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Research Article

Mitral Valve Prolapse And associated features

Adil M Najm [1],*, Laith Muhammed Mahmood [2], Arqam ghazi azeez

[1] Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul, Iraq

* dr.adel.mna@gmail.com

ABSTRACT

Mitral Valve Prolapse (MVP) is one of the most common valvular abnormalities encountered in clinical practice. Although it is frequently detected in otherwise healthy individuals and remains asymptomatic in many cases, it is an important cause of cardiovascular consultation. This prospective study was conducted to evaluate the demographic characteristics, clinical presentations, electrocardiogram findings, electrocardiograph features among patients with MVP. The study included 80 patients aged 18 years and older who attended the Echo-cardiograph Department at Al Salam Teaching Hospital in Mosul.

The results demonstrated that MVP was significantly more prevalent among females, with a female-to-male ratio of 1.58:1 and a mean age of 31 years. Most patients had no family history of valvular heart disease, while nearly half exhibited a normal BMI. Optimal arterial blood pressure was observed in the majority of participants. Palpitations represented the most frequent presenting symptom and were predominantly associated with sinus tachycardia. Mitral regurgitation was identified in one-fifth of patients and showed a significantly higher prevalence among females, with a strong association with atrial fibrillation. Other rhythm disturbances, including supra-ventricular tachycardia and ventricular ectopic beats, were also observed.

In conclusion, MVP predominantly affects young adult females and is associated with a normal or low BMI,normal blood pressure levels. Palpitations, mainly resulting from sinus tachycardia,(common clinical manifestation). Mitral regurgitation more frequent in female patients and is strongly associated with atrial fibrillation. Overall, MVP appears to have a relatively benign metabolic profile, with normal biochemical parameters and a low prevalence of metabolic abnormalities.

Keywords: Mitral Valve Prolapse (MVP), Mitral Regurgitation(MR), Atrial Fibrillation(AF), Sinus Tachycardia, Body Mass Index(BMI)

INTRODUCTION

The Mitral valve is the heart valve between the left atrium and left ventricle. It has two flaps, called leaflets or cusps, which closed and opened when the heart contracts and relax [1]. In some people these leaflets are longer or thicker than normal so when they close, they extend back into atrium [2].

So mitral valve prolapse (M.V.P) is characterized by systolic billowing of one or both leaflets into the atrium by at least 2mm above Mitral annulus in sagital view and often accompanied by mitral regurgitation when allowing blood to leak back into atrium through Mitral valve [2] this may produce a soft systolic murmur the “click murmur”, if present can sometimes be heard with stethoscope over the mitral area [2, 3, 4],but are not sufficient for diagnosis.so MVP has also been called the click murmur syndrome ,the floppy

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

valve syndrome, Barlaws syndrome [5] ballooning mitral valve, mid systolic -click-late murmur syndrome or click murmur syndrome [6, 7].

MVP represent the most frequant cause of primary Mitral regurgitation [8].

MVP can present from birth or develop at any age [5] and can be classified into 2 types [6].

Primary MVP

That is an autosomal dominant trait, the inheritance is affected by age and sex, with greater expression of mitral valve prolapse gene in female, characterized by myxomatous degeneration with an increased amount of leaflets tissue and proliferation of the spongiosa layer [2] and could be familial, non-familial conjugated with certain diseases that affect connective tissue as Marfan's syndrome or Ehlers-Danlos syndrome [1, 3, 6].

Secondary MVP

In which there is no myxomatous proliferation of the spongiosa layer cells with increased glycose amino glycan, collagen disorganization resulting in thick leaflet of mitral valve leaflets that may be caused by coronary heart disease, rheumatic heart disease, hypertrophic cardiomyopathy or normal variant [3, 5].

Patients with primary and secondary mitral valve prolapse must be distinguished from those who have finding on cardiac auscultation or echocardiography that have been misinterpreted [3].

Clinical Presentation

MVP is usually asymptomatic [3, 7], majority of patients are non progressive and benign. The most frequent complaint is palpitation and occur in 40% of Mitral valve prolapse [7] ;the usual source being premature ventricular beats[4] or supra ventricular arrhythmias also cause palpitation.

Paroxysmal SVT is the most common sustained tachycardia [2].

