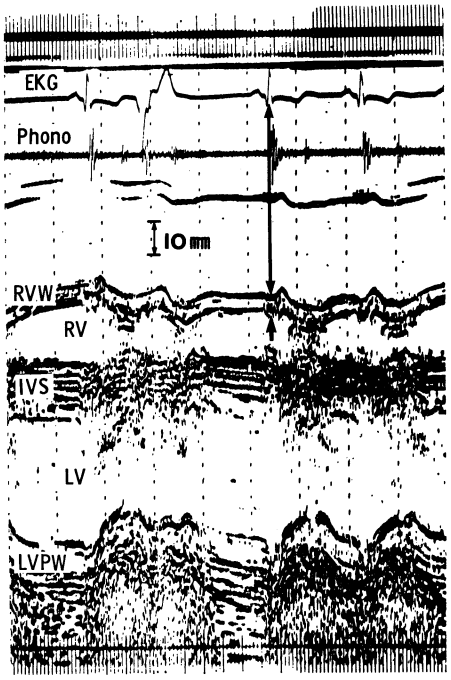

Fig. 2. Tracings obtained by a subxiphoid approach with 2.25 MHz transducer. Abbreviations : refer to Fig. 1.

cardiac symptoms. They were documented to have no heart disease after the physical examination, chest X-ray, exercise electrocardiography (double Master's two-step test), and peripheral blood examinations were performed.

The right ventricular wall was recorded by an anterior approach with a 5.0 MHz transducer, which had the highest recording rate according to the first study, and on an enlarged scale to measure the right ventricular wall thickness accurately (Figure 4). The thickness of the right ventricular wall was represented by the distance between the epicardial surface echo and the endocardial surface echo at the peak of the R wave on the electrocardiogram. The right vetricular thickness index was derived from dividing by the body surface area.

3) *Validity of anterior approach with 5.0 MHz transducer*

In the third part of the study, another 21 patients with various cardiac disorders of right ventricular overloads as shown in Table 2, who underwent cardiac catheterization, were studied to assess the validity of this method. The average age was 46.3 years (range 22-65 years). The echocardiograms of the

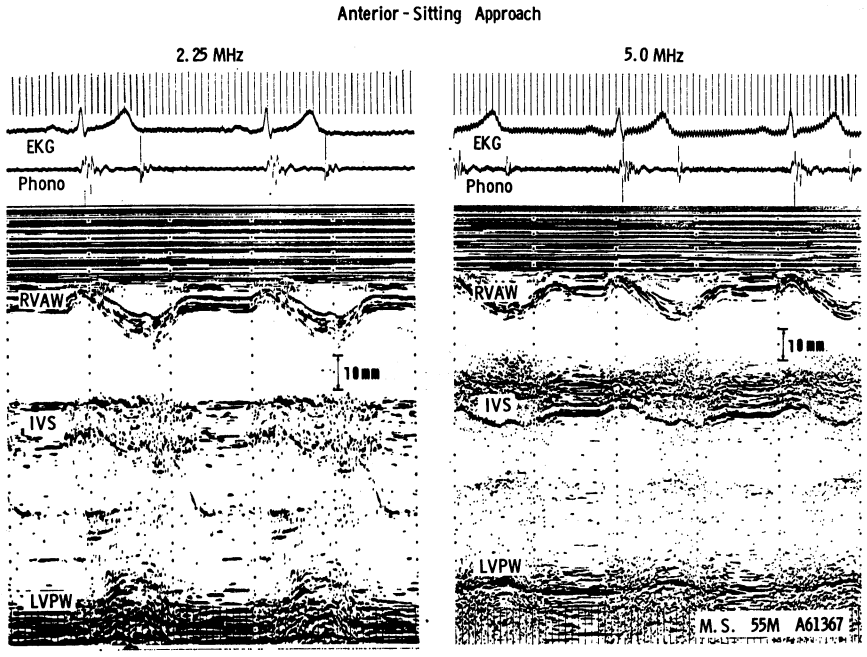

Fig. 3. Tracings obtained by an anterior-sitting approach with 2.25 MHz (left panel) and 5.0 MHz (right panel) transducers. Abbreviations : refer to Fig 1.

right ventricular anterior wall were recorded by the same method as the second part of the study. A correlation between the right ventricular anterior wall thickness and pulmonary arterial systolic pressure, and between the right ventricular anterior wall thickness index and pulmonary arterial systolic pressure were studied.

