

A STUDY ON THE ECHOCARDIOGRAPHY OF THE MITRAL VALVE IN NORMAL INDIVIDUALS AND PATIENTS WITH FUNCTIONAL MITRAL VALVE PROLAPSE

Ghazwa Hatem AL-Zubaydi (M.Sc)

Abstract:

The patient with mitral valve prolapse suffers from changes which occur in the myocardium , especially the left side , due to the changes which occur in orifice of mitral valve during the period of systole of left ventricle. The research worker classifies the causes of mitral valve prolapse to pathological heart causes , or congenital and others of unknown origin. **Objective:** the use of echocardiography instrument this study undertaken to evaluate the unnatural changes which occur on the left side of the heart , as a result of functional mitral valve prolapse , there are two tests including: the functional mitral prolapse and the structural mitral prolapse. **Setting:** Marjan teaching hospital , echocardiography unit: The study included (78) individuals divided into two groups; the first is the standard group which included normal of (40) persons, the second is the group of functional mitral valve prolapse which included (38) patients. The study is done by the use of Ultrasound wave (Echocardiography instrument) type "Combison 530 D model Voluson 530D". All the subjects were subjected to M-mode and Two- Dimensional and Doppler echocardiography techniques which were used to evaluate the left atrial parameters that include: internal transverse diameter and internal longitudinal diameter in diastole and systole and that to find atrium volume in both situations. As well as echocardiography techniques , which were used to evaluate the left ventricular structure parameter: (Left ventricular internal diameter in diastole and systole (LVIDs, LVIDd), Inter ventricular septum thickness in diastole and systole (IVTs, IVSTd), Posterior wall thickness of LV (cm) in diastole and systole (PWTs and PWTd). Evaluation of left ventricular structure by using specific formula of (Left ventricular mass (g) in diastole and systole (LVM), Left ventricular mass index (g/m^2) (LVMI) and Relative wall thickness of LV in diastole and systole (RWT)). **The results:** The study showed hypertrophy of the left atrium in functional prolapse and the results illustrated that there are differences among left atrium measurement for control and patients group (P value < 0.01). As well as our observations indicated an increment correlation between body surface area and (LVM) among patients group (P < 0.01), so as the relation between body mass index and stroke volume were significant . There is no much change in the function of the heart as a result of age and body mass index (Kg / m^2). There is no much change in the heart including ages of those included in the study. Data are presented as means \pm SD; two means were compared by paired student T test, and P value less than 0.05 was considered to be significant, P value less than 0.01 was considered to be high significant. **Conclusions:** Most of the measurements which were recorded left the atrial hypertrophy (recorded size) during contraction and the relaxation condition and this is what proved with what the previous researches pointed at the mitral valve prolapse. No significant effect of (BMI) that depends on body length and weight was noticed on the results of measurement, or on the nature of diseases.

الخلاصة:

المريض بتدلي الصمام التاجي يعاني من تغيرات تطرأ على عضلة القلب وخصوصاً الجانب الأيسر منه نتيجة التغيرات التي تطرأ على فوهة الصمام التاجي خلال فترة الانقباض للبطين الأيسر . لقد صنف الباحثين أسباب تدلي الصمام التاجي إلى أسباب مرضية قلبية وأسباب ولاديه، وأخرى مجهولة المنشأ . **الاهداف:** باستخدام جهاز الصدى القلبي تم تكريس هذه الدراسة لتقييم التغيرات غير الطبيعية التي تطرأ على الجانب الأيسر من القلب نتيجة تدلي الصمام التاجي الوظيفي، حيث يوجد معيارين للتدلي التاجي هما التدلي التاجي الوظيفي والتدلي التاجي البنيوي . **المكان:** مستشفى مرجان التعليمي / شعبة الفحص بالموجات فوق الصوتية (الايكو) : تضمنت الدراسة (78) شخصاً قسماً إلى مجموعتين المجموعة الأولى هي المجموعة القياسية التي تشمل