1. Chest pain frightening symptom because of its association with panic attacks, this atypical chest pain may be sharp or dull, lasting from few seconds to several hours [9].
2. Some individuals report mild and common symptoms related to M.V.P. mechanism such as shortness of breath (S.O. B), fatigue and dizziness.
3. Although controversial, anxiety and panic disorder may be more common in patient with Mitral valve prolapse (M.V.P) than they are in the general population [10].
4. Syncope, presyncope [4].
5. Orthostasis [6].
6. Head ache, migraines.
7. Intestinal problem, such as irritable bowel syndrome (IBS)[10].
8. Cerebrovascular Thramboembolism.
9. Sudden death [11].

There is no correlation between the degree of prolapse and severity of symptoms and not use physical examination to diagnose MVP [8]. M.V.P. can be induced in a healthy woman with typical body texture following dehydration and reversed with re-hydration. M.V.P. resolve during pregnancy and following weight gain in anorexic patients [7].

Diagnosis

The diagnosis of mitral valve prolapse is sometimes considered in patients who have thoracic skeletal abnormalities: the most common are scoliosis, Arachnodactyly, low body mass index, pectus excavatum [12], straightened thoracic spine and narrowed antero-posterior diameter of the chest [13] ;and in others show features of Marfan syndrome [3, 5, 14]

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

The classical finding of mitral valve prolapse on physical examination is mid systolic click caused by tensing of the mitral apparatus as the leaflets prolapse in mid systole; followed by murmur of varying duration , heard best at the cardiac apex [7].

In the standing position and during valsalva maneuver, the click is delayed (i.e.: close to S1), and the murmur is longer. This may identify a murmur that previously was not noted [7].

In the squatting position, the click is delayed (i.e.: closer to S2) and the murmur is shorter, the click and the murmur even may disappear [15].

The isometric hand grip exercise increases the intensity (the loudness) of the murmur without affecting the position [7, 9].

Electrocardiography is often normal in patients with mitral valve prolapse [13]. The most common abnormality is the presence of ST-T wave depression or T wave inversion in the inferior leads (II, III and aVF)[16, 17] .

Two dimensional and Doppler echo-cardiography are the most useful non invasive test for the diagnosis of mitral valve prolapse with or without regurgitation [3, 17, 18].

Cardiac MR :MRI is an adequate tool to study the MVP as well as thickness and severity of leaflet prolapse and presence of Mitral annular degeneration [17].

Complications

1. Arrythmias: atrial fibrillation, ventricular ectopic, sustained and non sustained ventricular tachycardia [4].
2. Infective endocarditis.
3. Rupture chordae tendineae (the most frequent serious complication).
4. Mitral regurgitation and pulmonary hypertension [7].
5. Stroke.
6. Sudden cardiac arrest [6, 18].

AIMS OF THE STUDY

1. To compare sex (gender) distribution in patients with M.V.P.
2. To study the relation of body mass index and M.V.P.
3. To evaluate the clinical presentations.
4. To evaluate the arterial blood pressure in patient with M.V.P.
5. To evaluate the random blood sugar, blood urea, serum creatinine and serum cholesterol in these patients with M.V.P.

PATIENTS & METHODS

During the period from the first of July 2025 to 30-december-2025 study protocol anticipated that 80 subjects from different regions of Mosul ,of (18-62) years groups of both sexes outpatient consulting to the electrocardiograph department in Al Salam teaching Hospital.

THE DIAGNOSTIC CRITERIA OF MITRAL VALVE PROLAPSE

The electrocardiograph changes of M.V.P. in B-mode supported by M-mode electrocardiograph diagnosis of M.V.P. The information regarding the investigated factor which achieved through direct questionnaire during specific interview ,the data from the patient were recorded after confirming the electrocardiograph feature of M.V.P.

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

ECHOCARDIOGRAPHIC CRITERIA OF MITRAL VALVE PROLAPSE

Although the finding of the combination of a mid-systolic click and a systolic murmur is relatively specific for mitral valve prolapse,its sensitivity is limited [19].

Trans Thoracic Echo (TTE)is the first and most commonly imaging modality for diagnosis of MVP [20].

The echocardiographic diagnosis of mitral valve prolapse made only if one or both leaflets are displaced by at least 2mm above the mitral annulus during systole in either parasternal or apical long axis view on 2 dimensional imaging[20,21] .

