MITRAL VALVE PROLAPSE: TWO DIMENSIONAL ECHOCARDIOGRAPHY REVEALS A HIGH PREVALENCE IN THREE TO TWELVE YEAR OLD CHILDREN

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ABSTRACT

The prevalence of mitral valve prolapse (MVP) appears to be age related, MVP being commoner in children as compared to adults. This suggests that asymptomatic MVP may be most frequent in children who are very young. In this study, to better define the prevalence of MVP in young children, we used two dimensional echocardiography and prospectively surveyed 213 healthy urban school children between 3 and 12 years of age. MVP was diagnosed when prolapse of mitral leaflet/s was demonstrated by both two-dimensional and M-mode echocardiography at parasternal long-axis views. Overall, MVP was found in 28 of 213 (13.1%) children. MVP was similarly prevalent in all age groups studied (3-5.9 years: 13 of 83 (13.5%); 6-8.9 years: 9 of 71 (11.2%); and 9-12 years: 6 of 31 (16.2%) children; Chi square = 0.57, p>0.5). Univariate analysis showed that the prevalence of MVP was independent of sex, birth weight, resting heart rate and systolic or diastolic blood pressure. A mid systolic murmur was present in 50.6% of the children although it correlated with echocardiographic diagnosis of MVP in only 39.3%. The left ventricular size or wall thickness and mitral EF and DE slopes were similar in children either with or without MVP. Our results indicate that asymptomatic MVP is frequent in children upto 12 years of age. As a diagnostic test of MVP, presence of apical systolic murmur is considerably inferior to echocardiography. No morphological left ventricular correlates were identified in MVP.

Key words: *Mitral valve Prolapse, Echocardiography.*

Mitral valve prolapse (MVP) is a common disorder with protean manifestations(1-5). The clinical significance of this condition is uncertain. For example, it is not clear whether MVP is a nonspecific phenomenon with multiple etiologies or a unique entity with a definite biological basis(6,7).

Studies based on cardiac auscultation have shown that MVP is frequently prevalent in healthy people, particularly women, in whom its prevalence may reach 10 to 20%(7-11). Echocardiographic studies using M-Mode and 2-dimensional (2-D) views have shown that MVP is more prevalent than previously suspected and may vary from 4 to 34% depending on the diagnostic criteria used(11-15). Following the use of more uniform criteria for echocardiographic diagnosis, current estimates of the prevalence of MVP in adults range from 3 to 5%(16-22).

Studies of MVP in children, which have been limited, show a prevalence of 4 to 5%. Most of these studies used clinical criteria and not the recently revised echocardiographic criteria for diagnosing MVP(7,12-15).

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Also, previous studies showed that prevalence of MVP is lowered with increasing age. Therefore, MVP may be even more common in younger children. To better define the prevalence of MVP, we studied middle class urban school children between 3 and 12 years of age by using two dimensional echocardiography.

Material and Methods

All children attending an urban middle class school in Jaipur were selected for detailed clinical and echocardiographic study. It was initially noted that in this school, there were more children between the ages of 3 and 6 years in comparison to children between 6 and 12 years old. Therefore, to avoid a skewed distribution of children in various age groups, whole sections of lower grades were randomly selected according to the criteria established by the WHO(23). A detailed proforma for listing various clinical variables, such as birth weight, immunization, past illnesses and family history of heart disease was provided to be completed by the parents. There were no non-responders.

Detailed physical examination of all subjects included measurement of height and weight, skeletal abnormalities, blood pressure and review of organ systems. Special note was made of abnormal cardiac auscultatory sounds and murmurs. Echocardiography was performed by a single observer (RG) using ATL Compuscan 4000 model with a 3.0 MHz transducer. The examination was performed in a left lateral decubitus position and details of mitral valve motions recorded in both M-mode and 2-D views. The revised criteria for diagnosis of MVP as suggested by Devereaux *et al.*(7) were used. The diagnosis was based on demonstration of systolic prolapse of anterior, posterior or both mitral leaflets in left atrium seen on parasternal long axis view on two dimensional and M mode recordings. The details of left ventricular size were measured and any associated abnormality noted. The echocardiographic findings were also recorded on a videotape for subsequent analysis.