الأصحاء (40) شخصا" والمجموعة الثانية هي مجموعة مرضى تدلي الصمام التاجي الوظيفي (38) مريض. أنجزت الدراسة باستخدام جهاز فحص القلب بالأموح فوق الصوتية , نموذج (530 D) وباستخدام طراز - الحركة , وطراز البعدين ودوبلر , وذلك لقياس متغيرات تابعة للأذين الأيسر شملت : قطر الأذين العرضي وقطر الأذين الطولي في حالتي الانقباض والانبساط وذلك لإيجاد حجم الأذين في كلتا الحالتين . كذلك باستخدام جهاز فحص القلب بالأموح فوق الصوتية تم قياس قطر البطين الأيسر , وسمك الحاجز البطيني والجدار الخلفي للبطين الأيسر في حالتي الانقباض والانبساط . أما تحديد هيكلية البطين الأيسر فقد تم تحديدها باستخدام معادلات (كتلة البطين الأيسر , كتلة البطين الأيسر المعتمدة على الوزن والطول وسمك جدار البطين الأيسر النسبي) . **النتائج:** أظهرت النتائج تضخم الأذين الأيسر في التدلي التاجي الوظيفي. وان هناك فروق معنوية عالية بين قياسات الأذين الأيسر لمجاميع المرضى والأصحاء (الاحتمالية أقل من 0.01) . كما اظهرت الدراسة وجود علاقة خطية بين كتلة البطين الأيسر ومساحة الجسم السطحية (الاحتمالية أقل من 0.01) , كما ان العلاقة بين حجم الضربة وعامل كتلة الجسم (كغم /م²) (العامل الكتلي) كانت ذات أهمية إحصائية . لا يوجد تغير كبير في وظيفة القلب بسبب العمر والعامل الكتلي للجسم (المعتمد على طول ووزن الجسم) , كما لم يلاحظ تغير كبير في القلب ضمن مدى أعمار المشمولين بالدراسة . تم التعبير عن النتائج بـ (متوسط القيم \pm أنحراف معياري) كما قورن متوسط القيم عن طريق فحص (Student's T – test) . وتعد النتائج ذات أهمية إحصائية إذا كانت الاحتمالية أقل من 0.05 وعالية الأهمية الاحصائية إذا كانت أقل من 0.01. **الاستنتاجات:** اغلب النتائج سجلت تضخم الأذين الأيسر خلال فترتي الانقباض والانبساط وهذا الذي اثبت ما توصلت اليه البحوث السابقة في تدلي الصمام التاجي. ليس هناك تأثير هام للعامل الكتلي المعتمد على طول و وزن الجسم على نتائج القياسات او على طبيعة المرض.

Introduction:

Heart Valves:

The heart has four chambers. The upper two are the right and left atria. The lower two are the right and left ventricles. Blood is pumped through the chambers, aided by four heart valves. The valves open and close to let the blood flow in only one direction. **there are four heart valves:**

- The **tricuspid** valve is between the right atrium and right ventricle.
- The **pulmonary** or **pulmonic** valve is between the right ventricle and the pulmonary artery.
- The **mitral** valve is between the left atrium and left ventricle.
- The **aortic** valve is between the left ventricle and the aorta.

Each valve has a set of flaps (also called leaflets or cusps). When working properly, the heart valves open and close fully[1].

Mitral Valve:

The mitral valve controls the flow of blood between the two chambers on the left side of the heart. The two chambers are the left atrium and the left ventricle . The mitral valve allows blood to flow from the left atrium to the left ventricle, but not back the other way. (The heart also has a right atrium and ventricle, separated by the tricuspid valve).

At the beginning of a heartbeat, the atria contract and push blood through to the ventricles. The flaps of the mitral and tricuspid valves swing open to let the blood through. Then, the ventricles contract to pump the blood out of the heart. When the ventricles contract, the flaps of the mitral and tricuspid valves swing shut and form a tight seal that prevents blood from flowing back into the atria[2],[3].

Normal physiology:

During left ventricular diastole, after the pressure drops in the left ventricle due to relaxation of the ventricular myocardium, the mitral valve opens, and blood travels from the left atrium to the left ventricle. About 70-80% of the blood that travels across the mitral valve occurs during the early filling phase of the left ventricle. This early filling phase is due to active relaxation of the ventricular myocardium, causing a pressure gradient that allows a rapid flow of blood from the left atrium, across the mitral valve. This early filling across the mitral valve is seen on doppler echocardiography of the mitral valve as the E wave. After the E wave, there is a period of slow filling of the ventricle. Left atrial contraction (left atrial systole) (during left ventricular diastole) causes added blood to flow across the mitral valve immediately before left ventricular systole. This late flow across the open mitral valve is seen on doppler echocardiography of the mitral valve as the

A *wave*. The late filling of the LV contributes about 20% to the volume in the left ventricle prior to ventricular systole, and is known as the atrial kick[2],[4].

Mitral Valve Prolapse (MVP):

Mitral valve prolapse involves spectrum of structural and functional mitral valve dysfunction. In MVP, when the left ventricle contracts, one or both flaps of the mitral valve flop or bulge back (prolapse) into the left atrium. This can prevent the valve from forming a tight seal, which allows blood to flow backward from the ventricle into the atrium. The backward flow of blood is called regurgitation, and it can lead to symptoms and complications. Regurgitation doesn't occur in all cases of MVP. In fact, the majority of people with MVP don't have regurgitation and never have any symptoms or complications. In these people, even though the valve flaps prolapse, the valve is still able to form a tight seal. When regurgitation does occur, it can cause complications and troublesome symptoms such as shortness of breath, chest pain. Arrhythmias are problems with the rate or rhythm of the heartbeat. regurgitation can get worse over time and lead to changes in the heart's size and higher pressures in the left atrium and lungs. Regurgitation increases the risk for heart valve infections[5]. MVP was once thought to affect as much as 5 to 15 percent of the population. It's now believed that many people who were diagnosed with MVP in the past didn't actually have an abnormal mitral valve. They may have had a slight bulging of the valve flaps due to other conditions such as dehydration or a small heart. However, their valve was normal and there was little or no regurgitation through the valve.

now, more precise rules for diagnosing MVP with a test called an echocardiography make it easier to identify true MVP and to detect troublesome regurgitation.