The left para-sternal long axis is preferable, apical four chamber may lead to number of false positive, because of non-flat, saddle shape annulus of mitral valve [22].

Two dimensional echo is less sensitive ,but more specific for mitral valve prolapse than M-mode [22].

Doppler echo-study was performed to every patient having feature of mitral regurgitation in echo study to confirm the diagnosis of mitral regurgitation.

LABORATORY INVESTIGATIONS

Bio-chemical tests were sent for random blood sugar ,blood-urea, serum-creatinine and total serum cholesterol.

STATISTICS

The comparison of both sexes in the study and predictive value was calculated by using Z-test with p-value of :

less than 0.05 was considered to be significant .

less than 0.01 was considered to be highly significant .

less than 0.001 was considered to be very highly significant .

while more than 0.05 was considered to be non significant .

Age of patients were expressed as mean ± SD (years).

Chi-square test used for comparison between male and female.

RESULTS

Eighty cases with mitral valve prolapse were studied, 31 males and 49 female their age ranged (18- 62) years old (mean ±SD: ±31 years). The ratio of male: female was (1:1.58) with significant predictive value as shown in table No.1.

The study of body mass index of those cases showed that most of them (37 cases) were with normal range, (male : female=8.5:10), 7 cases were have below normal range (male : female =1:6), over weight represented by 22 cases (male : female = 1:1.2).

Obesity was present in 13 cases (male : female = 3:10) , while morbid obesity represented by one female case. The all subgroups of BMI were of significant or high significant p-value between males and females except the over weight subgroup as illustrated in (Table 2).

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

The study showed that the most cases with Mitral valve prolapse were non smokers (59 cases , male : female =1:3 with high significant predictive value) .

Eleven cases had family history of M.V.P. (male : female = 5:6) with no significant p-value as illustrated in (Table 4).

The study showed the clinical presentation of mitral valve prolapse as follows:

- Palpitation in 87.5%.
- Shortness of breath in 56.25%.
- Atypical chest pain in 50%.
- Dizziness in 38.75%.
- Head ache in 30%.
- Irritable bowel syndrome in 17.5%.
- Anxiety in 8.75%.
- Syncope in 6.25%.
- Stroke in 2.5%.
- Other presentation (as joint pain, generalized fatigue, anorexia ,….) in < 0.05% as reviewed in Figure 1.

The study of arterial blood pressure in patients with mitral valve prolapse demonstrated that the majority of them (62 cases, male:female =1:1.66) had optimal normal blood pressure, normal blood pressure in (8 cases, male : female=1:1), high normal blood pressure in one male cases ,and hypertension was founded in (9 cases, male : female=1: 2). The normal and high normal blood pressure between males and females was of significant and very high significant predictive value respectively as shown in (Table 5).

Mitral valve regurgitation represented by 16 cases (20%); 13cases were females (male: female 1:4.33) with P-value of (<0.001), as shown in Table 11.

The electrocardiograph changes of the study sample against the presence or absence of mitral valve regurgitation ECG revealed that most patients 47 (57.5%) have sinus rhythm, 3(4.75%)with mitral valve regurgitation, 44(55%) without mitral valve regurgitation (M.R:non MR=1:14.75), with very high significant predictive value between both groups, 10(12.5%)were with ventricular ectopic (M.R:non M.R=1:4), Atrial fibrillation was present in 14(17.5%) with (M.R:non M.R=5:2) and very high significant predicative value between the both groups, supra-ventricular tachycardia in 9(11.25%) with (M.R:non M.R=1:8) with significant predictive value between both groups ,as shown in (Table 6).

The evaluation of random blood sugar in the study group showed that 14(17.5%) were hypoglycemic (male : female=1.33:1) with very high significant p-value, 55(68.75%) were normo-glycemic (male: female=1:1.75), while hyperglycemia represented in 11(13.75%) cases (male: female =1:2.66) with significant p-value between males and females as illustrate in (Table 7).

The study of total random serum cholesterol revealed that 18(22.5%) cases were below normal range, with (male: female=1:1.63) with very high significant p-value between males and females, 58(72.5%) were having normal range of total serum cholesterol (male:female=1:1.9) not significant p-value, while just 4 (5%) with hyper-cholestrolemia (male:female=1:3) with significant p-value , as shown in Table 8.