4) *The differentiation between hypertrophic cardiomyopathy and hypertensive heart disease*

The feasibility in differentiating hypertrophic cardiomyopathy from hypertensive heart disease was assessed in order to demonstrate clinical usefulness of this method. Study group consists of another 75 patients.

Fifteen patients with hypertrophic cardiomyopathy, including 3 patients with idiopathic hypertrophic subaortic stenosis (IHSS), who were all normotensive (Group I). The average age was 45.8 years (range 21–64 years). The diagnosis was based on cardiac catheterization (11 patients) or echocardiography with other clinical data (4 patients). Right heart catheterization was performed in 6 patients as shown in Table 3.

TABLE 2. Echocardiographic and hemodynamic data in 21 patients with right ventricular overload

Case No.	Age & Sex	Diagnosis	BSA (m^2)	RVAWT (mm)	RVAWTi (mm/m^2)	PAP (mmHg)
1	41M	ASD	1.44	8.0	5.6	102/50
2	55F	ASD	1.14	4.0	3.5	80/35
3	42F	ASD	1.50	4.0	2.7	32/12
4	45F	ASD	1.58	4.5	2.8	30/15
5	44M	ASD	1.70	3.0	1.8	23/7
6	65M	ASD	1.38	3.5	2.5	30/12
7	22F	ASD	1.44	2.5	1.7	35/10
8	55M	ASD	1.00	3.0	1.9	33/15
9	56M	VSD	1.43	4.0	2.8	45/14
10	24M	VSD	1.55	4.0	2.6	36/15
11	45F	PDA	1.16	6.0	5.2	110/70
12	46M	PPH	1.60	16.0	10.0	120/60
13	49M	CP	1.40	7.0	5.0	100/55
14	56F	CP	1.35	4.0	3.0	84/40
15	55F	MSR	1.39	8.0	5.8	74/30
16	36F	MS	1.26	3.0	2.4	25/14
17	56F	MS	1.37	2.5	1.8	40/17
18	37F	MS	1.40	2.5	1.8	26/10
19	53F	MS	1.43	2.5	1.7	45/25
20	45F	MS	1.52	2.5	1.6	23/8
21	45F	MSR	1.31	3.0	2.3	36/16

ASD=atrial septal sefect, BSA=body surface area, CP=cor pulmonale, MS=mitral stenosis, MSR=mitral stenosis with regurgitation, PAP=pulmonary artery pressure, PDA=patent ductus arteriosus, PPH=primary pulmonary hypertension, RVAWT=right ventricular anterior wall thickness, RVAWTi=right ventricular anterior wall thickness index, VSD=ventricular septal defect

The second group consists of 7 patients with severe hypertension, whose electrocardiogram revealed severe left ventricular hypertension, whose electrocardiogram revealed severe left ventricular hypertrophy with giant negative T wave (0.7 mV or more). The average age was 39.1 years (range 25–50 years). The level of blood pressure are shown in Table 3. A pulmonary arterial pressure was measured in 2 patients (Table 3).

The third group consists of 15 patients with mild hypertension (160/95 mmHg or more) associated with mild left ventricular hypertrophy. There were 13 males and 2 females whose average age was 49.2 years (range 29–74 years).

Twenty subjects without any clinical evidence of heart disease were used as normal control (Group IV). There were 18 males and 2 females whose average age was 51.6 years (range 35–63 years).

Left ventricular echograms were recorded by the method introduced by

TABLE 3. Clinical, hemodynamic and echocardiographic data

Case No.	age	sex	Diagnosis	BP (mmHg)	PAP (mmHg)	UCG (mm)		
						LVPW	IVS	RVAW
HCM & IHSS								
1	46	M	HCM	136/88		13	16	3.5
2	48	M	HCM	132/80		12	16	3.5
3	47	M	HCM	106/56		12	12	4.0
4	39	M	HCM	142/86		12	18	4.0
5*	40	M	HCM	115/70	18/9	12	22	7.0
6	57	M	HCM	120/78	25/12	12	12	3.5
7	23	M	HCM	114/58	30/10	13	13	6.0
8	64	F	HCM	130/80	21/10	12	17	4.0
9	47	M	HCM	126/80		11	9	3.5
10	46	M	HCM	102/70	20/6	12	16	5.0
11	47	F	HCM	96/54		12	15	5.0
12	21	M	HCM	134/54		13	14	4.0
13	56	M	IHSS	98/60	20/6	11	25	6.5
14	62	M	IHSS	126/70		12	26	4.0
15	44	F	IHSS	126/74		10	30	4.0
severe hypertension								
16	40	M	essential	190/120		12	11	3.0
17	48	M	essential	190/110		13	15	3.5
18	25	M	essential	180/130	18/7	12	10	2.5
19	38	M	essential	230/120	18/6	15	15	3.0
20	30	F	essential	240/130		12	10	2.5
21	50	M	essential	160/120		12	13	2.5
22	43	M	secondary	290/130		12	12	2.5