The reasons of mitral valve prolapse can be cited to include the following[6],[7]:

- 1- Congenital prolapse.
- 2- Myxomatous.
- 3- Rheumatic disease.
- 4- Fractures.
- 5- Tearing of papillary muscles.
- 6- Elongation of chordae tendineae or papillary muscles.
- 7- Displacement of papillary muscles secondary to left ventricle expansion.
- 8- Cardiomyopathy.

Functional Prolapse:

The functional changes affect part of the leaflet, or both leaflets, and it noted that the displacement systole upper posterior from the level of mitral ring towards the left atrium during echocardiography. The affection of the posterior leaflet is the most popular. The functional prolapse is fixed prolapse and it is usually found a standard for prolapse diagnosis. It is observed that the leaflets of the valve remains unaffected but probably displaced upwards, and the billowing appears during protruding of the part of valve posteriorly to the left atrium about 10 mm [5],[7].

Structural Prolapse:

The structural prolapse in the mitral valve prolapse includes the thickening of the leaflets of the valve; it means the increase of the fatty tissue, expansion of mitral ring, elongation of chordae tendineae associated with tricuspid valve prolapse and also the increase in its ring and aortal valve prolapse [6].

Aim Of This Project:

- 1- Effects of mitral valve prolapse type functional on the heart through a non- invasive study, which echocardiography.
- 2- To elucidate the left ventricular geometric adaptation to mitral valve prolapse type functional .

Patients and Method:

This study included two groups : the first is “Standard group ” which consists of (45 person), the second group consists of the patients with structural mitral valve prolapse, which are (40 pateints).The diagnosis of functional and structural mitral valve prolapse made by echocardiography with the use of “M-mode, 2 D, Doppler”. The study was depending on the in-patient “i.e those who are admitted to the hospital in most of the cases . The study was completed in the echocardiography unit in Marjan hospital in the Babylone governorate “A specialized hospital for cardiac and gastrointestinal diseases”.The study was depending on the Ultrasonic character of echocardiography,using variable related to the left side of the heart “ EDV, ESV, SV ”, also measurements of artial dimensions in systole and diastole, and ventricular dimensions to measure LV mass index, RWT, LVEF, LVSF and LV.E.D. stress and the measuring body weight and height for BSA and BMI . Each variable has been detected using “Doppler, M-mode,2 D.

Characteristics of the Ultrasonic System Used :

The echocardiography which was used in this project consisted of the following components [8]:

A- The Instrument:

It's of the type combison 530 D model voluson 530 D, it has two properties :

I- It has the capability of magnifying the images.

II- It has the capability of storing several forms with serial pictures and displays them in slow motion .

B- The Monitor:

The monitor was Avitron KDS type (U.S.A), model AV-5T multiscanning at horizontal frequencies of 30 KHz to 70 KHz, and vertical frequencies of 50 Hz to 120 Hz, 15 inch (14 view area), of Sony Trinitron picture tube with automatic display setup button and digital controls .

C- The Video Copy Processor:

Mitsubishi video copy processor model P 91w, P 91E with thermal paper K65 HM (high-density) synthetic paper for high quality printing.

D-The Probe:

Probe used in this study was electronic probe type S-PPA2 -4, it has sector transducer, which gives curved waves. This probe offers diagnostic possibilities of B- mode, M-mode, and 2D- mode in both pulse wave (PW) and continuous wave (CW) of the heart.This type of scanner utilizes frequencies 2-5 MHZ.

The Ultrasonic system offers the following diagnostic possibilities :

1- A-mode.

2- B-mode.

3-Doppler.

Echocardiographic Windows Which Used in our Study :

The heart has five windows these are :

A- Parasternal long – Axis View :

This window helps to record as many of the cardiac structures as possible.It shows the heart from its to the apex.

B- Apical View (5 – ch view , 4 – ch view) :

In apical view the transducer was placed at or in the vicinity of the apex, the sector beam was directed superiorly medially and roughly in the direction of the right shoulder.Thus, it transactions the heart from apex to base.The apical views were used to assess LV septum in systole and diastole.

