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Value of Magnetic Resonance Imaging in Diagnosis of Mitral Valve Diseases

Nesma D. Ali*[1], Mahmoud A. Mohamed[1], Amina A. Sultan[1]
Department of Radiology, Faculty of Medicine, Mansoura University, Egypt
***Corresponding Author**: Nesma D. Ali, **Mobile**: +20 10 20136412, **Email**: nesma.desoky82@gmail.com

ABSTRACT

Background: Cardiovascular magnetic resonance (CMR) imaging has been considered an essential tool for the assessment of cases with mitral valve (MV) disease (MVD). It offers a detailed assessment of MV and its effects on the heart by offering accurate volumetric evaluation and myocardial scar evaluation.
Aim: This study aimed to assess the role of CMR in diagnosis and evaluation of mitral valve diseases.
Methods: This prospective study included 25 patients with mitral valve diseases. Radiological approaches were done at both Cardiology Department and Radiology Department and included two-dimensional transthoracic echocardiography (echo) (2D TTE) and CMR of the heart and proximal great vessels.
Results: The mitral valve by MRI revealed mild MR in 36%, moderate MR in 4% and severe MR in 12%. Thickened MV leaflets in 28 %. MV prolapse 8%. Annular disjunction in 4% of the patients. Mild MR by Echocardiography was detected in 48%, moderate MR in 16% and severe in 8%. SAM of AML was shown in 4%. Mitral annular disjunction (MAD) was recorded in 4%. Thickened leaflets in 28%. There was mild agreement between MRI and echo in detection of LVOT (κ=0.359, P=0.019). There was a significant strong agreement between MRI and echocardiography in detection of ejection fraction (Interclass correlation coefficient was 0.714) (p=0.006).
Conclusion: CMR played an essential role in terms of valvular heart disease (VHD). It enabled the visual analysis of valvular shape and function. CMR as a noninvasive imaging modality played an important role to assess mitral regurgitation (MR) severity and mitral regurgitant volume (MRV).
Keyword: Mitral valve diseases, Cardiovascular magnetic resonance, Transesophageal echocardiography.

INTRODUCTION

Cardiovascular magnetic resonance (CMR) imaging has been considered an essential modality for the evaluation of cases with MVD. It could offer an in-depth evaluation of the MV apparatus, leaflet structure, papillary muscles, and their impacts on the left atrium (LA) and left ventricle (LV) by the assessment of their size, function, and myocardial fibrosis or scar burden [1]. Globally, MR is a prevalent VHD whose prevalence rises with age, reaching 13.3% in participants 75 years of age and above. MR could progress without evident manifestations, causing LV overload and dysfunction. As a result, MR is accompanied by a higher rate of mortality and decompensated heart failure (DHF) attacks [2].

Based on several health organizations, CMR assessment in the context of VHD has been recommended when inadequate or conflicting data are achieved by echocardiogram [3]. Mitral valve prolapse (MVP), a common etiology of chronic primary MR, is characterized by a displacement of at least two millimeter above the MV annulus (MVA) of the leaflet, in presence or absence of leaflet thickening, is a common VHD [4]. Mitral annular disjunction (MAD) is featured by a separation between the MVA-left atrial wall junction and the basal segment of the LV wall. It is accompanied by MVP and independently accompanied by extensive LV dilatation [5].

Because of the good visualisation of the MV anatomy it affords, its great temporal resolution, and simplicity of use, 2D echo (accompanied by transesophageal echo (TEE) if required), is the first-line radiological approach for analysing mitral leaflet motion and thickness and quantifying MR. On the other hand, the visualisation and quantification of MR could be difficult in cases of poor quality [6].

CMR provides a detailed assessment of MR as well as its effects on the heart by offering accurate volumetric evaluation and myocardial scar evaluation. Hence, CMR is occasionally corresponding to echo providing guidance for MR clinical treatment [7]. Therefore, this study aimed to assess the role of cardiac MRI in diagnosis and evaluation of mitral valve diseases.

PATIENTS AND METHODS

This prospective study comprised 25 cases with mitral valve diseases and was conducted at MRI Unit of Radiology Department, Mansoura University Hospitals, and Specialized Medical Centers over a period from September 2022 to September 2024. Entire cases were recruited from the Cardiology Department.

Exclusion criteria: Patients with frequent ventricular arrythmias, patients who underwent surgeries comprising the insertion of metallic pieces in the heart or the eye, patients with bad general conditions (DHF & orthopnea) and patients with contraindications to MRI assessment (as with pacemaker of the heart, cochlear implants and metallic dental implant).