HCM : hypertrophic cardiomyopathy, IHSS : idiopathic hypertrophic subaortic stenosis, BP : blood pressure, PAP : pulmonary arterial pressure, UCG : echocardiography, LVPW : left ventricular posterior wall, IVS : interventricular septum, RVAW : right ventricular anterior wall

* (case 5) had an obstruction in the right ventricle

TABLE 4. Percentages of successful recordings of the right ventricular wall by various methods (n=40)

transducer	anterior approach		subxiphoid approach
	supine	sitting	
2.25 MHz	19 (47.5%)	15 (37.5%)	20 (50.0%)
5.0 MHz	32 (80.0%)	28 (70.0%)	

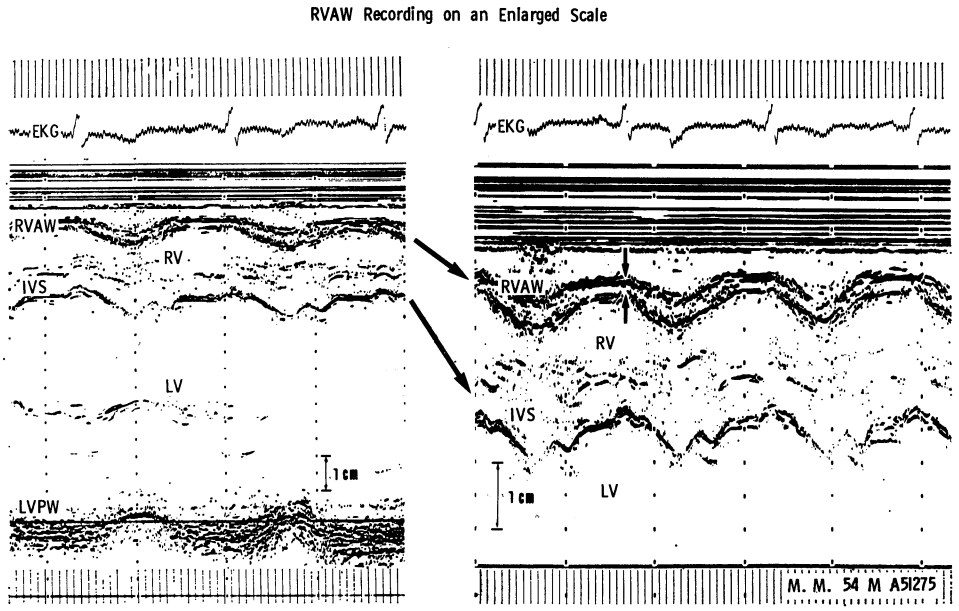

Fig. 4. Right ventricular anterior wall recordings on an ordinary scale and an enlarged scale using an anterior-supine approach with 5.0 MHz trausducer. The right panel shows an expanded recording of the right ventricular anterior wall. The right ventricular wall thickness was measured from the upper border of the epicardial echo to the upper border of the endocardial echo. Abbreviations : refer to Fig. 1.

Feigenbaum et al.[1] and right ventricular echograms were recorded by the same method as the second part of the study.

The thickness of interventricular septum (IVS), left ventricular posterior wall (LVPW) and right ventricular anterior wall (RVAW) were measured at end-diastole (at the peak of the R wave of the simultaneously recorded electrocardiogram) (Figure 5). From these observed values, the ratios of IVS to LVPW (IVS/LVPW), RVAW to LVPW (RVAW/LVPW) and RVAW to IVS (RVAW/IVS) were calculated.

RESULTS

1) *Optimal method of recording*

Of the tracings obtained by the five recording methods, the percentages of subjects whose right ventricular wall could be measured were as shown in Table 4. Either in the supine or sittng position the rate of successful recording with a 5.0 MHz transducer was higher than with a 2.25 MHz transducer.