Left ventricle :		
Internal diameter	LVIDs	2.0 – 4.0 (cm)
	LVIDd	3.5 – 5.6 (cm)
Wall thickness	IVSTd	0.6 – 1.2 (cm)
	IVSTs	0.9 – 1.8 (cm)
	PWTd	0.6 – 1.2 (cm)
	PWTs	0.9 – 1.8 (cm)
	RWTd	0.4 – 0.5 (cm)
	RWTs	0.7 – 0.8 (cm)
Fractional shortening	Fs	30 – 45 %
Ejection fraction	Ef	50 – 85 %
Left ventricle mass	LVM	138.7 -168.2 (g)
End systolic volume	ESV	63.9-78.2 (cm³)
End diastolic volume	EDV	264 – 340 (cm³)
Left atrium:		
Diameter	D	2.0 – 4.0(cm)
Left atrium diameter	LADs	15.9(mm)
	LADd	24.55(mm)
Left atrium longitudinal diameter	LALs	25.55(mm)
	LALd	35.75(mm)

The Normal Echocardiography:

It is important to know the standard values while studying left side of the heart, studies found out that measured values by echocardiography for healthy are[9],[10] :

Measurements of Parameters of Left Side to Heart by Echocardiography:

1- Left Atrium Volume :

The left atrium dimensions should be measured at the end of systole and diastole from posterior wall of the aorta to the leading edge of the atrial wall by use a two-dimensional echocardiography to measure the left atrial volume. These have been used for the long axis apical two-chamber examination. The area, length and minor dimensions are first measured, and, then, the volume is calculated [11]. We can say that the left atrium is a cylindrical shape, and we can get its volume from the following equation :

$$V = \pi r^2 h$$

Where :

r : (LA) transverse radius.

h : longitudinal diameter.

$$V_{LAD} = \pi \times \frac{1}{4} (LAD)^2 \times LALd$$

LAD : left atrium transverse radius.

$LALd$: left atrium longitudinal diameter.

2- Left Ventricular Ejection Fraction (Ef) [12]:

$$Ef = \frac{SV}{EDV} = \frac{EDV - ESV}{EDV}$$

Where:

EDV : end-Distole volume.

ESV : end-systolic volume.

From the end–diastolic and end systolic volumes , the stroke volum can be calculate with the formula : $SV = EDV - ESV$ (cm³), the ejection fraction can be calculated from the stroke volume divided by (*EDV*).

3- Left Ventricular Fractional Shorting [12] :

$$Fs = \frac{LVEDd - LVESd}{LVEDd} \times 100$$

Where :

LVEDd : represents the left ventricular end diastolic diameter.

LVESd : represents the left ventricular end systolic diamete .

The (*Ef*) and (*Fs*) study is don by using M-mode.

4- Patient's Body Mass Index (Kgm/m²) [13]:

$$BMI = wt / (Ht)^2$$

Where :

wt : represents the weight of the subject.

Ht : represents the height of the subject.

5- Left Ventricular Mass (LVM):

Left ventricular mass is determined by measuring the left ventricular internal diameter during the period of diastole through long–axis view of LV septal thickness of LV in period of diastole through apical view and diastolic period by M-mode echocardiography[14].

$$LVM(gram) = 0.8 \{ 1.04 [(LVSTd + LVEDd + PWTd)^3 - (LVEDd)^3] \} + 0.6$$

Where :

LVSTd : represents the left ventricular septal wall thickness in diastole.

LVEDd : represents the left ventricular end – diastole diameter.

PWTd : represents the left ventricular posterior wall thickness in diastole.

6- Patient's Body Surface Area :

Body surface area (m²) can be determined by formula [15] :

$$BSA(m^2) = ((W^{0.425}(Kgm) \times H^{0.725}(Cm)) \times 0.007184)$$

Where :

Wt : represents the weight of the subject.

Ht : represents the height of the subject.

7- Left ventricular – mass Index (gm/m²)[16] :

$$LVMI(gm/m^2) = \frac{LVM(gm)}{BSA(m^2)}$$

Where :

LVM (gm) : left ventricular mass (gram).

BSA (m²) : body surface area (m²).

8- Relative Wall Thickness :

Relative wall thickness ratio is determined by measuring posterior wall thickness in systole and diastolic period through M–mode echocardiography, the posterior wall thickness is measured by determining distance between the inside of endocardial echo (anterior part of endocardial echo) and

the inside of the “ Hard ” epicardial–pericardial echo at specific times in the cycle. Then, we measure the left ventricular internal diameter in systole and diastolic period through long-axis view of LV [17].

$$RWT = \frac{2 \times PWT}{LVID}$$

Where :

PWT : represents the posterior wall thickness.

LVID : represents the left ventricular internal diameter.

