

**EJECTION FRACTION RATE FOR HYPERTENSIVE PATIENTS USING
ECHOCARDIOGRAPHY**

K.M.Sharief^{1,2}, H. A. Hassan², H.Osman^{1,2}, Al-Safi Ahmed²

1. Taif University, Faculty of Applied medical Science KSA.

2. Sudan University college of Medical Radiologic Science, Khartoum, Sudan

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For Correspondence
Email ID:
K.anarmedo@yahoo.com

Abstract:

The main objectives of this study were to measure ejection fraction (EF) in hypertensive patient (HTN) and to correlate ejection fraction (EF) in hypertensive with age, gender, left ventricle hypertrophy (LVH) and left ventricle diastolic dysfunction (LVDD) using Echocardiography. EF was calculated by using Echocardiography for 100 HTN patients with varying ages started from 50 to 80 years, half of them were male and other half were female (50/50). Echocardiography instrumentation that used for this calculation was my lab 50 from Esaote Company.

This study showed that the EF was normal in more than two third of study samples. Few samples of study were high EF that may lead to Hypertrophy cardiomyopathy (HCM) and very few samples of study were low EF that may lead to heart failure (HF).

Also the study showed that the EF found to be decrease as the LVH increases and LVDD decreases in HTN patients, the LVDD may occurred before the LVH, but the EF can be normal in both cases. A low EF is indicated cardiac failure, and high EF is indicated hypertensive cardiomyopathy (HCM). Even with normal ejection fraction, over all cardiac function may not be normal.

Keyword: Ejection fraction (EF), Left Ventricle Hypertrophy, Left diastolic dysfunction, HTN

Introduction:

Hypertension is considering a major public health problem that associated with considerable morbidity and mortality. The major effecting of hypertensive on heart is abnormalities that include left ventricular hypertrophy (LVH), systolic and diastolic

dysfunction, and their clinical manifestations including arrhythmias and symptomatic heart failure so it can call hypertensive heart disease. In hypertensive heart disease the first part affecting is the left ventricular (LV) wall thickens in response due to elevated blood pressure as a

compensatory mechanism to minimize wall stress. So after a series of poorly characterized events ("transition to failure"), the left ventricle dilates, and the LV ejection fraction (EF) declines (defined herein as "dilated cardiac failure")⁽¹⁾.

The ejection fraction can be defined as the percentage of blood that's pumped out of a filled ventricle with each heartbeat. Also the ejection fraction (EF) can be expressed as the fraction of blood in the left and right ventricles that is pumped out with each heartbeat or cardiac cycle⁽²⁾. In order to the left ventricle is the heart's main pumping chamber, so ejection fraction is usually measured only in the left ventricle (LV)⁽³⁾.

(LV) function can be evaluated with echocardiography by the left ventricular ejection fraction and analyzed according to increase or decrease from the normal rate of (EF) (50-70%). If the left ventricular ejection fraction is initially evaluated to be <50%, there is a nearly tenfold increased risk for hospitalization for congestive heart failure as compared to hypertensive patients with a normal ejection fraction and if more than 70% is lead to hypertrophy cardiomyopathy.

Hypertension is considered a heterogeneous disorder with a number of well defined as well as putative etiologies. The World Health Organization estimates that hypertension may cause 7.1 million premature deaths and 4.5% of the disease burden worldwide^(3,4).

Hypertension is considered a major risk factor for stroke and cardiovascular diseases, and is thus associated with significant morbidity and mortality^(5,6).

Hypertensive heart disease is a complex entity that involves changes to the cardiovascular system resulting from arterial hypertension; it is therefore the major cause of hypertension related complications^(5,6).

The Framingham et al study showed that the hazard for developing heart failure in

hypertensive as compared with normotensive subjects was about twofold in men and threefold in women, thus documenting the importance of assessing left ventricular function in hypertensive heart disease⁽⁷⁾.

As far as authors knowledge no studies in Sudan has been published locally or worldwide regarding the rate of EF in hypertensive patients, so this motivate researcher to go ahead in this work.

Objectives of the study

- To assess the ejection fraction (EF) for HTN patients.
- To correlate the relationship of EF with age and gender.
- To correlate relationship between EF and size of heart chambers in hypertensive patient.
- To assess the LV H and LV diastolic Dysfunction & its relation with ejection fraction (EF)

Materials and Methods

The data was collected from Saudi Arabia during 18 months using special designed data collection sheet, after ethics approval was performed for each patient.

The study was carried for 100 cases included pure HTN patient (primary HTN) underwent echocardiography examinations with exclusion for all patients that complained from any other pathology such as Diabetic Mellitus DM, Thyroid problems or renal disorders and secondary HTN. The echocardiography machine that used was my lab 50 from Esaote company utilized phased array (PA) probe with (2.5 MHz) frequency.

Echocardiography technique:

The gross anatomy of the heart can be evaluated by two-dimensional echocardiography in the para-sternal, apical, suprasternal and subcostal position. The standardized planes used are long axis, short axis and four-chamber. Echocardiography allows a detailed assessment of the functional anatomy of the heart. The long-

axis view is obtained by placing the apicosternal position and provides detailed images of the left ventricle, aorta, left atrium, and mitral and aortic valves. Angling the beam towards the right also allows assessment of the right atrium, right ventricle and tricuspid valves. Rotating the transducer by 90° in the clockwise direction produces the short-axis view, which allows assessment of the left ventricle, papillary muscles, chordae tendineae and mitral valves. The four-chamber view demonstrates the ventricles, atria and mitral and tricuspid valves. Rotation of the transducer allows two-chamber views of the

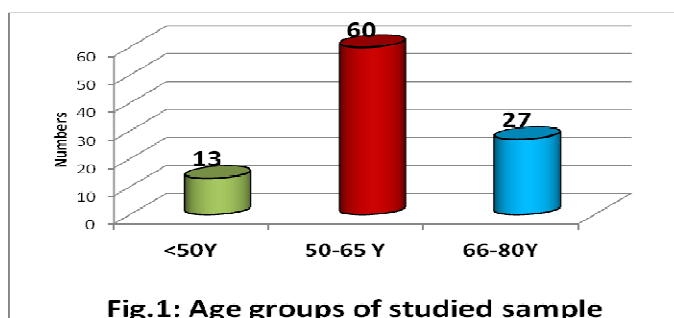
ultrasound transducer in the left heart and more detailed assessment of the aorta and aortic valves.

