

PREVALENCE OF BICUSPID AORTIC VALVE AND MITRAL VALVE PROLAPSE IN A HEALTHY SAUDI POPULATION AND THE CLINICAL IMPLICATIONS OF THEIR ASSOCIATION

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In this study, 103 Saudi males and 172 Saudi females were referred for medical check-up for employment purposes and/or as undergraduate students. Clinical evaluation of all participants included full cardiovascular examination, with the following investigations being performed: ECG, chest x-ray, and cross-sectional echocardiography. Bicuspid aortic valve was detected in three males and in four females, for a total percentage of 2.5%. Isolated mitral valve prolapse was detected in seven males (6.7%) and six females (3.5%). Association with mitral valve prolapse was reported in five males and seven females, with a total percentage of 4.3%. This association seems to have important etiological, medical and surgical implications. *Ann Saudi Med* 1996;16(4): 417-419.

Aortic valves were sketched by Leonardo Da Vinci as early as 1570 with two, three and four cusps, although he seemed to realize that the optimal relationship between aortic valve structure and function would be provided by three cusps. In 1885, Osler described a bicuspid aortic valve and stated that it might still function normally.¹ This was confirmed by several studies in 1928 by Wauchope,² and in 1977 by Fenoglio, et al.³ In 1886, Peacock recognized the role of bicuspid aortic valves in the development of aortic stenosis.⁴ In 1953, Campbell et al. suggested that underlying congenital anomalies might lead to easily detected murmurs from late infancy.⁵ Emanuel et al. attributed the delay in recognizing the prevalence of bicuspid aortic valves to the difficulty of making a diagnosis before stenosis develops with clinical signs of obstruction to left ventricular outflow, since this may not occur before the third or fourth decade or even later, by which time the bicuspid nature of the aortic valve becomes obscured by calcification.⁶ And, in 1970, Roberts stated that the bicuspid aortic valve is probably the most common congenital malformation, occurring in approximately 2% of the general population.⁷

Bicuspid aortic valve and mitral valve prolapse are the most common congenital malformations found in the young

and adult population. Mitral valve prolapse is frequently a common innocuous finding in young and middle-aged people with a wide spectrum of cardiovascular manifestations. The prevalence rate of mitral valve prolapse varies, ranging from 6% in some studies up to 20% in others.⁸⁻¹⁰

Since neither the prevalence of bicuspid aortic valve in the Saudi population nor its association with mitral valve prolapse were studied, this study is considered to be a trial look into this problem and its clinical implications.

Patients and Methods

One hundred and three males and 172 females were referred for routine medical checkup, either as new employees of the University or as undergraduates prior to University admission. The two groups agreed to participate in the study after thorough explanation of the purpose of the proposed work.

All participants were clinically evaluated, with complete cardiovascular examination, as well as routine investigations, including chest x-ray and electrocardiogram. Echocardiographic study was performed on every candidate by using the cross-sectional method in the parasternal long axis, short axis, four-chamber, as well as five-chamber views. Hewlett Packard ultrasound imaging system was used with 2.5 MHz transducer of 2.5 inch diameter. The Tajik technique was applied and Fowles' criteria were followed, where the diagnosis of bicuspid aortic valve is considered more accurately in the short axis view. The criteria included the number of cusps seen in real time

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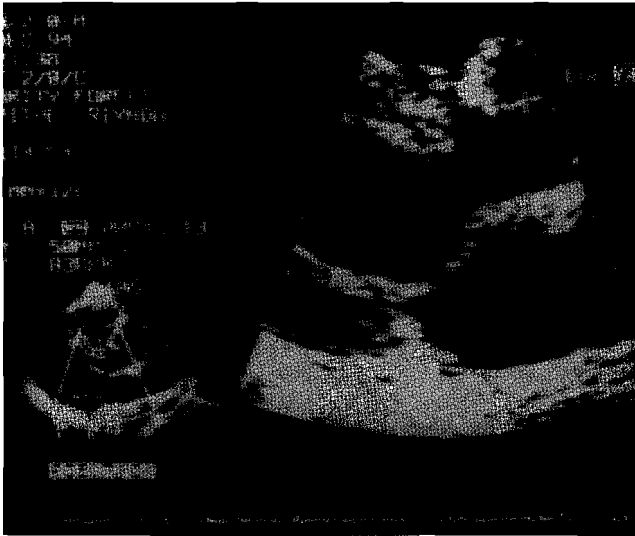


FIGURE 1. Parasternal long axis showing arching or systolic billowing of the anterior mitral leaflet posteriorly and superiorly into the left atrium after crossing the plane of the mitral annulus.