10 – Left Ventricular End–Systolic Stress (mmHg) :

Left ventricular stress is determined by measuring the systolic blood pressure, using sphygmomanometer and measured posterior wall thickness of LV also internal diameter of LV in systolic period [18].

$$LV.E.Dstress = \frac{0.334P \times LVEDs}{PWTs[1 + PWTs / LVEDs]}$$

Where:

P.Bs : systolic blood pressure (arm cuff).

LVEDs : Left ventricular end–systolic diameter.

PWTs : The left ventricular posterior wall thickness in systole.

Statistical Analysis :

After calculating the results, these are tabulated and measurement for the function of the left side (left atrium and left ventricle). We need to establish the difference between these measurements and between the normal persons and the patients with functional mitral valve prolapse the difference between the mean values of the normal persons and [(MVP (Fu)] .Then the rate difference from control 1% is calculated together with the T–test (the comparison between the mean values for two groups tested by un paired students T-test). Exel program was used to do that.

as well as their T–test (the comparison between the mean values for each one group tested by paired students T- test).

Finally, P value less than 0.05 (P<0.05) was considered to be significant (*), it is highly significant when (P<0.01).

Results:

A total of (78) subject were involved in the present study,(40) were healthy individuals, while the rest (38) were functional mitral valve prolapse patients. Calculations were made from a row data in order to establish the variability of constituent units for the function of left side of the heart (left atrium and left ventricle) of normal persons and the other relative groups parameters.

1.Control Group (group I) :

This group included (40) subjects, mean age (31.6±11.3) years of both sexes, their body mass index (BMI) was (24.217±2.134) Kg/m². They had normal left side of the heart structure. The normal echocardiographic findings and the statistical analysis showed that there was normal regarding to echocardiographic measurements of left side. Therefore, the mean values and standard deviation of LV parameters were considered for the combination of both sexes are clarified in (Table1,2,3).

2.Group Mitral Valve Prolapse of Functional (group II) :

This group included (38) patients, the mean of MVP (Fu) age was (35.7± 15.4) years, their body mass index (BMI) was (24.173±3.556) Kg/m² and the systolic blood pressures B.P of patients were (140.6±29.8) mmHg. The mean values of systolic B.P to (MVP(Fu) & control) group was highly significant. Left side structures included the parameter [LADd, LADs, LALd, LALs& LVIDd, LVIDs, IVSTd, IVSTs, PWTd, PWTs]. According to the statistical analysis, high significant difference of (LADd, LADs & LALd, LALs) for this group and control group and the mean value of (LVIDd and LVIDs) were significantly higher in this group as compared with control group which were (52.4±5.8) and (32.1±5.9)cm, respectively to this group, but to control group which were (83.3±43.4) and (39.0±3.1) cm. While IVSTs and PWTs, PWTd were significantly higher in this group as compared with control group, but (IVSTd) were not significantly different in this group, as compared with control group (P<0.01). The mean value of LVMI in MVP (Fu) subjects was smaller in this group than control group (122.422±30.391) and (208.82±28.596) Kg/m², respectively (P<0.01), there was high significant of different in this group and when compared with control group for RWTd and RWTs (P< 0.01). The mean value of LV.ED. stress was high significant different in this group and when compared with control group (Table 1,2,3).

Table (1): The characteristics of patients group and control group.

Parameters	Control	MVP(fu)	P Value
	Mean ± SD	Mean ± SD	
	(Range)	(Range)	
AEG	31.6 ± 11.3	35.7 ± 15.4	0.403
	12.0 – 51.0	11.0 – 61.0	
B.P	164.4 ± 9.0	140.6 ± 29.8	0.0001*
	155.0 – 180.0	98.0 – 190.0	
SV	192.13 ± 49.15	70.62 ± 49.59	0.0001*
	123.00 – 292.05	26.40 – 195.90	
EDV	271.25 ± 56.20	140.16 ± 73.86	0.0001*
	198.00 – 383.00	80.30 – 326.50	
ESV	79.30 ± 9.76	51.99 ± 32.32	0.0001*
	51.50 – 90.95	20.10 – 117.80	
Ef	70.122 ± 4.143	63.194 ± 12.567	0.02*
	60.476 – 76.381	28.056 – 83.910	
FS	44.636 ± 17.177	39.058 ± 6.332	0.004*
	10.968 – 77.223	28.333 – 60.000	
HT	167.9 ± 4.3	164.2 ± 5.3	0.001*
	160.0 – 177.0	152.0 – 175.0	
WT	68.4 ± 7.8	65.3 ± 10.6	0.226
	51.0 – 80.0	49.0 – 85.0	
BMI	24.217 ± 2.134	24.173 ± 3.556	0.069
	19.433 – 29.385	17.959 – 32.388	
BSA	1.774 ± 0.114	1.709 ± 0.138	0.122
	1.514 – 1.972	1.434 – 1.966	

Fu: functional

IVSTd & IVSTs(cm) : Inter ventricular septum thickness in diastole and systole

LVIDd & LVIDs(cm) : Left ventricular internal diameter in diastol and systole.