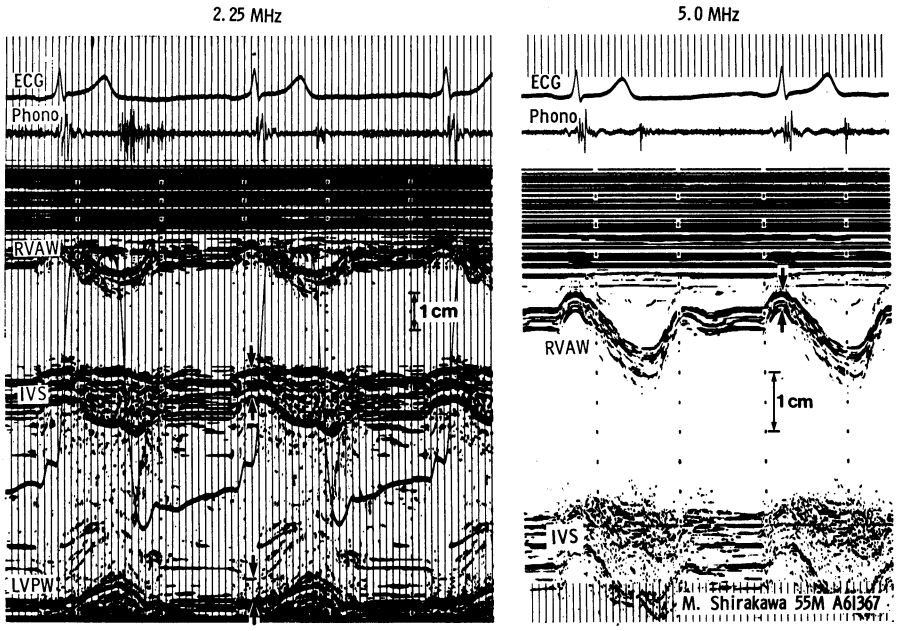

Fig. 5. Method of echocardiographic measurement. The left ventricular posterior wall (LVPW) thickness and the interventricular septal (IVS) thickness were measured on the left ventricular echogram with 2.25 MHz transducer (left). The right ventricular anterior wall (RVAW) thickness was measured on the expanded right ventricular echogram with 5.0 MHz transducer (right). These were measured at the peak of R wave on electrocardiogram (end-diastole).

The best method for the recording was the one with the patient supine using a 5.0 MHz transducer (80 %). Using a 2.25 MHz transducer in the supine position, the success rate was 47.5%, and with a 2.25 MHz and a 5.0 MHz transducers in the sitting position it was 37.5% and 70% respectively. A subxiphoid approach with a 2.25 MHz transducer gave a 50% success rate.

2) *Normal value*

By the best recording method of the right ventricular wall, i.e., the anterior approach in supine position with a 5.0 MHz transducer, the right ventricular wall were clearly recorded in 25 out of 32 normal subjects (78%). The normal thickness of the right ventricular anterior wall was 2.4 ± 0.5 mm (mean $\pm$ 1 SD), ranging from 1.8 mm to 3.5 mm. The right ventricular anterior wall thickness index was 1.7 ± 0.2 mm/m^2 (mean $\pm$ 1 SD).

