Arrhythmia in Young Patients with Mitral Valve Prolapse

TOMOYUKI KUMAKI, M.D., TSUTOMU INOH, M.D*, YOSHIYUKI YOKOTA, M.D.
HIDEO KAWANISHI, M.D*, MASANORI HAYAKAWA, M.D., AKIRA TAKARADA, M.D.
TOMOO INOUE, M.D., KATSUYA KOBAYASHI, M.D.
AND HISASHI FUKUZAKI, M.D.

Twenty four-hour ambulatory ECG monitoring were examined in 68 patients (33 patients in a young group and 35 patients in an adult group) with mitral valve prolapse (MVP) in order to characterize the features of arrhythmias in young patients with MVP in comparison with those in adult patients. Diagnosis of MVP was made by two-dimensional echocardiography.

On 24-hour ambulatory ECG monitoring 29 patients (88%) in a young group had arrhythmias which was as frequent as those in adult group, but serious ventricular arrhythmias were more often detected in the young group (7 patients) than in the adult group (2 patients). It was considered that arrhythmias in young patients with MVP were frequently serious but accompanied without any symptoms and cardiac dysfunction.

THE clinical features of mitral valve prolapse (MVP) has been well described, and arrhythmia represents one of the most important problems of this disease. In patients with MVP various arrhythmias are found in high frequency and especially serious ventricular arrhythmias have been reported in many studies. In this study we examined arrhythmias in patients with MVP by 24-hour ambulatory ECG monitoring, and characterized the difference of arrhythmias between those in young patients and those in adult patients.

MATERIALS AND METHODS

The study group consisted of 68 patients with MVP diagnosed by two-dimensional echocardiography (2-DE), and was divided into two groups.

Key Words:

Arrhythmia
Holter electrocardiography
Two-dimensional echocardiography
Mitral valve prolapse

Group I consisted of 33 patients younger than twenty-years old (17 males and 16 females, age ranging from 9 to 19 year) and group II, 35 adult patients (20 males and 15 females, age ranging from 20 to 73 year).

Echocardiographic examinations were performed using a Toshiba Ultrasonoscope Model SSH-11A. The M-mode echocardiograms were recorded on Honeywell strip chart recorder Model FR-06A, and the 2-DE were recorded on Pollaroid Films. The left ventricular short axis dimensions in end-diastole (LVDd) and in end-systole (LVDs) were measured by M-mode echocardiograms. The left ventricular percent fractional shortening (%FS) and the left ventricular end-diastolic dimension index (LVDdI) were calculated respectively as follows. $\%FS = [(LVDd - LVDs)/LVDd] \times 100$, $LVDdI = LVDd/\text{body surface area}$. MVP was diagnosed on the image of the long axis view of 2-DE in accordance with the criteria we have reported previously!¹

Twenty four-hour ambulatory ECG moni-

*First Division, Department of Internal Medicine, Kobe University School of Medicine, Kobe, *Department of Internal Medicine, Miki City Hospital, Miki, Japan*

Mailing address: Tomoyuki Kumaki, M.D., First Division, Department of Internal Medicine, Kobe University School of Medicine, Kusunoki-cho, Chuo-ku, Kobe 650, Japan

TABLE I SYMPTOMS IN PATIENTS WITH MVP

Case No.	Group I (<20 y.o.)	Group II (≥ 20 y.o.)
	33 cases	35
Symptom	(-)	5 (14)
	(+)	30 (86)
palpitation	6	24
chest pain	8	12
dyspnea	0	3
dizziness	2	4

TABLE II CLINICAL FINDINGS IN PATIENTS WITH MVP

	Group I $n = 33$	Group II $n = 35$
Deformity of chest wall	6 cases (18%)	2 (6)
click	8 (24)	10 (29)
systolic murmur	21 (64)	23 (66)
CTR	$45.9 \pm 5.9\%$	47.2 ± 4.6

CTR = cardio-thoracic ratio

toring was recorded with a Delmal Avionics electrocardiorecorder Model 447 and analyzed by a Delmal Avionics evaluator Model 9500. The severity of ventricular premature contractions (VPCs) was classified into 5 grades according to Lown's classification²

RESULTS

1) Symptom (Table I)

Of the 33 patients in group I, only 15 patients (45%) complained of various symptoms in contrast to 30 (86%) of 35 patients in group II. Palpitation was the most frequent symptom which was a complaint in 6 patients in group I and in 24 patients in group II, and atypical chest pain followed.