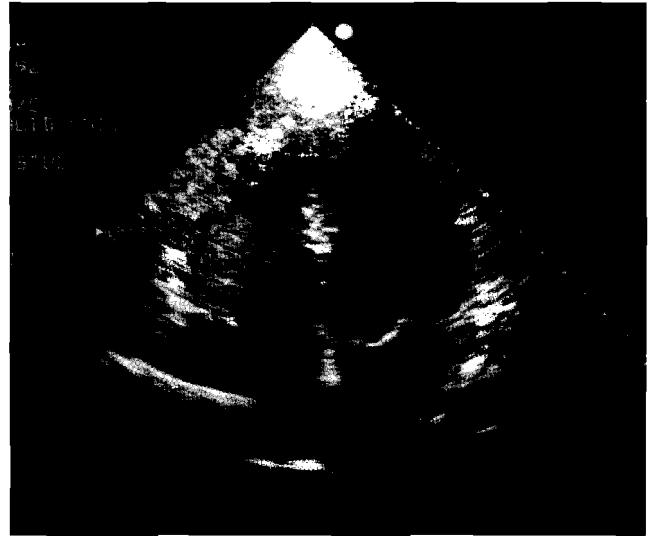


FIGURE 2. Bowing or arc-like shape of the anterior mitral leaflet during systole in the four-chamber view.

motion, irregularity or folding of the cusp margin, and location of the commissural insertions. Marked asymmetry of valve closure and of aortic root shape were also noted.^{11,12}

A positive diagnosis of mitral valve prolapse by cross-sectional echocardiography was based on criteria laid down by Alpert et al., and the diagnostic precision of Wann et al.^{13,14} Figure 1 shows a parasternal long axis view with arching or systolic billowing of the anterior mitral leaflet posteriorly and superiorly into the left atrium after crossing the plane of the mitral annulus. Figure 2 shows bowing or arc-like shape of the anterior mitral leaflet during systole in the apical four-chamber view. Figure 3 shows doming of the anterior mitral leaflet, which was characterized by a helmet-shaped deformity during diastole in the parasternal short-axis view.

It must be pointed out that in all the studied views, the image quality did not interfere with the diagnostic precision of each studied participant. All results were analyzed by at least two co-investigators.

Results

Two hundred and seventy-five subjects participated in this study, with an average age of 20 to 30 years and a mean of 22.4 years. Bicuspid aortic valve was detected in three males and four females, 2.9% and 2.3% respectively, for a total of 2.5%.

Isolated mitral valve prolapse was detected in seven males (6.7%) and six females (3.5%). The two anomalies were reported in association with two males and three females, for a total of 1.8%. Taking into consideration that

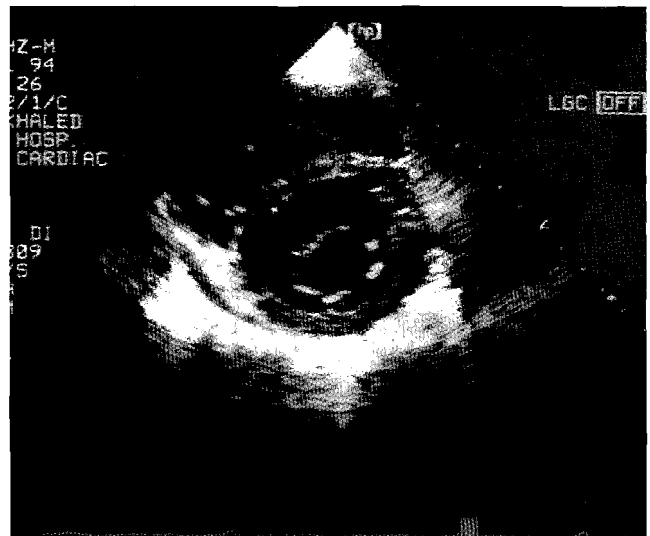


FIGURE 3. Doming of the anterior mitral leaflet characterized by a helmet-shaped deformity during diastole in the parasternal short axis view.

the prognostic and therapeutic significance of mitral valve prolapse varies with the severity of associated mitral insufficiency, color Doppler studies were performed and there were no significant abnormalities reported.

Discussion

The normal aortic valve is tricuspid with nearly equal size cusps. Brandenburg et al. stated that whatever the number of cusps, one can obtain different numbers of sinuses and different shapes of raphes.¹⁵ In our study, we found that cross-sectional echocardiography, in its short

axis view of the aortic valve, is a prerequisite in determining the number of aortic cusps. The prevalence rate of bicuspid aortic valve varies from one study to another, while Brandenburg reported a rate ranging between 0.4% and 2.0% of all births, which is considered the highest rate reported. Bound and Logan criticized the low figures and considered them to be an underestimation of the prevalence rate of congenital heart anomalies.¹⁶ But our prevalence rate matches that of Brandenburg. Mitral valve prolapse is undoubtedly the most prevalent form of valvular heart disease. The prevalence rate of isolated mitral valve prolapse was as low as 0.4% and as high as 17%, as stated by Bound and Logan.¹⁶ In Saudi Arabia, Nouh and Al-Harthy reported the prevalence rate to be 7% to 10% among the healthy Saudi population.^{17,18}

There seems to be a real association between mitral valve prolapse and bicuspid aortic valve. Considering the increased awareness of mitral valve prolapse and bicuspid aortic valve in the general population, this association should be expected on more than a random basis.¹⁹ In their studies, Rippe et al. and Chisholm confirmed this association with 3% of the studied patients having had mitral valve prolapse associated with bicuspid aortic valve.^{20,21} These results match the results obtained in the present work. It is of great importance that the cardiac surgeon who is replacing a heart valve or mitral apparatus be aware of the clinical implications of associated bicuspid aortic valve and mitral valve prolapse, as difficulty has been reported in suturing the valve prosthesis to the mitral ring or the aortic wall. This is due to disruption or tearing of the suture line with the expected delayed healing.^{22,23} We concluded that the presence of one valve deformity necessitates careful and prompt evaluation for the presence of the other, as earlier diagnostic confirmation of both abnormalities has important etiologic and surgical implications.

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