3) *Validity of anterior approach with 5.0 MHz transducer*

The right ventricular anterior wall thickness of the patients with right

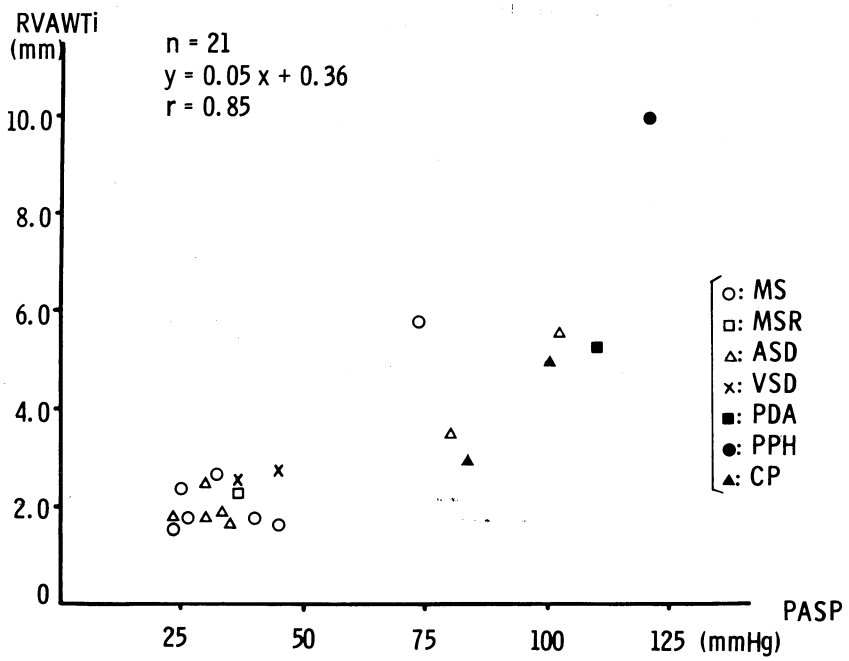

Fig. 6. Relationship between right ventricular anterior wall index and pulmonary arterial systolic pressure. A good correlation was obtained (r=+0.85). ASD = atrial septal defect, CP = cor pulmonale, MS = mitral stenosis, MSR = mitral stenosis with regurgitation, PASP = pulmonary arterial systolic pressure, PDA = patent ductus arteriosus, PPH = primary pulmonary hypertension, RVAWTi = right ventricular anterior wall thickness index, VSD = ventricular septal defect

ventricular overload ranged from 2.5 mm to 16 mm (4.6±3.1 mm (mean± 1 SD)). The right ventricular anterior wall thickness index were between 1.6 mm/m^2 and 10 mm/m^2 (3.3±2.1 mm/m^2). Pulmonary arterial systolic pressure ranged from 25 mmHg to 120 mmHg (53.8±32.3 mmHg).

The right ventricular anterior wall thickness had a good correlation with the pulmonary arterial systolic pressure (r = +0.77). The right ventricular anterior wall thickness index gave a better correlation with pulmonary arterial systolic pressure as shown in Figure 6 (r = +0.85). An echocardiogram of the patient with primary pulmonary hypertension who had the thickest right ventricular anterior wall (16 mm) is shown in Figure 7, whose pulmonary arterial systolic pressure was 120 mmHg.

4) *The differentiation between hypertrophic cardiomyopathy and hypertensive heart disease*

There were no significant difference in the thickness of LVPW and IVS

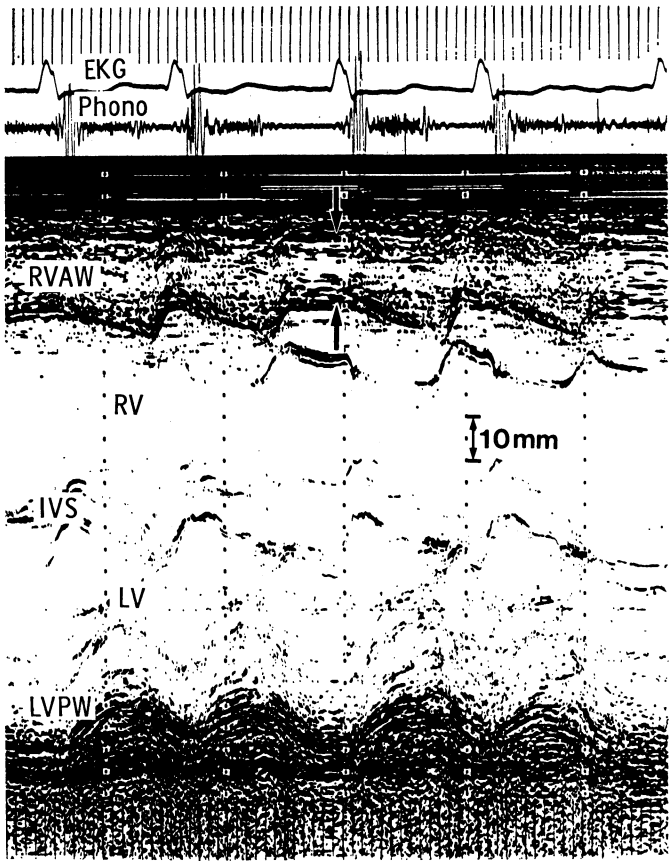

Fig. 7. Echocardiogram by an anterior approach with 5.0 MHz transducer in a 46-year-old man with primary pulmonary hypertension (case 12 in Table 2). The right ventricular anterior wall thickness is 16 mm, as indicated by arrows.

between group I [11.9±0.8 mm (mean± 1 SD) and 17.4±5.9 mm, respectvely] and group II (12.6±1.1 mm and 12.3±2.1 mm, respectively), as shown in Figure 8.

