

Prevalence and Characteristics of Mitral Valve Prolapse in Adult Echocardiography Population in King Abdulaziz Medical City Over a 10Year Period

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Abstract

Background: Mitral Valve Prolapse (MVP) is a well-recognized pathological entity that is associated with significant morbidity. Prevalence, pathological characteristics and clinical outcome of MVP in Saudi Arabia has not been estimated. **Aims:** Aim of the study is to estimate the prevalence, and type of management practices of MVP among an adult population who underwent echocardiographic (echo) evaluation at King Abdulaziz Cardiac Center (KACC) over 10-year period. **Methods:** Retrospective review of consecutive echo database (Xcelera®) studies performed for adult (≥ 14 y) patients at KACC between January 2002 and December 2011. Out of 53,258 database subjects, 232 definite myxomatous MVP cases were identified and included in the study. Mitral valve diseases other than myxomatous MVP were excluded. **Results:** Prevalence of MVP was 33 cases per 10,000 echo studies and average annual incidence was 3 cases per 1000 echo studies per year. Mean age at first echo evaluation was 40 ± 18 years. Saudi nationals represented 87% of cases, mostly of male gender (65%). Frequencies of bi-leaflet, posterior leaflet and anterior leaflet were 37.5%, 33.5% and 29% respectively. Hemodynamically significant MVP was present in 55% of cases with 30% of cases having flail segments and 18% having ruptured chordae. One third of patients (34%) underwent surgical intervention, mostly in form of valve repair (89%). **Conclusion:** MVP in this large echo-based population seems to be less prevalent than internationally known figures. Under-detection of MVP in the community might be a reason behind the low prevalence and late referral for a tertiary care management. Community-based physical screening and multicenter MVP registry are recommended.

Keywords: Adult population, Echocardiogram, Kingdom of Saudi Arabia, Mitral Valve Prolapse, Mitral Valve Repair, Myxomatous Mitral Valve.

INTRODUCTION

Over the past 50 years, mitral valve prolapse (MVP) as a distinct clinical entity has undergone major evolution with respect to diagnosis and management approach¹. Clinical manifestations and complications of MVP are discussed elsewhere, however it is the leading cause of nonischemic mitral

regurgitation (MR) and the most common cause of isolated severe MR requiring surgical intervention in the developed countries^{2,4}. Primary MVP, also known as degenerative or myxomatous MVP is characterized by thick and redundant valve leaflets, elongated chordae tendineae, and dilated annulus and broadly classified into classical and nonclassical forms, depending on the degree of valve thickness⁵. Echocardiogram (echo) is the diagnostic test of choice and considered the gold-standard for establishing the diagnosis of MVP and assessing its hemodynamic sequel³. The role of echo surpasses the diagnostic purposes into guiding the treating team for the appropriate surgical technique^{1,4,6}. Currently accepted echo criteria for the diagnosis of MVP consist of having one or both mitral leaflet(s) displaced into the left atrium for more than 2mm above the annular level during systole at parasternal long axis view⁷. Additional echo findings may include ruptured chordae tendineae, flail mitral valve leaflets, variable degrees of MR and features of adverse hemodynamic consequences in advanced cases.

Prevalence of MVP in earlier studies has been widely variable and generally ranged between 5 and 15 %⁷. Earlier reported prevalence rates are currently considered overestimated due to technology limitations and erroneous diagnostic criteria⁸. With better understanding of the mitral valve anatomy, with regards to leaflet-annulus relationship a new set of diagnostic criteria have been made^{7,8}. With the implementation of the recently modified diagnostic criteria prevalence of MVP has significantly decreased⁷. Variations in MVP prevalence continue to emerge, which might be due to methodical differences in study design or due to real differences in genetic and environmental predisposition of various societies^{9,10}.

Published data on MVP are scarce and old^{11,12,13,14}. Those studies were limited in sample size and inclusion criteria. Moreover they were based on the old diagnostic criteria which tended to overestimate MVP prevalence. To our knowledge, echo characteristics and trends of MVP management have not been studied in Saudi Arabia.

The aim of this study was to determine the prevalence of mitral valve prolapse in a large echo-database population at a tertiary hospital in KSA. In addition we aimed to identify the morphologic echo characteristics and the management trends of MVP in this population.

METHODOLOGY

This was a retrospective, case-series study that included consecutive cases of echo-confirmed MVP diagnosed at King Abdulaziz Medical City in Riyadh (KAMC-R) between January 1st 2002 and December 31st 2011. Study population was identified through the digital echo database (Xcelera® R4.1L1, 4.1.1.1133-2013, Philips Medical Systems), by searching for items that are coded for diagnosis of MVP or any of its echo features (MV0066-MV0070, MV0075, MV0078- MV0085, MV0106, MV0108, MV0110 - MV0114). Actual echo views of potential MVP cases were reviewed and verified by the principal investigator, applying the standard diagnostic criteria⁷. Relevant demographic and clinical variables were obtained from electronic patient records.