Methods: All subjects were subjected to complete history taking including age, complaint (whether routine follow up or any other complaint), sex, residency, occupation, smoking habit, past history of previous surgeries (especially cardiac surgery), past history of medical diseases, and any preceding cardiac

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researches and previous relevant history. General and cardiac examinations were conducted at the Cardiology Department. Evaluation of pulse, which was adjusted to be approximately 80-100 beat per minute (B.P.M). Laboratory investigations were done at Cardiology Department. Radiological approaches were done at both Cardiology Department and Radiology Department and included two-dimensional transthoracic echocardiography (2D TTE) and CMR of the heart and proximal great vessels.

2D TTE: Echo was conducted using traditional views with colour, pulsed wave and continuous wave Doppler by phase array probe on TOSHIBA Xario and GE Healthcare US unit.

Evaluation was conducted by, sub-xiphoid long axis view to evaluate the cardiac situs and RV and LV function, sub-xiphoid short axis view to assess the IVC, atrial and ventricular septum, apical two chamber view (A2C) was to evaluate LV dimensions & mobility, and MR, apical three chamber view to assess LV outflow tract (LVOT), parasternal long axis view to assess LA size, LV size and LVOT diameter and regional wall motion, parasternal short axis view to evaluate degree of MR, apical four chamber view to asses LV (Dimensions, myocardial thickness and wall motion), mitral valve (mobility, structure, annulus and coaptation of the valve), LVOT (aortic regurge) and suprasternal notch view to evaluate the first vessel off the aortic arch and the aortic arch. The LV function was assessed according to mitral annular plane systolic excursion (MAPSE), while LV size was evaluated based on Dd (Dimensions in end-diastole).

Cardiac MRI: Two weeks to a month after the echocardiogram, the CMR was conducted. The test was performed using a superconducting magnet in every case by using CMR (Ingenia 1.5T; A Philips, the Netherlands, at both MUH.1.5 Tesla scanner Simens Magnetom Area at specialist medical centers). All data were acquired via retrospective ECG gating. For processing, images were saved in DICOM format. The vendor's extended MR workspace 2.6.3.5, which was provided by Philips, Nederland B.V., was used to transfer the DICOM pictures. RV and LV volumes (including EDV, EDVI, ESV, and ESVI) and EF were calculated offline using axial images for RV and SA images for LV.

Ethical consideration: The study design was approved by The Institutional Review Board, Faculty of Medicine, Mansoura University and according to the Declaration of Helsinki. Confidentiality was respected. Cases had the right to leave the study at any time. Collected data will not be used for any other purpose. Written informed consents were obtained from all participants.

Statistical Analysis

All data were tabulated in SPSS sheet version 27. Categorical data were expressed as number and percent. Continuous data were tested for normality using Kolmogorov test. Normally distributed data were expressed as mean and SD. Non-parametric data were expressed as median, minimum and maximum. Kappa (κ) agreement coefficient was used to test the agreement between different assessment modalities. A p value ≤ 0.05 was considered statistically significant.

RESULTS

Table (1) displayed that the mean age of the studied cases was 41.20 ± 14.73 years and age ranged between 14 and 64 years. Among the cases, there were 15 males (60%) and 10 females (40%). The mean BMI was 28.94 ± 9.41 kg/m^2 and range between 12.81 and 60.42. The mean LV EF was 57.52 ± 20.4, the mean LV ED wall mass was 142.38 ± 35.99 gm, the mean LV ED wall Mass/ BSA was 72.23 ± 20.18 gm/m^2, the mean EDV was 158.38 ± 64.91 ml, the mean ESV was 75.35 ± 60.24 ml, the mean SV was 86.92 ± 32.31 ml, the mean EDVI was 131.61 ± 230.3 ml/m^2 and the mean ESVI was 34.67 ± 29.71 ml/m^2. The systolic functions were increased in 12 %, impaired in 36% and preserved in 52%. The myocardial thickness showed hypertrophy in 28%, normal in 60% and thinned in 12%. The LVOT showed obstruction in 16%. The left atrium was dilated in 60%. Late gadolinium enhancement (LGE) was enhanced in 40%.

Table (1): Age, sex, Anthropometric measures, MRI findings of LV and LA in the patients of the study