The thickness of RVAW was significantly greater ($P < 0.01$) in group I (4.5±1.2 mm) than in group II (2.8±0.4 mm) or group III (2.7±0.3 mm) as shown in Figure 9. The thickness of RVAW in group IV was 2.5±0.4 mm. Among patients in group I, the thickest RVAW was 7 mm, which was recorded in a patient (case 5 in Table 3) who had pressure gradient in a right ventricular cavity.

The IVS/LVPW ratio was significantly higher in group I (1.5±0.6) than in group II (1.0±0.1), group III (1.1±0.2) or group IV (1.1±0.2) ($p<0.05$), as shown in Figure 9.

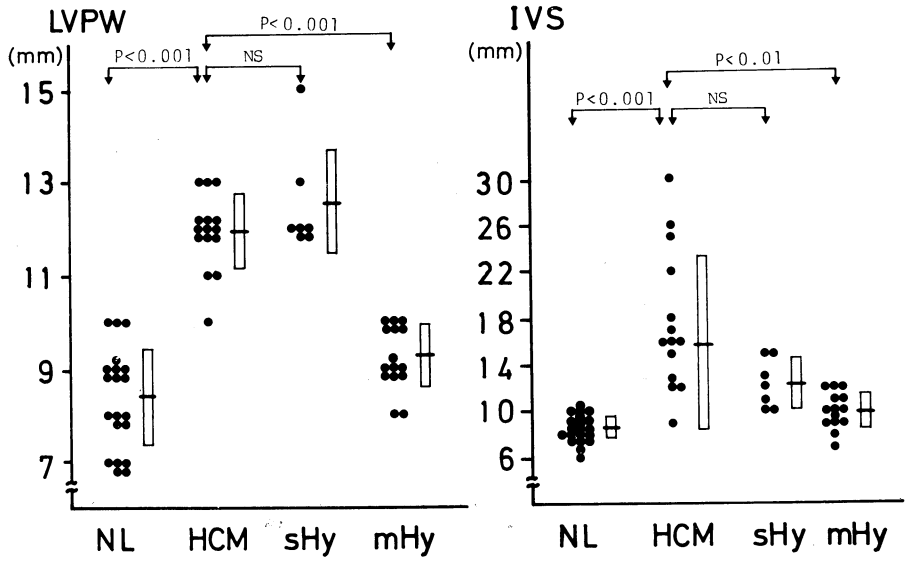

Fig. 8. The thickness of the left ventricular posterior wall (left) and the interventricular septum (right) in various groups. Individual values, mean ± 1 SD for all groups and P values between each two groups are shown. NL : normal (group IV), HCM : hypertrophic cardiomyopathy (group I), sHY : severe hypertension (group II), mHy : mild hypertension (group III).