STUDY AREA

Study was conducted in King AbdulAziz Cardiac Center (KACC) which hosts the echo lab and provides advanced cardiac services in KAMC-R. Echo lab covers KAMC-R, a 1000-bed JCI accredited governmental organization, and several primary health care centers. KACC receives referrals from all over the Kingdom and provides private business services for self-paying and insured patients. Echo lab at

KACC is accredited by the European Association of Echocardiography and provides basic and advanced adult and pediatric echo applications, utilizing state of the art digital technology. Echo lab is staffed with highly qualified echocardiologists and well trained echo technologists. About 10,000 adult echo studies are done every year in average. Echo studies are digitally acquired and electronically reported and archived using (Xcelera®) database. Echo lab was equipped with HP Sonos 5500 echo machines and 4 MHz probe (Philips Medical systems) up to year 2008, after which old machines were replaced by iE 33 machines and S5-1 probe (Philips Medical Systems). All echo studies followed the standard adult echo protocol format.

STUDY SUBJECTS

Consecutive adult echo reports that included diagnosis of MVP or any of its echo features (n=573) were reviewed as potential study candidates. Adult patients (14 years and older) with myxomatous MVP, based on systolic leaflet displacement of > 2mm beyond the annular level into the left atrium and diastolic leaflet thickness of > 3mm (n=232) were included in data collection and analysis. Patients at pediatric age group (<14 years) and cases of; secondary MVP (due to connective tissue diseases), pseudo prolapse (commonly due to rheumatic heart disease), fibroelastic deficiency (ruptured chordae with no myxomatous changes), and myxomatous changes that did not meet the diagnostic criteria of MVP were excluded.

STUDY SAMPLING AND TECHNIQUE

A total of 93,989 adult transthoracic echo (TTE) studies were performed for 53,258 subjects during the study period. Five hundred and seventy three (573) cases were labeled as or suspected of having MVP, out of which 232 cases were confirmed to have the disease.

DATA COLLECTION AND STATISTICAL ANALYSIS

Data of relevant echo variables were collected from electronically retrieved echo reports of the study candidate. Variables were coded for the sake of data entry, as shown in the attached data collection form (Appendix A). The principal investigator (PI) completed very few missing data after reviewing the studies. Excel spreadsheet was designed for data entry purposes and was filled accordingly. Data management and statistical analysis were carried out using Microsoft Excel 2010. Results of continuous variables were expressed as mean and standard deviation and categorical variables as frequencies and percentages. Data were presented in the appropriate graphical and tabular format.

ETHICAL CONSIDERATIONS

Study was approved by King Abdullah International Medical Research Center (KAIMRC) scientific committee. Study was exempted from the Institutional Review Board (IRB) and consent was not required, as this study dealt only with retrospective data review and no direct human candidate contact was involved. Each study candidate was assigned a unique anonymous identifying serial number. Strict data confidentiality was maintained throughout study process. Data were secured and backed up under the control of principle investigator. Accessibility to data was limited to the investigators.

RESULTS

Two-hundred and thirty-two (232) individuals were identified to meet the inclusion criteria; representing a prevalence of 0.43% of all adult population who underwent echocardiographic evaluation during the study period. Annual incidence of MVP, in average, was 3 cases per 1,000 adult echo studies per year. Baseline demographic and clinical characteristics of patients with MVP are shown in TABLE 1& TABLE 2. Three hundred and forty-one (341) candidates were excluded as shown in Fig 1. More than one third of patients underwent surgical intervention, mostly in form of mitral valve repair.

Table1. Baseline characteristics and clinical outcomes of mitral valve prolapse patients, diagnosed at King Abdulaziz Cardiac Center between 2002 and 2011 (N=232)

Variable	Mean (SD)/ Number (%)
Demographic	
Age (y)	40 ± 18
Male gender	150 (65%)
Saudi Nationals	202 (87%)
BSA (m ²)	1.7
Echocardiographic	
Left atrial size ≥ mild	94 (40%)
Left ventricular size ≥ mild	66 (28%)
Ejection fraction < 55%	10 (4%)
Clinical outcomes	
Atrial fibrillation	26 (11%)
Surgical intervention:	83 (36%)
Valve repair	74 (89%)
Valve replacement	9 (11%)