Variables	**Patients (N = 25)**	
	Mean ± SD	**Median (Range)**
Sex Males Females	(%) n 15 (60%) 10 (40%)	
Age (Years)	41.20 ± 14.73	43 (14 - 64)
Weight (kg)	76.93 ± 18.21	76.5 (41.5 – 110)
Height (cm)	163.82 ± 14.26	165 (120 – 180)
BSA (body surface area)	1.81 ± 0.24	1.86 (1.37 – 2.39)
BMI (body mass index) (kg/m^2)	28.94 ± 9.41	26.97 (12.81 – 60.42)
LV EF (%)	57.52 ± 20.45	61.5 (9.5 – 88)
LV ED wall mass (gm)	142.38 ± 35.99	142.5 (67 – 185)
LV ED wall Mass/ BSA (gm/m^2)	72.23 ± 20.18	71.15 (39 – 97)
EDV (ml)	158.38 ± 64.91	153 (69 – 334)
ESV (ml)	75.35 ± 60.24	56 (11 – 262)
SV (ml)	86.92 ± 32.31	84 (30 – 153)
EDVI (ml/m^2)	131.61 ± 230.3	75 (8.8 – 1125)
ESVI (ml/m^2)	34.67 ± 29.71	28 (7 – 139)
Myocardium thickness	18.29 ± 2.7	19 (15 – 21.7)
MRI findings of left ventricle		
Systolic functions		
Increased	3 (12%)	
Impaired	9 (36%)	
Preserved	13 (52%)	
Myocardial thickness		
Hypertrophied	7 (28%)	
Normal	15 (60%)	
Thinned	3 (12%)	
Type of hypertrophy (n=6)		
Asymmetric hypertrophy	5 (20%)	
Symmetric HCOM	1 (4%)	
LVOT		
Obstruction	4 (16%)	
No obstruction	21 (84%)	
Left atrium		
Not dilated (Normal)	10 (40%)	
Dilated	15 (60%)	
LGE		
Enhancement	10 (40%)	
No enhancement	15 (60%)	

Categorical findings expressed as Number (%). Continuous findings expressed as mean ± SD and median (range)
BSA: body surface area. BMI: body mass index. LV EF: left ventricle ejection fraction. ED: end diastolic. EDV: end diastolic volume. ESV: end systolic volume. SV: stroke volume. EDVI: end diastolic volume index. ESVI: end diastolic volume index.

Table **(2)** showed that the mitral valve by MRI revealed mild MR in 36%, moderate MR in 4% and severe MR in 12%. SAM was found in 16%. Thickened MV leaflets in 28%. MV prolapse in 8%. Annular disjunction in 4% of the patients. The mean regurgitation flow volume was 24.86 ± 19.31 and the mean regurgitation fraction (RF) was 23.75 ± 13.85.

Table (2): Mitral valve findings by MRI in the patients of the study

Variables	**Study patients (N = 25)**	
	Number	Percent %
Mitral valve MRI		
Mild MR	9	36
Moderate MR	1	4
Severe MR	2	8
No MR	13	52.0
Systolic anterior motion of MV leaflets		
No SAM	21	84
SAM	4	16.0
Leaflets thickness		
Normal	18	72
Thickened MV leaflets	7	28
MV prolapse		
MV prolapse	2	8.0
no prolapse	23	92.0
annular disjunction during systole		
Yes	1	4.0
No	24	96.0
	Mean ± SD	**Median (Range)**
Regurgitation flow volume	24.86 ± 19.31	18 (7 – 53)
Regurgitation fraction	23.75 ± 13.85	18.5 (6 – 46)

Continuous findings expressed as mean ± SD and median (range), MR: mitral regurge. SAM: systolic anterior motion. AML: anterior mitral valve leaflets.

Table **(3)** showed that mild MR by Echocardiography was detected in 48%, moderate MR in 16% and severe in 8%. SAM of AML was shown in 4%. Mitral annular disjunction in 4%. Thickened leaflets in 28%. Atherosclerotic MV leaflets were shown in 20%.

Table (3): Mitral valve findings by Echocardiography in the patients of the study

Variables	**Study patients (N = 25)**	
	Number	Percent
Mitral valve echo		
Mild MR	12	48
moderate MR	4	16
Severe MR	2	8
Normal	7	28
SAM		
SAM of AML	1	4.0
No SAM	24	96.0
Prolapse by ECHO		
Prolapse	5	20
No prolapse	20	80.0
Mitral annular disjunction		
MAD	1	4.0
No MAD	24	96.0
Leaflets thickness		
Thickened leaflets	7	28
Normal (not thickened)	18	72.0
MVL atherosclerosis		
Atherosclerotic MV leaflets	5	20
No atherosclerosis	20	80
Sub valvular apparatus		
Normal	25	100
Mitral valve area		
Normal	25	100

Continuous findings expressed as mean ± SD and median (range).

Table **(4)** showed that mean LV EF echo was 62.85 ± 11.53, FS was 34.96 ± 9.06, LVESD was 3.33 ± 1.01, LVEDD was 5 ± 0.98, PWT was 1.10 ± 0.25, SWT was 1.18 ± 0.48, LAD was 4.10 ± 0.64 and ARD was 3.11 ± 0.44. There was 12% with impaired systolic function by echocardiography. There was 36% with diastolic dysfunction. LV was dilated in 12%. Symmetric hypertrophy was reported in 20% and asymmetric hypertrophy in 16%. LVOT obstruction was detected in 4%. Dilated left atrium was shown in 40%.