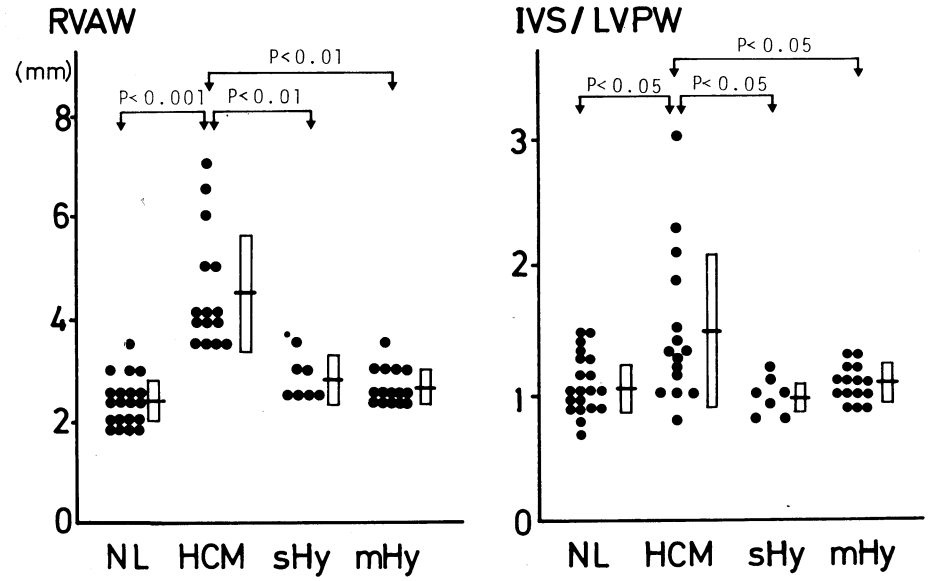

Fig. 9. The right ventricular anterior wall thickness (left) and the ratio of interventricular septum to left ventricular posterior wall (right). symbols and abbreviations as in Fig. 8.

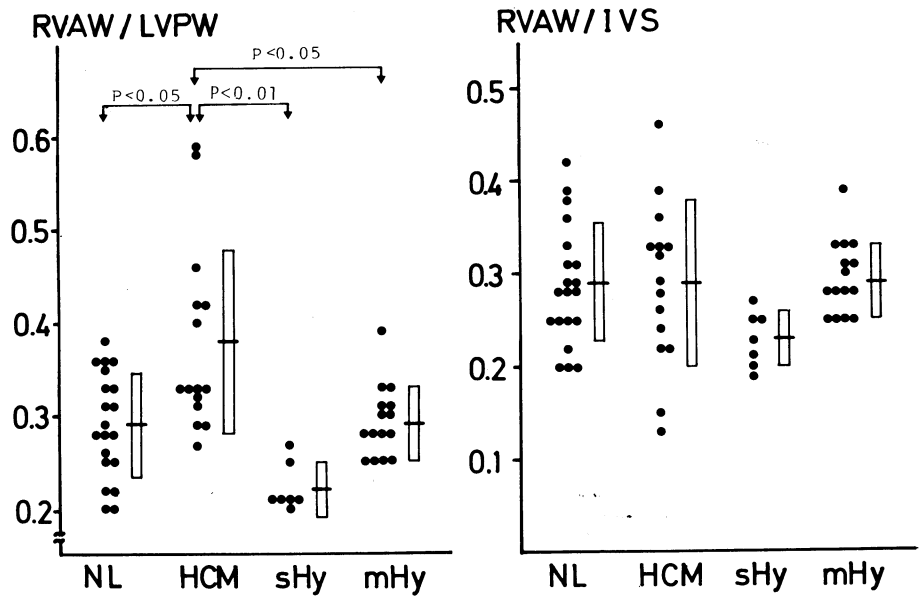

Fig. 10. The ratio of right ventricular anterior wall to left ventricular posterior wall (left), and the ratio of right ventricular anterior wall to interventricular septum (right). Symbols and abbreviations as in Fig. 8.

The RVAW/LVPW ratios were 0.38 ± 0.1 in group I, 0.22 ± 0.03 in group II ($p < 0.01$ versus ratios in group I), 0.29 ± 0.04 in group III ($p < 0.05$ versus ratios in group I) and 0.29 ± 0.06 in group IV ($p < 0.05$ versus ratios in group I), as shown in Figure 10.

The RVAW/IVS ratio in group I (0.29 ± 0.09) was not significantly different from the ratios in other three groups, as shown in Figure 10.

The most useful index in differentiating group I from group II was the thickness of RVAW or the ratio of RVAW/LVPW, for these two indices showed the most significant difference ($p < 0.01$). The former, however, was preferred because the latter had only a poor significance value ($p < 0.05$) in differentiating group I from group III.

DISCUSSION

1) *Optimal method of recording*

There are many reports available concerning the measurements of the left ventricular wall thickness by echocardiography[1-3], and its feasibility has been attested to by a good correlation with ventricular angiography[9] and surgical inspection[1]. However, reports related to the thickness of the right ventricular

wall have been limited to infants[10-13]. In adults it is only recently that subxiphoid approach[4] and standard approach using a 2.25 MHz transducer[14] have been introduced. But the measurement of the right ventricular anterior wall thickness by a standard approach with a 2.25 MHz transducer is usually uncertain because of poor recording[15].

This study revealed that an anterior approach with a 5.0 MHz transducer was the best method. It is well known that the higher the frequency of ultrasound, the greater its resolving power[5]. The results of this study seem to bear this out.