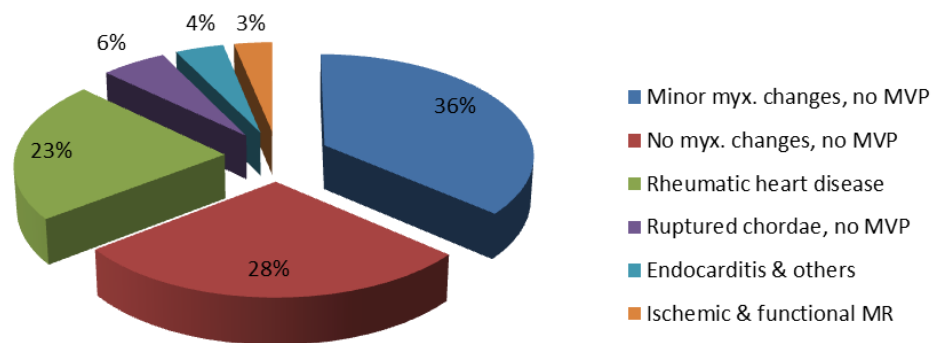


Figure1. Patients excluded from the study due to absence of diagnostic echo criteria for myxomatous mitral valve prolapse (n=341)

Table 2. Echocardiographic features of mitral valve prolapse patients, diagnosed at King Abdulaziz Cardiac Center between 2002 and 2011 (N=232)

Echo feature	Number (%)
Prolapsed leaflet	
Anterior	67 (29%)
Posterior	78 (33.5%)
Both	87 (37.5%)
Prolapse severity	
≤ Mild or less	96 (41%)
≥ Moderate	136 (59%)
Degree of mitral regurgitation	
≤ Mild	35 (15%)
Moderate	68 (30%)
> Moderate	129 (55%)
Flail leaflet/segment present	71 (30%)
Ruptured chordae present	43 (18.5%)

DISCUSSION

Available studies on MVP in Saudi Arabia are limited and old ^{11,12,13,14}. MVP prevalence of 11-12% in those studies has most likely been overestimated like all studies performed at that era ^{8,11,14}. More recent studies gave a prevalence rate of 2.2% and 2.4% using more strict and more scientific diagnostic criteria ^{5,7}, however other studies reported prevalence of less than 1% ^{9,10}. Our study revealed a prevalence of .33% that is closer to prevalence of 0.7% reported in a similar cohort ⁹ and almost identical to a community-based prevalence of 0.37% ¹⁰. Mean age of our study population was 40±18 which is similar to what has been found in a community-based study ¹⁰, however seems younger than what has been reported in the western societies ^{4,7,9}. MVP was more prevalent in the male gender 5.2/1000 as compared to 3.3/1000 in females, which is contrary to previously published local data and the general perception of higher MVP in females. Prolapse was almost equally distributed between the anterior leaflet, posterior leaflet and bileaflet involvement.

Majority of patients (59%) were found, up on the initial presentation, to have moderate or higher degree of MVP, as visually estimated by the reporting echocardiologist, a finding that correlated well with presence of more than moderate degree of MR in 55% of patients at presentation. These findings suggest late detection of the disease or late referral for surgical intervention. Atrial fibrillation was present in 11% which is higher than the reported rate of 1.2% ⁷. This finding is also consistent with the notion of late detection or late referral. Eighty-three patients (36%) underwent surgical intervention, mostly (74 cases) in form of valve repair. Only 9 patients (11%) underwent valve replacement (one mechanical valve after failed repair attempt, and all others were bioprosthetic valves; 2 due to anticipated repair failure, 2 due to old patient age and 4 due to unspecified reasons). Valve replacement was distributed all over the 6 surgeons. Some of these valve replacement procedures could have been potentially avoided, however few of them were unavoidable. Our repair rate is very close to the reported reparability rate of 90% or more ⁶.

CONCLUSION & LIMITATIONS

There are few limitations in this study. Being done in a tertiary care center, this study is prone to referral bias, however majority of the echo lab database are referred from primary and secondary care facilities. Retrospective review has always a drawback of missing data or missing candidates, however we did all possible efforts to avoid this limitation. Inter and intra-observer variability of the reporting physicians has not been studied in our echo lab, however considering their qualifications, years of experience and being in an accredited lab make the chance of major variation very low.

This limitation was overcome by reviewing the actual views of all potential cases by the investigators, who applied the standard diagnostic criteria to all patients. Additional limitation is lack of clinical data and non-surgical outcomes, as this study was mainly based on the echo diagnosis of MVP. In this echo-based adult population, prevalence of MVP is less than anticipated, compared to published data. MVP in the Saudi community seems to be more prevalent in males at middle age. Adverse hemodynamic effects of MVP, reflected by the echo findings and the high rate of atrial fibrillation suggest late referral for surgical intervention. Once referred to KACC as a tertiary care cardiac center, patients with MVP receive the appropriate care, including appropriate surgical technique.

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