Table (4): Echocardiographic findings of LV and LA in the patients of the study

Variables	**Study patients N = 25**	
	Mean ± SD	**Median (Range)**
LV EF echo	62.85 ± 11.53	62.5 (35 – 80)
FS	34.96 ± 9.06	34 (17 – 48)
LVESD	3.33 ± 1.01	3.01 (1.9 – 5.5)
LVEDD	5 ± 0.98	5.04 (3.4 – 6.6)
PWT	1.10 ± 0.25	1.10 (0.7 – 1.6)
SWT	1.18 ± 0.48	1.10 (0.60 – 2.5)
LAD	4.10 ± 0.64	4.15 (3.3 – 5.9)
ARD	3.11 ± 0.44	3.10 (2.3 – 3.8)
	Number	**Percent %**
Systolic Function by Echo		
Normal	22	88
Impaired	3	12
Diastolic function		
Diastolic dysfunction	9	36
Normal	16	64.0
LV by echo		
Dilated	3	12
Normal	22	88
Type of hypertrophy		
Symmetric hypertrophy	5	20
Asymmetric hypertrophy	4	16
No hypertrophy	16	64.0
LVOT obstruction		
LVOT obstruction	1	4.0
No LVOT obstruction	24	96.0
Left atrium Echo		
Dilated left atrium	15	60
Normal	10	40

Continuous findings expressed as mean ± SD and median (range)

Table **(5)** showed that there was a complete matching between MRI and echo in detection of left atrium dimensions. There was mild agreement between MRI and echo in detection of LVOT (**κ= 0.359, P = 0.019).** There was a complete matching between MRI and echo in Mitral annular disjunction. There was mild agreement between MRI and echo in detection of Systolic motion of MV leaflets (κ= 0.359, P = 0.019). There was moderate agreement between MRI and echo in detection of MV prolapse (**κ= 0.516, P = 0.003).**

Table (5): Agreement between MRI and echocardiography in detection of left ventricular and left atrium functions and MV affection

Variables	**MRI N = 25**		**Echo N = 25**		**Test of significance**
	Number	**Percent**	**Number**	**Percent**	
Systolic functions					
Increased	3	12	0	0	**κ= 0.114 P = 0.638**
Impaired	9	36	3	12	
Preserved	13	52	22	88	
LVOT					
Obstruction	4	16	1	4	**κ= 0.359 P = 0.019***
No obstruction	21	84	24	96	
Left atrium					
Not dilated (Normal)	10	40	10	40	**κ= 1 P < 0.001***
Dilated	15	60	15	60	
Systolic motion of MV leaflets					
No SAM	21	84	24	96	**κ= 0.359 P = 0.019***
SAM	4	16	1	4	
MV prolapse					
MV prolapse	2	8	5	20	**κ= 0.516 P = 0.003***
no prolapse	23	92	20	80	
Mitral annular disjunction					
MAD	1	4.0	1	4.0	**κ= 1 P < 0.001***
no MAD	24	96.0	24	96.0	

Categorical findings expressed as Number (%), κ: Kappa agreement coefficient, *: Statistically significant

Table **(6)** showed that there was a significant strong agreement between MRI and echo in detection of ejection fraction (Interclass correlation coefficient was 0.714) (p= 0.006).

Table (6): Agreement analysis MRI and echocardiography in assessment of ejection fraction

	Agreement coefficient (Interclass correlation)	95% CI	P
Ejection fraction by MRI and echocardiography	0.714	0.258 - 0.890	**0.006***
	Mean ± SD	**Median (Range)**	
Ejection fraction by MRI (%)	57.52 ± 20.45	61.5 (9.5 – 88)	
Ejection fraction by echocardiography (%)	62.85 ± 11.53	62.5 (35 – 80)	

CI: Confidence interval
*: Statistically significant (p< 0.05).

CASE PRESENTATION

Case (1) was male patient, 34 years old, hypertrophic cardiomyopathy (HCM) by echocardiography. Echo revealed mild asymmetric left ventricular hypertrophy (LVH). Cardiac MRI findings were cine axial image showed hypertrophied LV (myocardial thickness = 19 mm), cine axial showed thickened interventricular septum, cine short axis showed hypertrophied papillary muscles, cine LVOT showed mild LVOT obstruction, short axis phase sensitive inversion recovery (PSIR) showed patchy enhancement of hypertrophied ventricular wall and cine 2 chamber view mild MR (regurgitant flow volume = 15 ml, regurgitant fraction= 12 %) and SAM. MRI showed hypertrophied obstructive cardiomyopathy and mild mitral regurge with systolic anterior motion (SAM) (Figure 1).