Blood urea was normal in 64(80%) cases with (male: female=1:1.56) , 5cases (6.25%) had blood urea below normal range (male: female=2:3) and 11 cases (13.75%) having raised blood urea (male: female=1:1.75) all the 3 result were of not significant predictive value (Table 9).

Serum creatinine below normal range in 13 (16.25%) with (male: female =1:1.66), 63(72.75%)with normal serum creatinine (male : female=1:1.73) and 4 (5%) cases were have elevated serum creatinine (male: female =1:1) (Table 10).

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

Table 1. (a) Demonstrate the gender distribution in studied sample

Sex	no	%
Male	31	38.8
Female	49	61.2
Total	80	100%

X2: male, Female =4.05, p<0.05 significant

Table 2. The distribution of body mass index(B.M.I) in study sample

BMI(kg/m^2) **	male		female		Total	P-value *
	No	%	no	%		
Under weight <18.5	1	3.22	6	12.3	7	P<0.001
Normal range 18.5-24.9	17	54.83	20	40.8	37	P<0.05
Over weight 25-29.9	10	32.22	12	24.5	22	P>0.05
Obese 30-39.9	3	9.67	10	20.4	13	P<0.001
Morbid obesity >40	0	0	1	2.0	1	P<0.001
Total	31	99.94	49	100	80	

* =using Z-test, ** classification of adults according to body mass index

Table 3. The relation of mitral valve prolapse and smoking on both sexes

	male		female		Total	P-value
	no	%	no	%		
Smoker	16	51.61	5	10.2	21	P<0.001
Non Smoker	15	48.38	44	89.79	59	P<0.01
Total	31	100%	49	100%	80	

Table 4. The family history of mitral valve prolapse.

	male		female		Total	P-value
	no	%	no	%		
With family history of M.V.P.	5	16.1	6	12.2	11	X2=0.24 P >0.05 NS
No family history of M.V.P.	26	83.9	43	87.8	69	
Total	31	100%	49	100%	80	

X2 Male ,Female = 0.24, P-value > 0.05 not significant, NS = Not significant

Table 5. The estimated blood pressure in patients with mitral valve prolapse.

Blood pressure (mm Hg)	male		female		Total	p-value
	No.	%	No.	%		
Optimal normal < 120/<80	23	74.2	39	79.6	62	>0.05
Normal 120-130/80-85	4	12.9	4	8.2	8	<0.05
High normal 131-139/86-89	1	3.2	0	0	1	<0.001
Hyper tension >140/ >90	3	9.7	6	12.2	9	>0.05
Total	31	100	49	100	80	

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

Table 6. The Electrocardiograph study of heart rhythm in patient with Mitral valve prolapse compared against the presence or absence of Mitral regurgitation:

ECG study	M.V.R No.	%	No M.V.R No.	%	Total	P-value
Sinus rhythm	3	3.75	44	55	47	<0.001
Ectopic	2	2.5	8	10	10	>0.05
Atrial fibrillation	10	12.5	4	5	14	<0.001
S.V.T	1	1.25	8	10	9	<0.05
Total	16	20%	64	80%	80	

S.V.T= Supra ventricular tachycardia, M.V.R = mitral valve regurgitation

Table 7. Random blood sugar level of study sample

Random Blood Sugar (mmol/l) *	male		female		Total	P-value
	no	%	no	%		
< 3.6	8	25.8	6	12.2	14	P<0.001
3.6-6.1	20	64.5	35	71.4	55	P>0.05
> 6.1	3	9.7	8	16.4	11	P<0.05
Total	31	100%	49	100%	80	

* according to W.H.O. classification.

Table 8. Random total serum cholesterol in studied sample

Total Serum cholesterol (mmol/l) *	male		female		Total	P-value
	no	%	no	%		
< 3.8	10	32.2	8	16.3	18	P<0.001
3.8-6.4	20	64.5	38	77.6	58	P<0.01
> 6.4	1	3.3	3	6.1	4	P<0.01
Total	31	100%	49	100%	80	

* according to W.H.O. classification.