The means of various numerical variables given with ± values indicating one standard deviation. Significances of differences were determined by either independent groups 't' test or Chi square test.

Results

Two hundred and thirteen school children were studied clinically and by echocardiography. For analysis, they were classified as follows: Group 1: 3-5.9 years, Group 2: 6-8.9 years, and Group 3: 9-12 years. The demographic data of this population is shown in *Table I*. Apart from the expected differences in height and weight with increasing age, no significant difference was noted in other variables in various groups. Echocardiographic variables are shown in *Table II* and indicate similar results in all groups of children studied.

MVP was classified as late systolic prolapse and holo systolic prolapse according to the criteria described above, but for statistical analysis, both the groups were combined. The prevalence of MVP in various age groups and sexes is shown in *Table III*. Overall, MVP was prevalent in 13.1% (28 of 213 children). There was no significant difference in prevalence of MVP at various age groups (Chi square = 0.57, $p > 0.5$). Also, no significant difference was found between boys and girls (Chi square = 0.083, $p > 0.5$). Other demographic variables in groups either with or without MVP are shown in *Table IV*. There was no

TABLE I—*Demographic Characteristics of Study Population*

	Group 1 (3-5.9 years) (n = 96)	Group 2 (6-8.9 years) (n = 80)	Group 3 (9-12 years) (n = 37)
Mean age	4.41 ± 0.42	7.24 ± 0.51	10.12 ±0.31
Sex ratio (M:F)	49:47	53:27	25:12
Height (cm)	105.97 ±12.67	118.35 ±16.03	134.28 ±9.58
Weight (kg)	16.45 ± 3.10	22.01 ± 5.75	27.67 ±6.91
Pulse (per minute)	91.09 ±25.49	87.85 ±23.62	82.67 ±26.02
Systolic BP (mm Hg)	103.39 ± 9.36	102.67 ±12.06	10.56 ±10.87
Diastolic BP (mm Hg)	72.71 ± 8.42	68.15 ± 8.27	71.69 ±8.02

± number indicates 1 standard deviation.

TABLE II—*Echocardiographic Variables in Various Age Groups*

Variable	Group 1	Group 2	Group 3
Left ventricle diastolic dimension	2.85 ±0.35	3.03 ±0.36	3.33 ±0.59
Interventricular septum	0.53 ±0.09	0.62 ±0.12	0.63 ±0.16
LV posterior wall	0.50 ±0.11	0.62 ±0.14	0.62 ±0.11
Mitral DE excursion	1.26 ±0.41	1.41 ±0.39	1.38 ±0.43
Mitral EF slope (cm/second)	12.97 ±3.45	11.91 ±2.16	11.40 ±3.20

All measurements in centimeters. Diastolic dimensions.

TABLE III—*Prevalence of Mitral Valve Prolapse*

	Group 1 (n = 96)			Group 2 (n = 80)			Group 3 (n = 37)			Total		
	M	F	T	M	F	T	M	F	T	Male	Female	Total
MVP present*	9	4	13	5	4	9	2	4	6	16 (12.6)	12 (13.9)	28 (13.1)
MVP absent	40	43	83	48	23	71	23	8	31	111 (87.4)	74 (86.1)	185 (86.9)
Total	49	47	96	53	27	80	25	12	37	127	86	213

M = male; F = female; T = total. Number in parentheses indicate percentages.
*Chi-square statistic = 0.57, $p > 0.5$

TABLE IV—*Demographic Variables in the Groups with MVP*

	MVP present (n = 28)	MVP absent (n = 185)
Age (years)	6.78 ± 2.24	6.75 ± 2.85
Height (cm)	117.14 ± 13.57	115.47 ± 17.54
Weight (kg)	21.25 ± 6.90	20.43 ± 6.48
Chest size (cm)	44.10 ± 20.95	49.42 ± 16.83
Pulse (per minute)	93.89 ± 20.46	87.52 ± 25.50
Systolic BP (mm Hg)	109.29 ± 12.15	108.26 ± 11.65
Diastolic BP (mm Hg)	70.89 ± 7.94	70.86 ± 8.62

$p > 0.5$ for various variables.