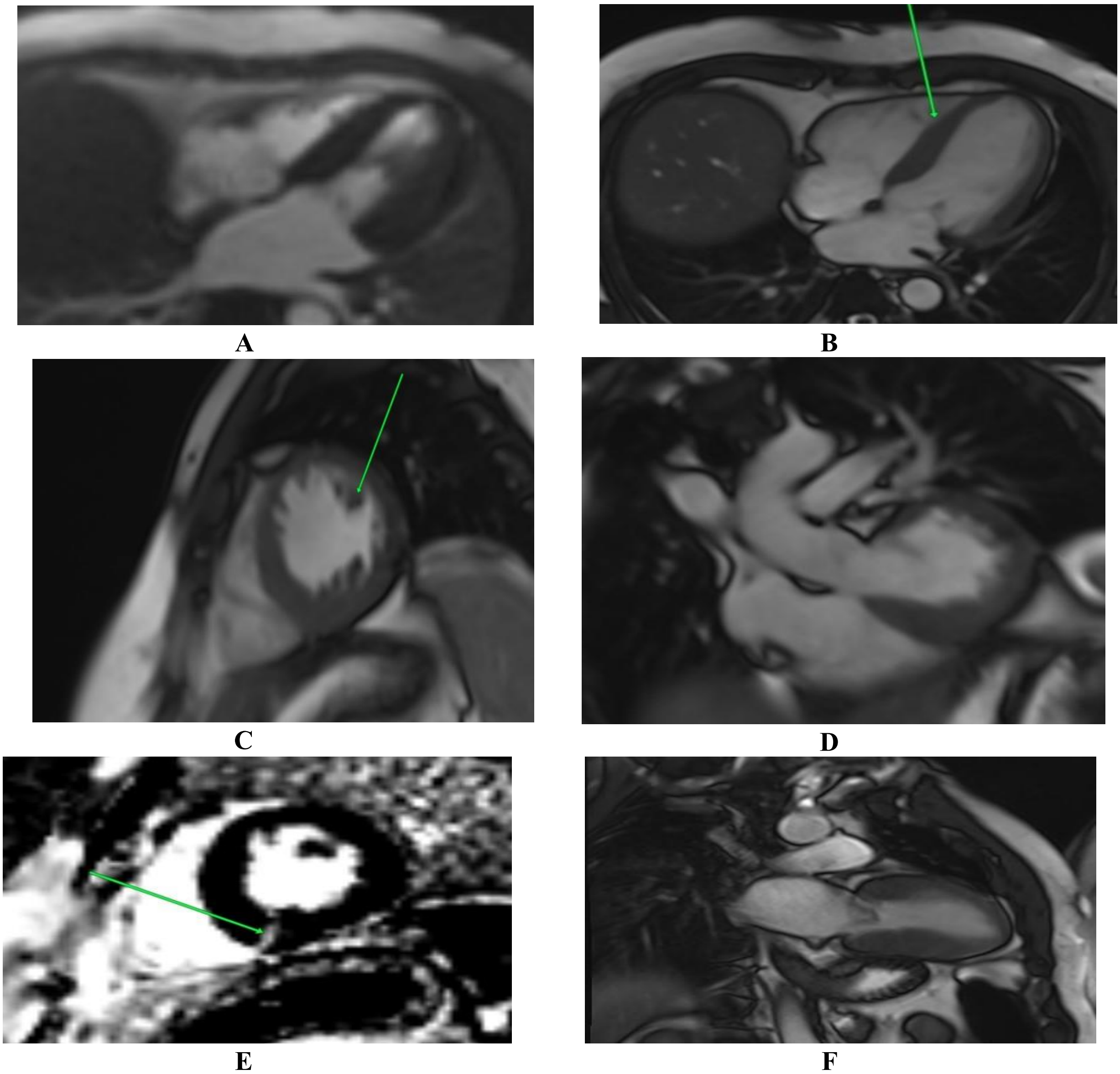

Figure (1): A Male patient, 34 years old, hypertrophic cardiomyopathy by echocardiography.

Case (2) was female patient, 22 years old, with severe MR, mitral valve prolapse by echocardiography. Cardiac MRI findings were Cine axial image showed average size left ventricular (EDV = 166 ml), cine short axis image showed average size left ventricular, cine LVOT image showed no LVOT obstruction, 4 chamber phase sensitive inversion recovery (PSIR) image showed no enhancement, cine 3 chamber image showed mitral valve prolapse (13 mm above mitral annulus), cine 2 chamber view image showed severe mitral regurge (regurgitant flow volume = 51 ml, regurgitant fraction = 46%) and cine 2 chamber view image showed dilated left atrium. MRI showed dilated left atrium and thickened redundant mitral valve leaflets with mitral valve prolapse (MVP) and mitral annular disjunction (MAD) with moderate to severe MR (Figure 2).