Table 9. The evaluation of blood urea in studied sample

B.urea mmol/l *	male		female		Total	P-value
	no	%	no	%		
< 3.3	2	6. 5	3	6.3	5	P>0.05
3.3-7.5	25	80.6	39	79.5	64	P>0.05
>7.5	4	12.9	7	14.2	11	P>0.05
Total	31	100	49	100	80	

* according to W.H.O. classification.

Table 10. The evaluation of serum creatinine in studied sample

S.creatinine (mmol/l)*	male		female		Total	P-value
	no	%	no	%		
< 62	6	19.3	7	14.3	13	P>0.05
62-124	23	74.3	40	81.6	63	P>0.05
> 124	2	6.4	2	4.1	4	P<0.05
Total	31	100	49	100	80	

* according to W.H.O. classification.

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

Table 11. The prevalence of M.V.P. with and without mitral regurgitation in both sexes

P-value	Total	Female	%	Male	%	
< 0.001	16	13	26.5	3	9.6	M.V.P with M.R.
>0.05	64	36	73.5	28	90.4	M.V.P without M.R.
<0.01	80	49	100	31	100	Total

For the table X2 male , female =3.37 (P<0.05) .

MVP =mitral valve prolapse.

MR = mitral regurgitation

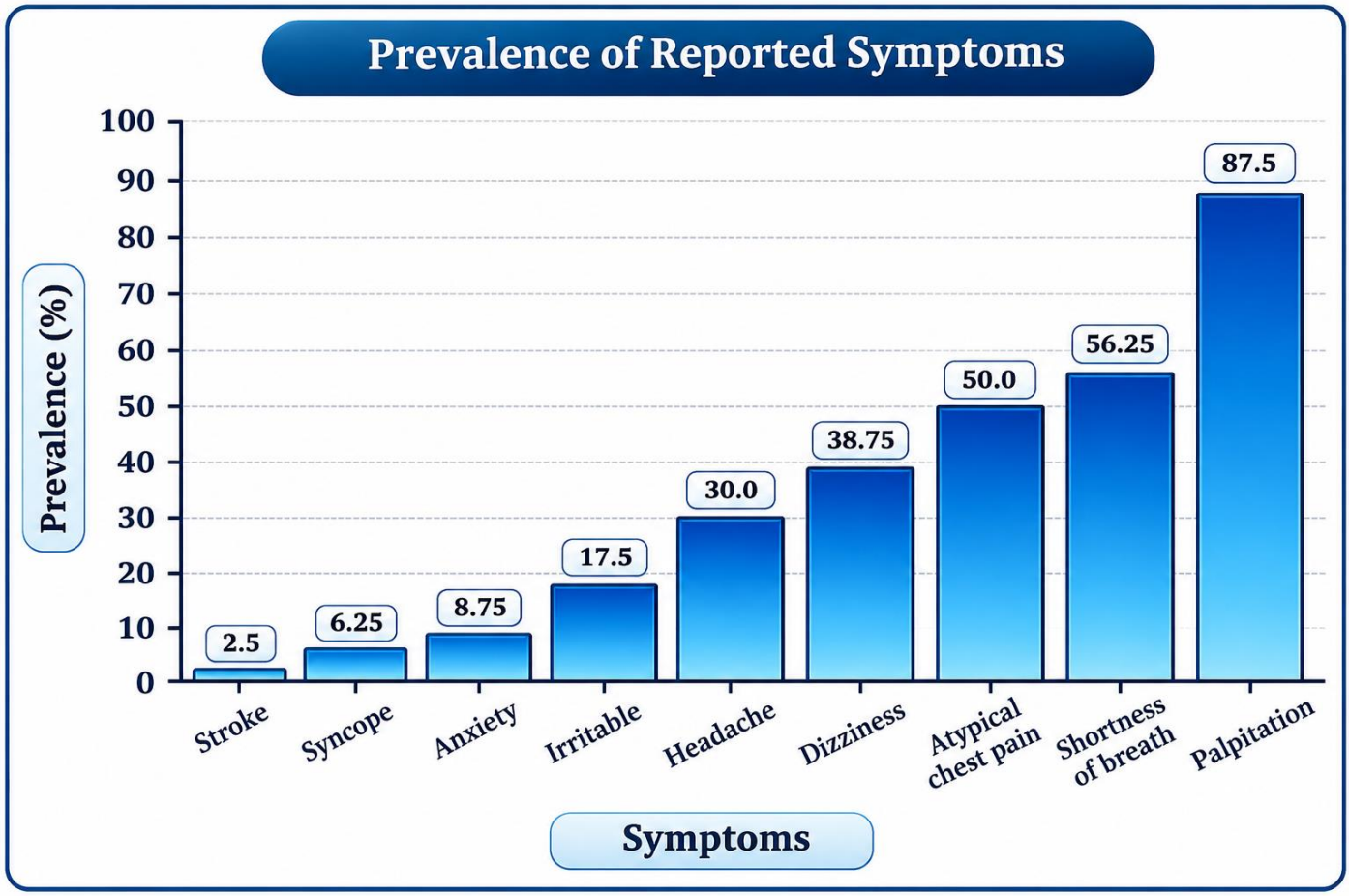


Figure 1. The percentage of clinical presentation of patients with mitral valve prolapse

S.O.B= Shortness of breath, I.b.s = irritable bauel syndrome

DISCUSSION

The present study showed that mitral valve prolapse is more common in females than in males ,this finding is consistent with other studies [1, 4, 9, 10], but differs with another previous studies which reported that mitral valve prolapse is equally distributed in both sexes as shown in Table 1 a, b

This variation in ratio could be due to randomly collected patients with mitral valve prolapse, and not represent the actual ratio between both sexes.

The study showed that most of mitral valve prolapse patients had normal body mass index, followed by overweight; then obesity, while the underweight represented the minority of study sample, thus it differs

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

from other studies which revealed that most patient with mitral valve prolapse are thin asthenic body habitus [4] and mitral valve prolapse is more common in people with low body weight [21, 22], genetic effect on obesity ,low physical activity (especially in female) made the patients with M.V.P. tend to have normal BMI or overweight, as shown in Table 2.

Although the mitral valve prolapse is genetically heterogeneous and is inherited as an autosomal dominant trait that affected by age and sex [19], that exhibits both sexes and age dependant prevalence [1, 9], this study showed that just 11 cases had family history of valvular heart disease (mitral valve prolapse), which was of no significance p> 0.05, as shown in Table 3.