2) *Normal value*

The normal value of the right ventricular wall thickness proved to be 2.4 $\pm$0.5 mm, which seems to coincide well with the findings of autopsied hearts in Japanese patients[16]. It has been said that the normal right ventricular wall thickness is from 2 to 3 mm, and right ventricular hypertrophy is diagnosed when right ventricular wall thickness is 3.5 mm or more in autopsied hearts[16]. By a subxiphoid approach the right ventricular wall thickness has been reported to have a normal range of 3.4$\pm$0.8 mm[4]. Although there are differences between anterior and subxiphoid approaches, our normal value correlated well with those of autopsied hearts[16] when we used an anterior-supine approach. Recording through the subxiphoid may give a slightly greater value because the ultrasonic beam may traverse the right ventricular wall diagonally.

3) *Validity of anterior approach with 5.0 MHz transducer*

The right ventricular anterior wall thickness had a good correlation with pulmonary arterial systolic pressure. In all 21 patients with right ventricular overload, pulmonary arterial systolic pressure was equal to peak systolic pressure of the right ventricle because they had no obstruction between the pulmonary artery and the right ventricle. It is considered from this study that the right ventricular anterior wall thickness increases in proportion as pulmonary arterial systolic pressure increases whether the right ventricle is volume-overloaded or pressure-overloaded.

The correlation coefficient between the right ventricular anterior wall thickness index and pulmonary arterial systolic pressure was higher than that between the right ventricular anterior wall thickness and pulmonary arterial systolic pressure. This fact indicates that the right ventricular anterior wall thickness index is more suitable for diagnosing right ventricular hypertrophy than the absolute value of the right ventricular anterior wall thickness.

4) *The differentiation between hypertrophic cardiomyopathy and hypertensive heart disease*

The most useful index for differentiating hypertrophic cardiomyopathy from hypertensive heart disease was the thickness of RVAW.

Previous investigators[17-20] reported many patients with IHSS which were combined with hypertension. And we often encounter patients with severe left ventricular hypertrophy with ill-matched and mild hypertension, in which cases cardiomyopathy seems to be the main contributing factor. In these cases it is mandatory to determine which is the main contributing factor for hypertrophy. The present study disclosed that it could be determined which factor is contributed chiefly for left ventricular hypertrophy if the thickness of RVAW is measured by echocardiography.

Roberto and collegues[21] reported that right ventricular hypertrophy was also observed in IHSS without obstruction in a right ventricular outflow tract. There is no report whether the right ventricle is hypertrophied or not in hypertrophic, non-obstructive cardiomyopathy to our knowledge. However, it is imagined that the right ventricle of hypertrophic cardiomyopathy may be hypertrophied because cardiomyopathic process involves both ventricles as evidenced by Horie et al.[22], who reported that the biopsy of the right ventricle in patients with cardiomyopathy revealed the same pathologic changes as that of the left ventricle. Another possibility of right ventricular hypertrophy is the secondary change caused by pulmonary hypertension due to left ventricular dysfunction. This possibility, however, may be unlikely because all our six patients in which the right heart catheterization was performed, revealed no pulmonary hypertension (Table 1).

In patients with systemic hypertension, right ventricular hypertrophy is caused by long-term elevation of pulmonary arterial pressure secondary to left heart failure[23-25]. All seven patients with severe hypertension in our study had symptoms of left heart failure, but pulmonary arterial pressure in two of them, whose right heart catheterization were performed after the left heart failure had subsided, was normal. It is thought, therefore, that the right ventricles in our patients with severe systemic hypertension were probably not hypertrophied, because pulmonary arterial pressure was not elevated although they had ever experienced left heart failure.

Thus, hypertrophic cardiomyopathy could be differentiated from hypertensive heart disease, if they had no long-standing left heart failure.

5) *Further clinical implication*

It is often difficult to diagnose right ventricular hypertrophy and biventricular hypertrophy by electrocardiography, especially in patients with bundle branch block or Wolff-Parkinson-White syndrome. Sometimes it is also difficult to differentiate right ventricular hypertrophy from true posterior wall infarction.

The present study indicates that echocardiography by anterior approach with a 5.0 MHz transducer would be quite useful for diagnosing right ventricular hypertrophy even in these cases because this method provides an adequate visualization of the right ventricular anterior wall facilitating the measurement of its thickness.

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