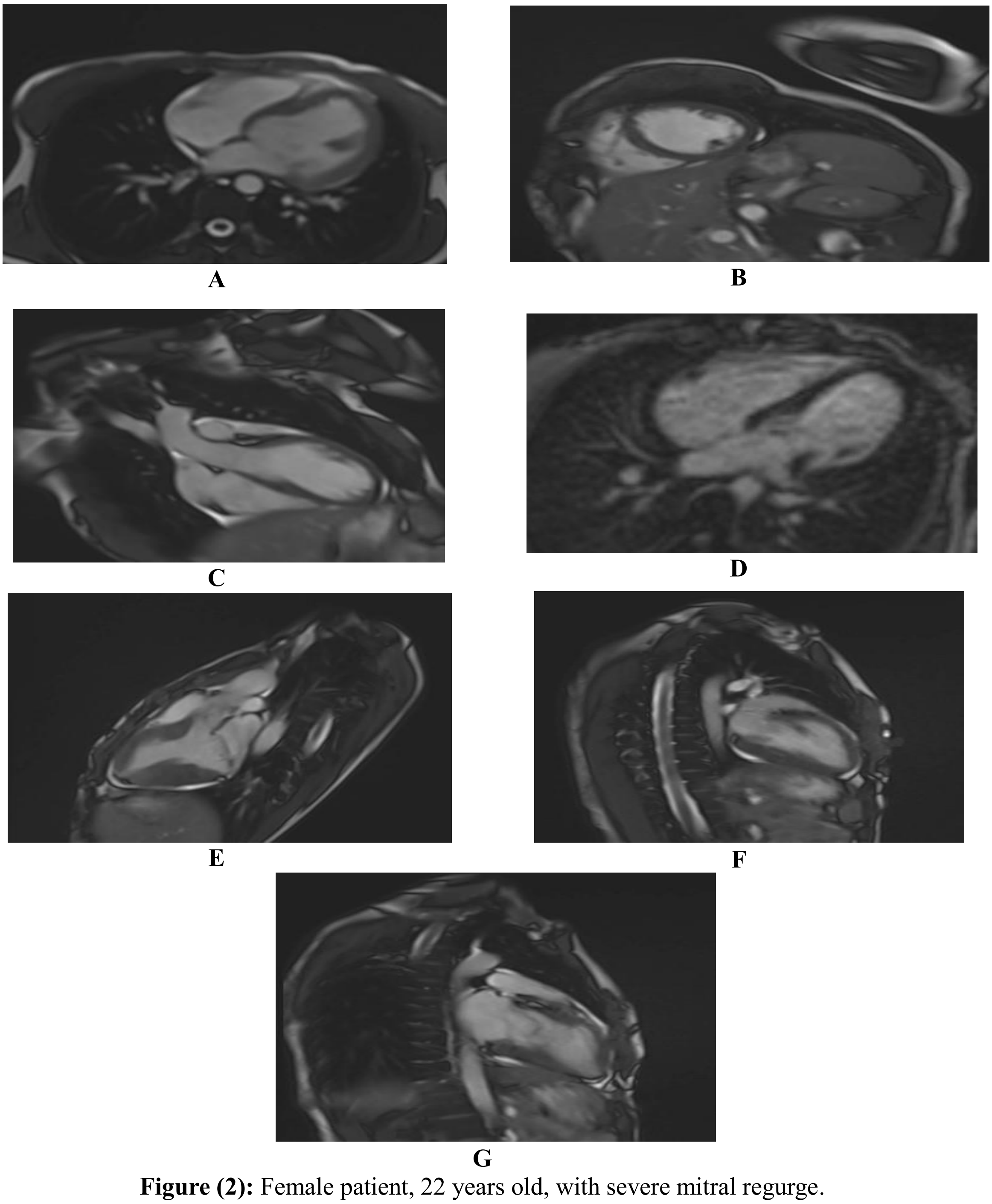

Figure (2): Female patient, 22 years old, with severe mitral regurge.

DISCUSSION

Valvular heart disease (VHD) is caused by the malfunction of one or more heart valves. About 7.5% of subjects between the ages of 65 and 74 and 15% of those over 75 suffer from VHD, and its incidence is rising abruptly, especially among cases living in high-income countries as life expectancy increases [8]. CMR has distinctive abilities, which could significantly benefit the evaluation of the case with VHD. While, echo is still the primary radiological approach for evaluating VHD, there are several regions in which CMR offers 'added value' to existing assessment and could complement the echo evaluation [1].

