Left Ventricular Function in Early Stages of Ischemia

Nadiya Younis Mohammed

ABSTRACT:

BACKGROUND:

Ischemic heart diseases are common diseases that influence the heart performance via the changes occurring in cardiac muscles resulting from the disease. These changes can affect the left ventricular wall, septum thickness and an eventual effect on the cardiac performance.

AIM OF THE STUDY:

The merit of this work is to investigate the effects of left ventricular function on patients who suffer from early ischemic heart.

METHODS:

Twenty five patients complaining from chest pain and diagnosed as angina were subjected to our investigation, they were free from other cardiac diseases and have no previous heart attack their average age was (52.85±12.69 years old). Eighteen normal individuals (control) with average age (48.33±12.55 years old) are chosen and are free from any disease. M-mode, 2- dimensional parasternal long axis view was used in the measurements of LV interdiameter, septum and posterior wall thicknesses. Doppler echocardiography tracing of four chamber apical view was obtained to indicate the ejection time and mitral flow velocities at early diastole E and at atrial contraction (end of diastole) A.

RESULTS:

The effect of early IHD was found on the interventricular septum (decreased by 44.18%), posterior left ventricular wall (decreased by 47.62%), fractional shortening (decreased by 28.93%), and ejection fraction (decreased by 20.05%). There was no significant change observed on the A/E ratio but a significant change was seen on E wave only.

CONCLUSION:

In early of IHD, ejection fraction and percentage changes of wall thickness indicate cardiac performance. In addition reduced early mitral flow velocity is more frequent than the change in early to late mitral flow velocity ratio.

KEY WORDS: ischemia, left ventricular performance.

INTRODUCTION:

Ischemic heart disease (IHD) is a narrowing of the blood vessels that result in ischemia that is lack of blood supply to the heart muscle. Ischemic heart patients with this diagnosis may at one time have had an acute heart attack (MI), stable or unstable angina[1]. In old patients ischemia may develop gradually due to aging because as expected more cholesterol precipitates with time [2, 3]. The lack of blood supply can induce many changes in the cardiac muscle, these changes including an abnormal cardiac wall motion , reduction in the wall thickness causing low contractility and a consequent low ejection fraction[4] ,in addition to the increase in either left ventricular isovolumetric relaxation and/or contraction times [5,6]. Doppler measurement of transmitral flow shows an increase in the late velocity A caused by an atrial contraction with a decrease in the early mitral flow velocity E [7,8].Patients with ischemic heart disease can develop left ventricular systolic dysfunction, segmental abnormal contractility and heart failure [9, 10].

The aim of our study was to find the effects of early ischemic heart disease on left ventricular function.

MATERIALS AND METHOD:

Two groups involved in this study: 25 patients with ischemic heart disease (angina) (16 males and 9 female mean age 52.85□12.69 years old) and 18 normal individuals (12males and 6 female with mean age 48.33□12.55 years old). All patients had their symptoms present for less than month. The study excluded patients with MI, valvular disease and hypertensive patients. Patients were diagnosed by clinical features and ECG exercise.

The normal control individuals had normal physical examination, normal ECG, normal Chest X-ray and echocardiography test. M-mode, 2- dimensional of

Physiology department / Medical physics Medicine
Collage of Baghdad University

parasternal long axis view and Doppler echocardiography tracing were taken using Voluson 530 D. M-mode measurements of left ventricle LV based on end diastolic inter diameter LVDd, end systolic inter diameter LVDs, inerventricular septum through diastole and systole IVSd, IVSs, and posterior LV wall in diastole and systole PLVWd, PLVWs, were made according to the guide lines of the American Society of echocardiography. Pulsed Doppler tracing of aorta flow velocity obtained from four chamber apical view during quiet respiration with patient in left lateral position. The ejection time ET is the interval from the beginning of the blood flow to the end of the blood flow.

Also pulsed Doppler tracing of mitral flow velocity is recorded at early diastole E and at atrial contraction (end of diastole) A. Percentage change of IVS thickness, PLVW thickness, fractional shortening FS, and ejection fraction EF are calculated according to the following equations respectively:

$$IVS\% = \frac{IVSs - IVSd}{IVSs} \times 100 \quad (1)$$

$$PLVW\% = \frac{PLVWs - PLVWd}{PLVWs} \times 100 \quad (2)$$

$$FS\% = \frac{LVIDd - LVIDs}{LVIDd} \times 100 \quad (3)$$

$$EF\% = \frac{(LVIDd)^3 - (LVIDs)^3}{(LVIDd)^3} \times 100 \quad (4)$$

Statistics:

All data and values are expressed as mean values $\pm$ 1 standard deviation. Student unpaired t- test is used to test the difference in mean values for IHD patients and normal individuals.

Table 1: Measurements of normal and ischemic heart disease IHD groups expressed as mean values $\pm$ 1 SD. S –significant difference, NS-not significant.