2) Clinical findings (Table II)

The incidence of chest wall deformity such as a funnel chest and a straight back was higher in group I (18%) than in group II, but no significant difference was found in the incidence of auscultatory findings (systolic click and systolic murmur) and the cardio-thoracic ratio (CTR) of

TABLE III ELECTROCARDIOGRAPHIC FINDINGS IN STANDARD 12-LEAD ECG

	Group I $n = 33$	Group II $n = 35$
no abnormality	13 cases (39%)	13 (37)
ST-T change	3 (9)	6 (17)
VPC	10 (30)	8 (23)
SVPC	3 (9)	4 (11)
Others	5 (15)	5 (14)
sinus bradycardia	0	2
complete RBBB	2	1
1° AV block	0	1
QT prolongation	3	1

VPC = ventricular premature contraction; SVPC = supraventricular premature contraction; AV block = atrio-ventricular block; RBBB = right bundle branch block

the chest X-ray between the two groups.

3) Standard 12-lead ECG (Table III)

The standard 12-lead ECG was entirely normal in 13 patients in each group. VPCs were recorded in 10 patients (30%) in group I and in 8 patients (23%) in group II, but serious VPCs such as ventricular tachycardia (VT) or coupled VPCs were detected in none of them. Three patients in group I and 4 patients in group II had supraventricular premature contractions (SVPCs) and there were a few patients with other arrhythmias [sinus bradycardia in 2 patients, complete right bundle branch block (RBBB) in 3 patients and first degree atrio-ventricular block (AV-block) in one patient]. In 3 patients in group I and in 6 patients in group II ST-T segment abnormalities were recorded in the inferior leads, and QT prolongation was detected in 4 patients.

4) Twenty-four-hour ambulatory ECG monitoring (Table IV)

VPCs were recorded in 23 patients (70%) in group I and in 24 patients (69%) in group II, but serious VPCs such as VT or coupled VPCs were detected more frequent in group I (7 patients, 21%) than in group II (2 patients, 6%), and were found in half of the 10 patients who had VPCs in standard 12-lead ECG in the young group. SVPCs were recorded in 17 patients (52%) in group I and in 25 patients (71%) in group II.

TABLE IV ARRHYTHMIAS ON 24-HOUR AMBULATORY ECG MONITORING

	Group I n = 33	Group II n = 35
Arrhythmia	29 cases (88%)	32 (91)
<i>total</i>		
VPC (Lown grading system)	23 (70)	24 (69)
Grade		
1: less than 30 VPCs/hr	8	11
2: 30 or more VPCs/hr	3	3
3: multiform VPCs	5	8
4A: coupled VPCs	5	1
4B: VT	2	1
SVPC	17 (52)	25 (71)
PSVT	1	1
Others	5 (15)	5 (14)
sinus tachycardia	2	3
sinus bradycardia	1	1
SA block	1	1
AV block	2	1

VPC = ventricular premature contraction; VT = ventricular tachycardia; SVPC = supra-ventricular premature contraction; PSVT = paroxysmal supra-ventricular tachycardia; SA block = sino-atrial block; AV block = atrio-ventricular block

Other findings were sinus tachycardia in 2 patients in group I and in 3 patients in group II, sinus bradycardia and sino-atrial block in one patient in group I and group II respectively, and AV-block in 2 patients in group I and in one patients in group II.

5) Correlation between symptoms and ECG abnormalities during ambulatory ECG monitoring (Table V)

In group I 5 episodes such as palpitation occurred during 24-hour ambulatory ECG monitoring. Among them no abnormalities in ECG were found in 3 episodes, and sinus tachycardia was in one. The patients in whom serious arrhythmias were detected had no symptom during arrhythmia except in one episode, VT attack with palpitation. In group II 15 episodes occurred during 24-hour ambulatory ECG monitoring, and frequent VPCs were found in 3 episodes, SVPCs in 2 episodes, and sinus tachycardia in 4 episodes.

TABLE V CORRELATION BETWEEN SYMPTOMS AND ECG ABNORMALITIES IN THE 20 EPISODES (GROUP I: 5, GROUP II: 15) DURING 24-HOUR AMBULATORY ECG MONITORING

ECG findings	Group I	Group II
no abnormality	3	7
VPC	0	3
SVPC	0	1
Sinus tachycardia	1	4
VT	1	0
Total	5	15

VPC = ventricular premature contraction; SVPC = supra-ventricular premature contraction; VT = ventricular tachycardia

Fig.1. Echocardiographic parameters (%FS and LVDdI) in patients with VPCs more than grade 3 of Lown's classification. %FS = percent fractional shortening; LVDdI = left ventricular end-diastolic dimension index

6) Correlation between arrhythmia and echocardiographic parameters (Fig. 1)

The echocardiographic parameters (LVDdI and %FS) in 22 patients (12 patients of group I and 10 patients of group II) whose VPCs were more than grade 3 of Lown's classification, were plotted in Fig. 1. Seven of the 10 patients of group II showed left ventricular dilatation ($LVDdI \geq 32 \text{ mm/m}^2$) and/or decreased left ventricular contractilities ($\%FS \leq 25\%$), but the majority of group I showed normal LVDdI and %FS.