Therefore, the current study aimed to assess the role of MRI in diagnosis and evaluation of mitral valve disease. The LV and LA size and function in comparison with 2D echocardiography. It included 25 patients with mitral valve diseases with a mean age of 41.20 ± 14.73 years. There were 15 males (60%) and 10 females (40%). The mean BMI was 28.94 ± 9.41 kg/m^2 and ranged between 12.81 and 60.42. This comes in agreement with **Uretsky *et al.*** [9] who displayed in their study that the ratio of male to female was 1.45:1. This discrepancy could be explained by the change in the sample size. Also, the mean age of the subjects was 61 ± 14 years.

The LV size was evaluated by CMR compared to 2D echo. LV size was evaluated for all cases by cardiac MRI and was compared to the reference range based on each age group for EDV and EDVI. EDVI was measured for all cases based on the BSA. 19 cases (76%) were found to have average LV size while 6 cases (24%) had dilated LV. The six cases with LV dilatation were 5 patients (20%) with asymmetric hypertrophy and 1 patient (4%) with symmetric hypertrophy. The mean of EDV, EDVI, ESV, ESVI and EF of LV were 158.38 ± 64.91, 131.61 ± 230.3, 75.35 ± 60.24 and 34.67 ± 29.71 respectively. The mean value of LV EDV was 158.38 ± 64.91, LV ESV was 75.35 ± 60.24 and stroke volume was 86.92 ± 32.31. **Elgammal *et al.*** [10] showed that the mean of LV EDV was 220.63 ± 53.15, ESV was 87.60 ± 35.04 and stroke volume = 132.33 ± 25.52.

The current study displayed that the mean LV EF was 57.52 ± 20.4. This value is similar to that seen in the study by **Elgammal *et al.*** [10] who displayed that the mean EF = 61.0 ± 7.90.

The current study displayed that the mean Regurgitation volume (RV) was 24.86 ± 19.31 ml, and the mean RF was 23.75 ± 13.85 %. **Uretsky *et al.*** [9] showed that the mean RF was 36%.

Regarding the LGE (based on CMR images), cases with primary MR, especially MVP cases, displayed LV fibrosis, which was more predominant in MR with MVP compared to cases without MVP. In cases with secondary MR, the myocardial scarring degree gives important data regarding the progression of ischaemic MR [11]. In the current study LGE was present in 10 patients (40%) of all cases. Likewise, **Pankaj Garg *et al.*** [11] displayed that LGE was present in 44% in cases of mitral valve disease.

Regarding LVOT obstruction, MR represents an important feature in patients with HCM due to LVOT and mitral valve systolic anterior motion (SAM). Mitral valve anatomical variants associated with HCM also participate in MR severity [12]. In our study, LVOT obstruction was present in 4 cases with MR 33 % of all cases. **Chen *et al.*** [13] showed that it was present in 55%.

Regarding the MVP, it is a common VHD that often is associated with a benign course provided that no marked MR or LV impairment is developed. Emerging predisposing factors involve MAD and myocardial fibrosis. While echo is still remains the primary approach of assessment, CMR plays an essential role in treating this state. CMR offer precise characterisation of MVP and annular disjunction, assessment of ventricular volume and function and quantitative assessment of MR when integrated with flow imaging [14]. In our study, MVP was present in two cases (8% of all cases), whereas **Malev *et al.*** [15] displayed that MVP was in 37 % of all cases. The difference in the ratio between the 2 studies can be explained by the fact that the **Malev *et al.*** [15] study was concentrated on the patients with MV prolapse.

Regarding MRI findings of left atrium, left atrial dilatation may present on radiological image in asymptomatic cases that may denote worse outcome if valve interference is postponed. The shapes of the endocardial borders of the LA are delineated at end systole using the cine long-axi 4C- and 2C views [11]. In the current study, the left atrium was dilated in 60% of all cases.

The current study showed that mild MR was found in 75%, moderate MR in 8.3%, severe MR in 16.7 %. **Uretsky *et al.*** [9] showed that mild MR was found in 52.5%, moderate MR in 33 % and severe MR in 14.5%. The alteration in the ratio could be explained by the difference in the sample size.

In this study, systolic anterior motion (SAM) was found in 16%. Thickened MV leaflets were detected in 28 %. Annular disjunction was shown in 4% of all patients. In this study, prevalence of MAD by CMRI in patients with MV prolapse (2 patients), it was found in 1 patient. This is in agreement with **Mantegazza *et al.*** [16] who found MAD prevalence was 42% in patients with MV prolapse.