PWTd & PWTs :Posterior wall thickness of LV (cm) in diastole and systole

LVMd & LVMs : Left ventricular mass (g) in diastole and systole

RWTd & RWTs : Relative wall thickness of LV in diastole and systole

LVMI : Left ventricular mass index (g/m²)

LV.E.D stress : LV.end.diastole wall stress (mmHg)

Table (2): Echocardiographic measurements of LV structure in control subjects and patients with MVP(fu) .

Parameters	Control	MVP(fu)	P Value
	Mean ± SD	Mean ± SD	
	(Range)	(Range)	
IVSTd	10.3 ± 1.1	10.3 ± 1.6	0.669
	7.7 – 11.7	7.0 – 15.0	
IVSTs	12.0 ± 1.0	14.3 ± 3.3	0.0001*
	9.3 – 12.7	7.0 – 24.0	
LVIDd	83.3 ± 43.9	52.4 ± 5.8	0.0001*
	46.5 – 166.7	40.0 – 62.0	
LVIDs	39.0 ± 3.1	32.1 ± 5.9	0.0001*
	32.3 – 41.9	20.0 – 43.0	
PWTd	8.5 ± 0.6	10.4 ± 2.0	0.0001*
	7.3 – 9.8	6.0 – 13.0	
PWTs	12.4 ± 0.9	14.3 ± 2.2	0.0001*
	10.3 – 13.8	9.0 – 17.0	
LVMd	507.328 ± 524.758	207.469 ± 44.486	0.0001*
	135.189 – 162.041	119.825 – 314.018	
LVMs	165.232 ± 33.186	163.193 ± 54.577	0.165
	92.168 – 204.920	81.111 – 360.434	
RWTd	0.243 ± 0.078	0.405 ± 0.095	0.0001*
	0.100 – 0.378	0.222 – 0.650	
RWTs	0.636 ± 0.037	0.921 ± 0.221	0.0001*
	0.560 – 0.713	0.486 – 1.524	
LVMI	280.818 ± 283.596	122.422 ± 30.391	0.0001*
	74.571 – 886.992	71.401 – 218.987	
LV.E.D stress	303.02 ± 40.09	155.43 ± 92.41	0.0001*
	234.93 – 377.05	37.18 – 467.94	

IVSTd & IVSTs(cm) : Inter ventricular septum thickness in diastole and systole
 LVIDd & LVIDs(cm) : Left ventricular internal diameter in diastol and systole.
 PWTd & PWTs :Posterior wall thickness of LV (cm) in diastole and systole
 LVMd & LVMs : Left ventricular mass (g) in diastole and systole
 RWTd & RWTs : Relative wall thickness of LV in diastole and systole
 LVMI : Left ventricular mass index (g/m²)
 LV.E.D stress : LV.end.diastole wall stress (mmHg)

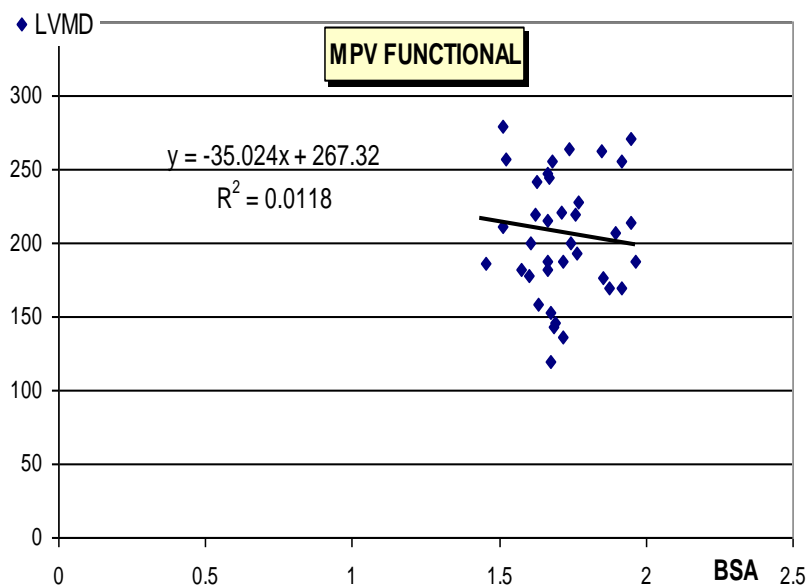
Table (3): Echocardiographic measurements of left atrial in control subjects and patients with MVP(fu).