This might be explained by that most of mitral valve prolapse patients are asymptomatic [3, 22] and might run unnoticed in family beside the shortage of availability of electrocardiograph study in the past decades.

The smoking among mitral valve prolapse patients was more in male, while the non smoking were mostly in females .(collectively smoking habit was represent by approximately ¼ of studied group), as shown in Table 3.

This could be due to social and morale effect that make smoking less prevalent in the females.

The greatest ratio of study sample had arterial blood pressure of an optimal normal value or below that and represented by 62 cases p-value > 0.05 and regarded of no significance), thus this results in accord with other studies which revealed that mitral valve prolapse is associated with low resting arterial blood pressure and orthostatic hypotension and possibly related to reduced blood volume, and documented abnormal autonomic function in symptomatic mitral valve prolapse ,on the other hand hypertension was represented by 9 cases (which regards of no significance P >0.05). This might be explained by elevated circulatory level of stress hormones (catecholamine, enhanced beta-adrenergic receptors affinity, increased vasoconstrictors tone especially in group with panic attacks who exhibit hyper-reactive heart rate and blood pressure increased in response to orthostatic stress, people with mitral valve prolapse are intermittently and unpredictably flooded with their own catecholamine leaving them with adrenal instability with hyper-reactivity followed by adrenal exhaustion, as shown in Table 5.

The clinical features in the majority of patients was the palpitation, which was present in 87.5% of the studied group, caused by either sinus tachy-cardia or by arrhythmia in response to elevated catechol- amin and beta adrenergic

receptors affinity in mitral valve leaflets, as shown in Table 6.

This result is consistent with other studies which demonstrated that the palpitation is the most frequent complaint and reach up to 40% of cases of mitral valve prolapse .

Other symptoms in decreasing frequency were:

Shortness of breath, atypical chest pain,dizziness, head ache, irritable bowel syndrome, anxiety, syncopal attacks, stroke and other complaints (generalized fatigability, anorexia, joints pain, bleeding tendency, etc) were represented by the minority.