On the other hand, regarding ECHO findings, **Han *et al.*** [17] displayed that traditional echo criteria for MVP, namely the excursion of MV leaflet segment beyond the mitral annular plane into the LA throughout ventricular systole by at least 2 mm in the LVOT view, might be applied to CMR.

The current study showed that mild MR was detected in 48%, moderate MR in 16% and severe in 8%. SAM of anterior mitral valve leaflets (AML) was shown in 4%. MAD was reported in 4%. Thickened leaflets in 28%. Atherosclerotic MV leaflets were shown in 20%. Mean LV EF echo was 62.85 ± 11.53, FS was 34.96 ± 9.06, LVESD was 3.33 ± 1.01, LVEDD was 5 ± 0.98, PWT was 1.10 ± 0.25, SWT was 1.18 ± 0.48, LAD was 4.10 ± 0.64 and ARD was 3.11 ± 0.44. There was 12% with impaired systolic function by echocardiography. There was 36% with diastolic dysfunction. LV was dilated in 12%. Symmetric hypertrophy was reported in 20% and asymmetric hypertrophy in 16%. LVOT obstruction was detected in 4%. Dilated left atrium was shown in 40%. Interestingly, our study displayed that there was complete agreement between MRI and echocardiography in detection of left atrium dimensions (k=1, P=<0.001). There was mild agreement between MRI and echocardiography in detection of LVOT (k= 0.359, P = 0.019). Also, the current study showed that there was a complete agreement between MRI and echocardiography in MAD (k=1, p=<0.001).

There was mild agreement between MRI and echo in detection of systolic motion of MV leaflets (k= 0.359, P = 0.019). There was moderate agreement between MRI and echo in detection of MV prolapse (k = 0.516, P = 0.003). There was fair agreement between CMR and echo in detection of MR (k = 0.246, P = .359). **Heitner *et al.*** [18] recorded moderate agreement in assessing MR both with echo and CMR (kappa coefficient = 0.47).

The result of the current study showed 2 cases with severe MR with regurgitation fraction (RF) was more than 35%, and this can cope with the result by **Le Goffic *et al.*** [19] who adopted a multiparametric method using echo as the reference and compared with CMR RF. They concluded that MR severity grading demonstrated good agreement, and the investigators suggested a CMR RF cut off value of 35% to define significant MR. Conversely, **Penicka *et al.*** [20] showed that the agreement between echo and CMR for categorizing primary MR was poor for cases with late systolic MR or multiple MR jets. Such results recommend that, in cases who have complex primary MR jet physiology, standard CMR quantification of MR could provide corresponding data to that acquired by echo for consideration of valvular interference. It was found that the MRI derived evaluation of MR could better detect cases with extensive MR and negative outcome than ECHO-derived integrative procedure necessitating strict follow up and may be early MV operation. A total of 85 cases (33%) had extensive MR on MRI and one hundred (39%) on ECHO (P>0.05).

In this study according to CMR findings, there were 6 cases with primary MR and 7 cases with secondary MR. **Lopez-Mattei *et al.*** [21] found CMR to have a decreased interobserver variability (IOV) compared to TEE for regurgitant volume and regurgitant fraction. In a group of cases that underwent MV surgery, postsurgical CMR and echo, CMR displayed superiority, recording a significant association between LV remodeling and MR severity (p < 0.0001) compared to echo (p = 0.1) [22]. Additionally, in **Uretsky *et al.*** [9] multicenter study of CMR vs. echo, evaluating the agreement, IOV and response of the LV to surgery, displayed significant disagreement between echo and CMR for MR quantification and MR volume quantified by CMR had a strong association with post-surgical LV reverse remodeling (P<0.0001), while this wasn't the case for echo (P=0.1).

The current study showed that there was a significant strong agreement between MRI and echocardiography in detection of ejection fraction (k= 0.714) (p= 0.006). This matches with **Nazir *et al.*** [23] who found that moderate agreement between 2D echo−derived versus CMR −derived LVEF. The inconsistencies in results of the aforementioned studies could be clarified by a lot of factors comprising differences in the concordance, inter-observer variability, the etiology of mitral valve disease, dissimilar populations, selection of patients and limited sample size.

LIMITATIONS

This study had some limitations, such as the small sample size. The comparison was made between cardiac MRI and 2D echocardiography and not 3D, long scan time. And there was no comparison with intra or post-operative findings. So, we recommend use 3D echo in comparison as it might offer more precise findings concerning the LV complex geometry.

CONCLUSION

CMR plays an essential role in terms of VHD evaluation. It allowed the visual analysis of valvular shape and function. CMR cine imaging is still the best approach for measuring left and right ventricular volumes and function, offering important data with regard to ventricular remodeling in response to VHD. CMR, as a noninvasive radiological approach, has an essential role in assessing MR severity and MRV and could be more precise than echo.

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