TABLE V—*Echocardiographic Characteristics of Persons with MVP*

Characteristic	MVP present (n = 28)	MVP absent (n = 185)
Left ventricle internal dimension (diastole)	3.15 ± 0.48	2.97 ± 0.43
Interventricular septum	0.58 ± 0.10	0.57 ± 0.13
Left ventricle posterior wall	0.58 ± 0.13	0.57 ± 0.28
Mitral DE excursion	1.42 ± 0.45	1.32 ± 0.40
Mitral EF slope (cm/second)	12.91 ± 4.12	12.20 ± 2.85
Holosystolic prolapse	7(25%)	nil
Late systolic prolapse	21(75%)	nil

Dimensions in centimeters.
$p > 0.5$ for various variables.

significant difference in various variables. Systolic murmur on auscultation was present in 11 children with MVP (39.3%) and 21 children without echocardiographic evidence of MVP (11.3%) (Chi square = 14.91, $p < 0.001$).

There was no significant difference in morphological echocardiographic measurements, such as left ventricular diastolic dimension, posterior wall and septal thickness, or mitral valve EF and DE slopes in children either with or without MVP (*Table V*). However, two children with MVP showed mild thickening of the posterior cusp. In addition, one child had a secundum atrial septal defect and another, a small ventricular septal defect.

Discussion

Our study shows a higher prevalence of MVP in children than other recent studies. Echocardiographic evidence of MVP was present in 13.1% of our subjects. Within the age group studied, the overall prevalence of MVP was neither age-nor sex-dependent. Clinical variables, such as height, weight, heart rate and blood pressure, were similar in children either with or without MVP.

Results from previous studies of MVP in children were different from ours. McLaren *et al.*(13) and Greenwood(14) used bedside cardiac auscultation for diagnosis of MVP and estimated its prevalence to be about 5%. Warth *et al.*(15), using older echocardiographic criteria, had shown a prevalence of 34%, but using revised criteria suggested a lower prevalence. Our results suggest that the prevalence of MVP in children is higher than these estimates. These differences may be due to an observer bias, as may occur in single observer studies, although previous studies showed this to be unimportant(24,25). Whether unknown nutritional influences

could play a pathophysiological role in MVP is unclear. In our study, children belonged to a middle or higher socio-economic group with no clinical evidence of protein calorie malnutrition or vitamin deficiencies.

Previous studies suggested that physical and bony abnormalities, including Marfan's syndorme, may accompany MVP(9). We did not find any such abnormalities in our subjects.

An apical systolic murmur on cardiac auscultation was present in fewer of our subjects as compared to previous studies which reported a systolic murmur in 30-80% of cases with MVP(3,4,18,26). Analysis of our results indicate that presence of a systolic murmur demonstrated poor sensitivity (39.3%) for diagnosing MVP but was more specific (88.6%).

Previous studies also suggested the occurrence of left ventricular structural abnormalities, including small left ventricular size, left ventricular hypertrophy, regional wall motion abnormality and mitral leaflet thickening in patients with MVP(3,7,27,28). In our study, only two children with MVP had mild posterior mitral cusp thickening. There was no difference in ventricular size in those with MVP, as compared to those without MVP.

MVP is an important precursor of severe non-rheumatic mitral regurgitation, congestive heart failure, infective endocarditis, cardiac arrhythmias and sudden death(7-9,14,29-31). It may also contribute to cardiac symptoms and morbidity in the pediatric age group(3,9,32,33). Our results indicate that asymptomatic MVP is common in children less than 12 years old. To define the natural history and clinical significance of MVP identified in young children, long-term prospective studies should be undertaken.

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NOTES AND NEWS

UPDATE IN PEDIATRIC RESPIRATORY DISORDERS

A one day Seminar on "Update in Pediatric Respiratory Disorders" is being organized under the joint auspices of Respiratory Chapter of IAP, Department of Pediatrics, Seth G.S. Medical College, K.E.M. Hospital, Bombay and Bombay Branch of IAP on *14th June, 1992* at Jivraj Mehta Hall (MLT) from 9 am to 5 pm.

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