	Normal	IHD	P- value	Percentage difference of mean value in IHD%
Age (years)	48.33+ 12.55	52.85+12.69	-	-
Heart rate (beat/min)	73.8+10.11	70.8 + 11.32	-	-
EF%	74.84 + 4.12	59.83 + 9.85	S	20.05
ET (sec)	O.29 + 0.1	0.24 + 0.06	NS	-
E (cm/sec)	64.66 + 17.35	50.08 + 16.38	S	22.55
A (cm/sec)	56.0 + 16.04	51.04 + 13.76	NS	8.85
A/E	0.87 + 0.24	1.019 + 0.37	NS	-

RESULTS:

The mean values of the ET showed an insignificant difference in both groups while EF% is significantly decreased in IHD as compared with normal group ($p<0.05$). The mitral flow velocity E is significantly decreased in IHD group as compared with normal group, while the flow velocity A shows no differences in both groups and this is the same result for the (A/E) ratio Table 1. The mean values of the parameters IVS, LVID and PLVW at diastole and systole showed insignificant differences between the two groups ($P>0.05$) Table 2. Other results reveal that the mean value of IVS% in IHD group is significantly lower than that in normal group ($P<o.o5$). Similarly the mean value of FS% in IHD group is less than that in normal group with significant difference ($P<0.05$). And the mean values of PLVW% in both groups showed a significant difference ($P<0.05$) Table 3.

Table 2: Echocardiography measurements of left ventricle during diastole and systole,NS- not significant difference.

	Normal	IHD	P-value
IVS d (cm) IVS s (cm)	1.15± 0.58 1.74 ± 0.64	1.208 ± 0.39 1.49 ± 0.46	NS NS
LVD d (cm) LVD s (cm)	4.42 ± 1.31 2.79 ± 0.91	4.92 ± 1.35 3.63 ± 1.03	NS NS
PLVW d (cm) PLVW S (cm)	1.31± 0.51 2.0 ± 0.78	1.45± 0.35 1.77± 0.44	NS NS

Table 3: The results expressed by mean values ± 1 standard deviation for normal and ischemic heart disease groups, S- significant difference.

	Normal	IHD	P-value	Percentage change of mean values in IHD%
IVS%	33.9 ± 15.49	18.92 ± 9.39	S	44.18
FS%	36.88 ± 10.18	26.21 ± 11.2	S	28.93
PLVW%	34.5 ± 13.18	18.07 ± 7.07	S	47.62

DISCUSSION:

Because patient age is not very old (in their early fifties) the change in echocardiography will not be attributed to aging process. The effects can be seen on the percentage change of the interventricular septum IVS thickness, posterior left ventricle wall PLVW thickness and fractional shortening FS.

In all the three parameters there is a deviation from normal group and this is reflected in the change percentage Table 3.

The change in these parameters IVS%, PLVW%, and FS% is a clear indication that the poor blood supply to the myocardium has introduced decrease in the muscle relaxation and stiffness due to fibroses and consequently decreased compliance.Although the change is not great on ejection fraction that is usually taken as an indicator for cardiac performance [11,12] i.e. the EF% results for patients do not fall within the abnormal category but the difference between the two groups is statistically significant. No significant effect was seen on ejection time. Results did not reveal a significant change in the A/E ratio, however, when we compare the mean values of A and E with their counterparts for both groups, a significant change in E wave between the two groups was observed, while no significant change was seen on mean value of A. This can give an indication that if there is change in A/E for patients with mild ischemia this change may be more strongly related to the change in E wave rather than in A wave.

CONCLUSION:

Parameters of left ventricular systolic and diastolic dysfunction are common in early ischemic heart disease. Acknowledgment: I would like to thank Dr. Readh Sulaiman /Al Yarmook teaching hospital and Dr. Khalil sarhan /Baghdad teaching hospital for their kind help in providing me the data belongs to the patients included in the present work.

REFERENCES:

1. All refer.com /Health/ischemic – cardiomyopathy –info.html.
2. Mitu.F, Mitu M and Livadariu E: Clinico functional particularities of cardiac dysfunction in the elderly. Rev –Med-Chir-Soc-Med – Nat –Iasi. 2003, 107: 72-7.
3. Nixon J and Burns CA: Cardiac effects of aging and diastolic dysfunction in the elderly. Edited by Gaasch WH, Lewinten M. Philadelphia. 1994, 427-435.
4. Abrahim A Jawad: practical Guide to echocardiogaphy and cardiac Doppler Ultrsound. Little Brown companies. 1990, 325-324.
5. Norager B, Husic M, Moller .JE : The myocardial performance index during low dos dobututamine with echocardiograghy in control subjects and patients with a recover myocardial infraction: A new index of left ventricular function reserve. J.Am.Soc echocardiography.2004, 7: 732-8.
6. ToumanidisST,Papadopoulou ES and Saridakis NS: Evaluation of myocardial performance index to predict mild rejection in cardiac transplantation. Clin . Cardiol.
7. Jose Missri: Clinical Doppler Echocardiography: Spectral and color flow imaging. 1990, pp 180-181.
8. Szymanski P, Rezler J, and Stec S: Long term prognostic value of an index of myocardiial performance in-patients with myocardial infraction. Clin. Cardiol, 2002, 25: 378-383.
9. Davis,R-C ,Hobbs F-D and Kenker J-E :Prevalence of left ventricular dysfunction and heart failar in high risk patients . BMJ. 2002,325:1156 .
10. Ruiz-Bailen M, Aguayo E, Lopez A: Reversible myocardial dysfunction, a possible complication in critically ill patients without heart disease . J-Crit-Care. 2003, 18: 245-52.
11. Thun J, Carlsen C, and Buch P : Different prognostic impact of systolic function in patients with heart failure and /or acute myocardial infraction. Eur-J-Heart –Fail .2005, 7: 852-8..
12. Loze.O, Tassan Mangina S and Nazeyrollas P: Prediction of improvement of left ventricular systolic function. Arch- Mal- Coeur-Vaiss.2001, 94:1038-44