Parameters	Control	MVP(fu)	P Value
	Mean ± SD	Mean ± SD	
	(Range)	(Range)	
LADd	21.88 ± 2.24	36.31 ± 3.70	0.0001*
	18.70 – 26.35	29.20 – 42.00	
LADs	17.08 ± 1.04	26.42 ± 4.96	0.0001*
	14.50 – 18.90	19.70 – 34.90	
LALd	32.70 ± 1.99	51.69 ± 3.74	0.0001*
	30.11 – 37.30	40.20 – 57.900	
LALs	22.06 ± 2.80	42.12 ± 4.81	0.0001*
	12.19 – 27.80	30.40 – 52.80	
LA.C.V.d	25.06 ± 6.59	108.29 ± 23.66	0.0001*
	16.57 – 40.70	68.20 – 156.30	
LA.C.V.s	10.26 ± 2.41	48.07 ± 19.59	0.0001*
	5.47 – 15.10	23.72 – 88.88	

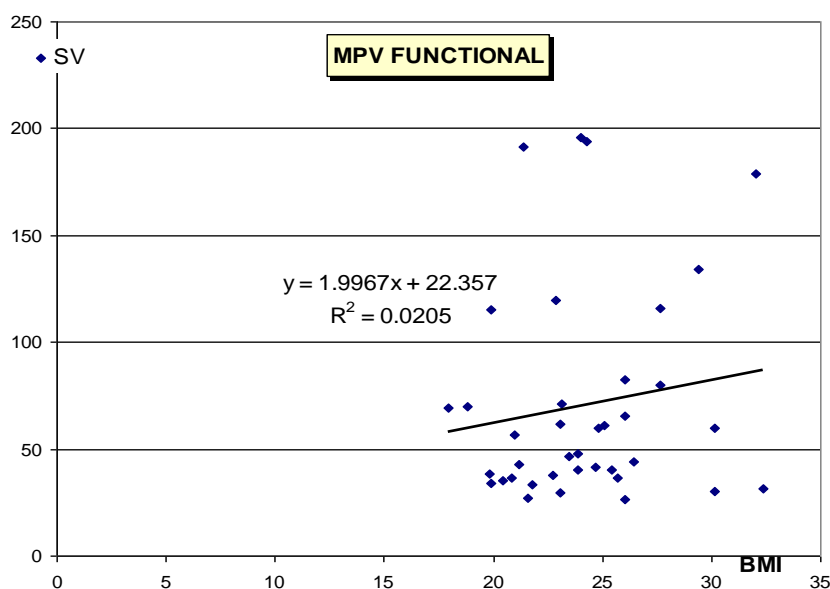
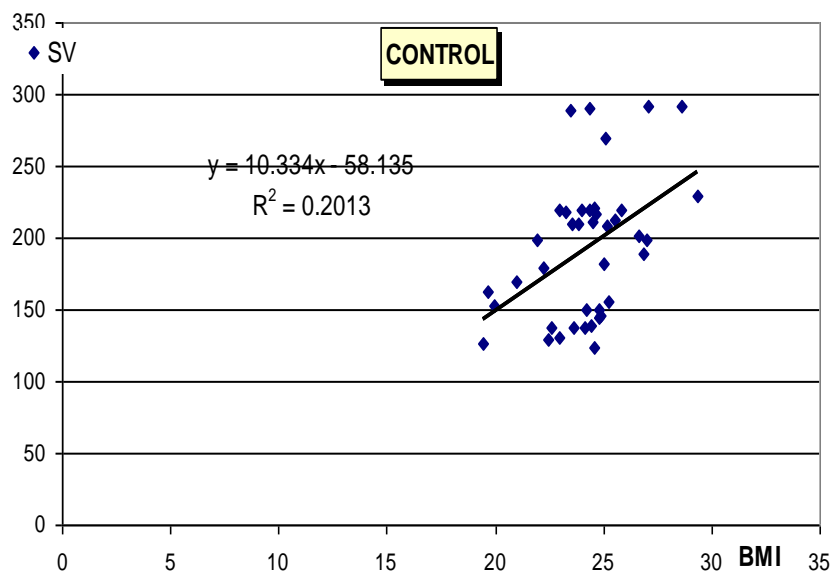
LADd & LADs : Left atrial diameter in diastole and systole (mm).

LADd & LALs :Left atrial longitudinal diameter in diastole and systole (mm).

LA.C.V.d & LA.C.V.s : Left atrial calculated volume (cm³) in diastole and systole.



Figures(1): Left ventricle mass during diastole versus body surface area in control group and MVP(fu) group.



Figures(2):Relation between body mass index and strok volume in control group and MVP(fu) group.

The Relation of Body Surface Area (BSA) with left Ventricle Mass(LVM) :

A statistical and increment correlation was found between LVM and Body surface area (BSA) in control group .The MVP(Fu) patients showed a significant and increment .