The electrocardiograph study, revealed that most of studied group (47cases) had sinus rhythm and represented mainly by mitral valve prolapse with-out mitral regurgitation (44 cases) and the remainder represent mitral valve prolapse with regurgitation, this result was very highly significant p <0.001.

Although all form of arrhythmia are common in patients with mitral valve prolapse [5], this study showed that ventricular premature ectopic beats present in 10 cases with following hypothesis that may explain the underlying mechanisms in mitral valve prolapse:

1. Abnormal tension or stretch on the papillary muscle or chordae tendineae.
2. Contraction abnormality due to localized cardiomyopathy.
3. Mechanical irritation of endocardium by thickened chordae tendineae.

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

4. Alteration of autonomic tone.
5. Abnormality of re-polarization.

The ventricular premature ectopic beats more prevalent in mitral valve prolapse without mitral regurgitation (8 cases) versus to with mitral regurgitation (2 cases), and this result is inconsistent with other studies which exhibited that this arrhythmia was also common among people without mitral valve prolapse, but showed wide discrepancy from other studies which state that the patients with mitral valve prolapse who have redundant mitral leaflets and mitral regurgitation may have an increased frequency of premature ventricular dysrythmia, including ventricular tachycardia [1] related to the haemodynamic abnormality and not the prolapse itself.

Atrial fibrillation was more prevalent in mitral valve prolapse with mitral regurgitation (10 cases) than those without mitral regurgitation (4 cases) ,which was of very high significance (P <0.001), that might be explained by the stimulation of atrial pacemaker by prolapsing leaflets or regurgitant jet of blood itself, or origin of impulses from electrically active cells have beta adrenocepters in mitral valve leaflets.

Supra-ventricular tachycardia, found in 9 cases, 8 of them without mitral regurgitation.

Blood glucose in majority of patients (55 cases) was within normal range, or in hypoglycemic range (14 cases) that might be explained by increased catabolic state that make mitral valve prolapse associated with lower prevalence of diabetes [17], while (11 cases) presented with hyperglycemia and significant P value < 0.05 that might be caused by unstable autonomic nervous system, which can trigger hyperglycemia [18], by excessive catecholamine and stress hormones especially during anxiety or hyperdynamic state which acts as insulin antagonists and plays role in elevating blood sugar, as shown in Table 7.

A random blood cholesterol may have no or minor role in the pathogenesis of mitral valve prolapse because the majority of studied sample were below normal or normal range of cholesterol , but hyper-cholesterolemia was present only in 4 cases, as shown in Table 8.

In regarding blood urea, the majority of studied group (64 cases) were in normal range , below normal range was represented in 5 cases, and 11 cases blood urea was above normal range, as shown in Table 9.

While serum creatinine was either normal (63 cases), or below normal. (13 cases), but elevated serum creatinine was present only in (4 cases), as shown in Table 10. Therefore, renal function was well preserved in the study group according to those renal function tests, that may be explained by well compensated intravascular volume and haemodynamic status by rennin-angiotensin system. Thus mitral valve prolapse is strongly associated with good renal function.

CONCLUSION

The present study showed that

1. Female gender is the predominant sex of mitral valve prolapse, most of the patients denied family history of valvular heart disease.
2. Mitral valve prolapse is associated with normal body mass index;and blood pressure.
3. Palpitation is the most frequent clinical presentation of mitral valve prolapse, which is caused consequently by: sinus tachycardia, atrial fibrillation, ventricular ectopic beats and supra-ventricular tachycardia.
4. Mitral valve regurgitation with mitral valve prolapse assotiated with atrial fibrillation more than mitral valve prolapse per se.
5. Mitral valve prolapse associated with low or normal blood sugar; serum cholesterol; serum creatinine and blood urea.
6. There was poor correlation between mitral valve prolapse and smoking or family history of valvular heart disease.

*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

RECOMMENDATION

1. To take a large random sample and study the incidence of mitral valve prolapse.
2. To study the effect of body weight, age, sex pregnancy and blood pressure in the development of mitral regurgitation in patient with mitral valve prolapse.
3. To study the thoracic skeletal abnormalities in patients with M.V.P.

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*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com

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*Corresponding author
Adil M Najm,
Al-Salam Teaching Hospital, Nineveh Health Directorate, Mosul
e-mail: dr.adel.mna@gmail.com