DISCUSSION

There have been many studies about mitral valve prolapse (MVP) and many investigators have pointed out that serious arrhythmias often occur in patients with MVP³⁻⁹ and in some cases these arrhythmias were accompanied by sudden death,⁷⁻⁹ so in the prognosis of this disease arrhythmia is considered as important as mitral regurgitation.

Recently the extensive application of examinations such as echocardiography and ambulatory ECG monitoring have advanced in diagnosis of MVP and detection of arrhythmia and have made it possible to investigate MVP in detail. However in young patients with MVP the characteristics of arrhythmia have still not been investigated sufficiently. Bisset et al.¹⁰ have reported that arrhythmias were detected in 17 cases (15%) out of 119 children with MVP in standard 12-lead ECG, but there were only 2 patients who needed the medication of anti-arrhythmic agents and no sudden death occurred during follow-up interval (mean 6.9 years). Therefore they concluded that MVP in children was a benign disease. On the contrary, Kavey et al.¹¹ have reported that of 26 cases with MVP serious arrhythmias were detected in 5 cases (19%) on treadmill exercise testing and in 6 cases (23%) on 24-hour ambulatory ECG monitoring, and they emphasized the importance of careful follow-up.

In our study the incidence of arrhythmias was not so different in the young group and in the adult group, but serious arrhythmias such as VT or coupled VPCs were detected more frequently in the young group (21%) than in the adult group (6%). It is noteworthy that most of young group with serious arrhythmias had normal heart size and contractility and were less symptomatic than those in adult group, although in the adult group serious arrhythmias were frequently detected in patients with left ventricular enlargement and/or left ventricular dysfunction, and moreover,

serious arrhythmias were detected in about half of the patients with VPCs in standard 12-lead ECG at rest in the young group.

REFERENCES

1. INOH T, MAEDA K, ODA A: Diagnosis and classification of the mitral valve prolapse by the ultrasoundcardiography and the evaluation of the M-mode technic. *Jpn Circ J* 43: 305, 1979
2. RYAN M, LOWN B, HORN H: Comparison of ventricular ectopic activity during 24-hour monitoring and exercise testing in patients with coronary heart disease. *New Eng J Med* 292: 224, 1975
3. DeMARIA AN, AMSTERDAM EA, VISMARA LA, NEUMANN A, MASON DT: Arrhythmias in the mitral valve prolapse syndrome. *Ann Intern Med* 84: 656, 1976
4. WINKLE RA, LOPSE MG, FITZGERALD JW, GOODMAN DJ, SCHROEDER JS, HARRISON DC: Arrhythmias in patients with mitral valve prolapse. *Circulation* 52: 73, 1975
5. CAMPBELL R, GODMAN MG, FIDDLER GI, MARQUIS RM, JULIAN DG: Ventricular arrhythmias in the auscultatory-echocardiographic variant of the balloon mitral valve syndrome. *Am J Cardiol* 37: 124, 1976
6. WINKLE RA, LOPES MG, POPP RL, HANCOCK EW: Life-threatening arrhythmias in the mitral valve prolapse syndrome. *Am J Med* 60: 961, 1976
7. SALMELA PI, IKÄHEIMO M, JUUSTILA H: Fatal ventricular fibrillation after treatment with digoxin in a 27-year-old man with mitral leaflet prolapse syndrome. *Br Heart J* 46: 338, 1981
8. JERESATY RM: Sudden death in the mitral valve prolapse-click syndrome. *Am J Cardiol* 37: 317, 1976
9. MARSHALL CE, SHAPPEL SD: Sudden death and the ballooning posterior leaflet syndrome. *Arch Pathol* 98: 134, 1974
10. BISSET GS, SCHWARTZ DC, MEYER RA, JAMES FW, KAPLAN S: Clinical spectrum and long-term follow-up of isolated mitral valve prolapse in 119 children. *Circulation* 62: 423, 1980
11. KAVEY REW, SONDHEIMER HM, BLACKMAN MS: Detection of dysrhythmia in pediatric patients with mitral valve prolapse. *Circulation* 62: 582, 1980