The Relation of Body Mass Index (BMI) with Strok Volume (SV) :

A statistical and increment of correlation in Structural mitral valve prolapse MVB(Fu) and control groups. Ship between (BMI) and (SV) was significant statistically ($P < 0.01$).

Discussion:

Effect of the Disease on the studied parameters:

In our study , we noticed the doppler echocardiography is useful in evaluating the size and intensity of the mitral prolapse flow or jet. The severity of mitral prolapse is determined by the

prolapse volume. Mitral prolapse results in increased diastolic filling of the left ventricle and increased left atrial pressure. Patients with chronic prolapse consequently have a hard time effectively increasing their cardiac output, and the increases in left atrial pressure and volume can lead to left atrial enlargement and atrial fibrillation. Also the measured and calculated parameters concerning the left side of the heart have shown that the left atrial dimension was much higher during diastole and systole, and, also, measurements of echocardiograph for thicknes of ventricular septum and left posterior ventricular wall at the conditions of diastolic and systolic and ventricular skeletal left by use of the left ventricular mass that depends on the weight, length, and thickness of left ventricular wall, and left ventricular end systolic stress (mmHg). There was small difference between the end diastolic volume and end systolic volume in comparison with control groups. Also, it was noticed an increase in the volume of the left atrium at the two conditions of diastolic and systolic, the explanation for this increase had been offered by Jacob, H. [19], while for the measurement of left ventricular it was highly significant in comparison with control groups, and the reason may be that during systole and because of mitral prolapse a lot of blood will pass from left atrium to left ventricular and it includes the blood, which comes from the pulmonary blood circle pulse; the blood which return percentage, widening (percentage volume for each of left atrium and left ventricular will happen). These results have been previously described by Yasin, M. [20]. The body mass index importance never records any differences (no significant) from control group, while LV.ED stress (mmHg) was significant in comparison with the control group, From the above mentioned discussion, if we wanted to define heart cardial fail in relation to the definition of the scientist doctor (Dr.Sirtomas.L): He defined it as the ability of the heart to eject its contents effectively, so here the heart considered insufficient from the physiological aspect and naturally from the clinical aspect, however , most of the patients were from the first part according to what had mentioned in the recommendations of the cardiac society in NewYork, and they were (patients who underwent body activity without symptoms, despite their suffering from heart diseases). It was noticed that from ECG measurements (reading) prolonged U wave, and this may be due to torn of chorda tendena is some of conditions which lead to circulized the left ventricular, also it was noticed Q wave deformed and elevation of (S-T) and inversion of T wave, and the decline of QRS complex. These results have been previously described by Julian, D.G [3].

Effect of Age:

Our study has demonstrated that the measuring and calculated parameters concerning the left side of the heart have no significant relation to the age of control group and left atrial parameters.

Effect of Body Mass Index:

Our study has demonstrated that the measuring and calculated parameters of left side of the heart have no significant relation between body mass index (BMI) of control group and lift ventricle . besides it has been found there is significant relation between body mass index (BMI) and MVP(fu) parameters because mitral valve parameters were greatly dependent on the pressure gradient from atrial contraction.In addition , it has been found that there is no significant relation between body mass index (BMI) and left atrial measured and calculated parameters.

Conclusion:

1. Most of the measurements which were recorded left the atrial hypertrophy (recorded size) during contraction and the relaxation condition and this is what proved with what the previous researches pointed at the mitral valve prolapse.
2. No significant effect of (BMI) that depends on body length and weight was noticed on the results of measurement, or on the nature of diseases.
3. This study has used the Echocardiographic measurements of LV structure as marker for comparing the clinical with the physical judgments to estimate the progress of heart change in mitral valve prolapse patients .

4. If we remove cardiac insufficiency that emerged from the decrease venous return and the affected heart with functional MVP, or structural MVP will consider (insufficiency) for its inability to eject its contents effectively.
5. Mitral V.P. patients are the patients who are in two categories: The first who suffers from heart symptoms, during severe and moderate exertion, and the second category includes those who are not suffering from any clinical symptoms.
6. Two-dimensional and Doppler echocardiography is the most useful noninvasive test for diagnosing MVP. The M-mode echocardiographic definition of MVP includes posterior displacement of one or both leaflets 2 mm or more during late systole or holosystolic posterior displacement greater than 3 mm.

Recommendations :

- 1- Studying the structural mitral valve prolapse disease and comparing results with functional mitral valve prolapse MVP(fu).
- 2- Making studies to know how hormonal disturbance effect on cardiac muscle tissue and its valves.
- 3- Although most patients with MVP benefit from regular exercise, it is generally agreed that those who have moderate LV enlargement, LV dysfunction, uncontrolled tachyarrhythmias, a prolonged QT interval, unexplained syncope or aortic root enlargement should be restricted from sports.

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