The EF and volumes were measured with 2D-biplane Simpson's method, 2D-triplane, and 3-dimensional echocardiography (3DE) by 2 investigators blinded to any clinical data ⁽⁹⁾.

Results:

Table1: Age groups of studied sample			
	Frequency	Percent	Cumulative Percent
Age groups: <50 years	13	13	13
50 - 65 years	60	60	73
66-80 years	27	27	100.0
Total	100	100	

Table2: Gender of studied sample			
	Frequency	Percent	Cumulative Percent
Gender: Male	50	50	50
Female	50	50	100
Total	100	100	



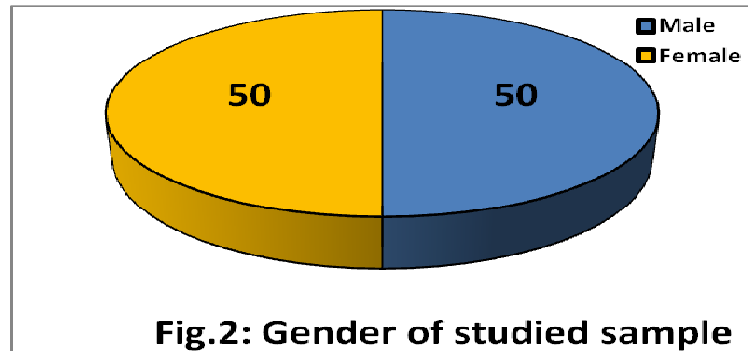


Fig.2: Gender of studied sample

	Frequenc y	Percent	Cumulative Percent
Low rate(<50)	2	2	2
Normal rate(50-70)	70	70	72
High rate(>70)	28	28	100.0
Total	100	100.0	

Table3 as well as Fig.3 demonstrate the ejection fraction of studied sample. More than two thirds of hypertensive patients were of normal EF (70%). While 28% were with high EF and only 2% were of low EF.

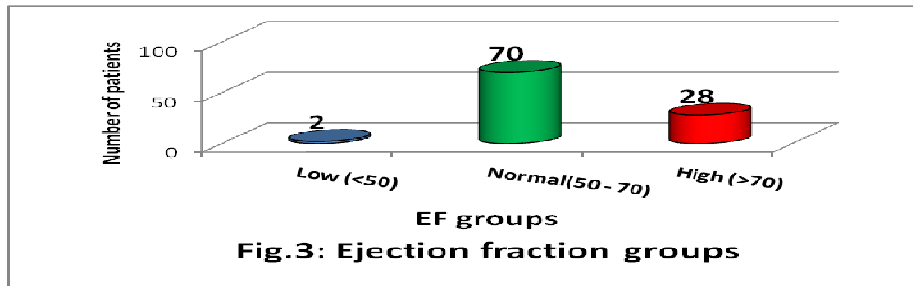


Fig.3: Ejection fraction groups

Table4: Ejection fraction groups distributed by age groups of studied sample

Age groups	Ejection fraction groups			Total	P value of difference
	Low (<50)	Normal (50-70)	High (>70)		
<50 years	1 7.7%	10 76.9%	2 15.4%	13 100%	
50 - 65 years	1 1.7%	43 71.7%	16 26.7%	60 100%	* $\chi^2=4.27$, P=0.37 NS
66-80 years	0 0%	17 63%	10 37%	27 100%	
Total	2 2%	70 70%	28 28%	100 100%	

* Likelihood ratio

Table 4 demonstrates the EF of cardiac output groups distributed by gender .More than two thirds of HTN patients with normal EF rate were male & only (64%) were female .While near to half percentage with EF rate were female (34%) & only (22%) were male . And both there were equal percentage in low EF of cardiac output (2%).

Table5: Ejection fraction groups distributed by gender

Gender	Ejection fraction groups			Total	P value of difference
	Low output(<50)	Normal output(50-70)	High output(>70)		
Male	1 2%	38 76%	11 22%	50 100%	* $\chi^2=1.81$, P=0.40 NS
Female	1 2%	32 64%	17 34%	50 100%	
Total	2 2%	70 70%	28 28%	100 100%	

*Likelihood ratio

Table6: Ejection fraction groups distributed by LVH as a cause of hypertension

	Ejection fraction groups			Total N=100	P value
	Low rate(<50) N=2	Normal rate (50-70) N=70	High rate(>70) N=28		
LVH:	0 0%	34 87.2%	5	39 100%	0.005* Sig.
NIL	2 3.3 %	36 59 %	12.8%	61 100%	
LVH			23 37.7%		

* Likelihood ratio

Table 6 demonstrates ejection fraction groups according to LVH as a causes of hypertension. 3.3% of patients with abnormal LVH showed low ejection fraction , compared to 59% among hypertensive patients with normal EF, and 37.7% among patients with high EF. The difference was significant statistically (p=0.005).

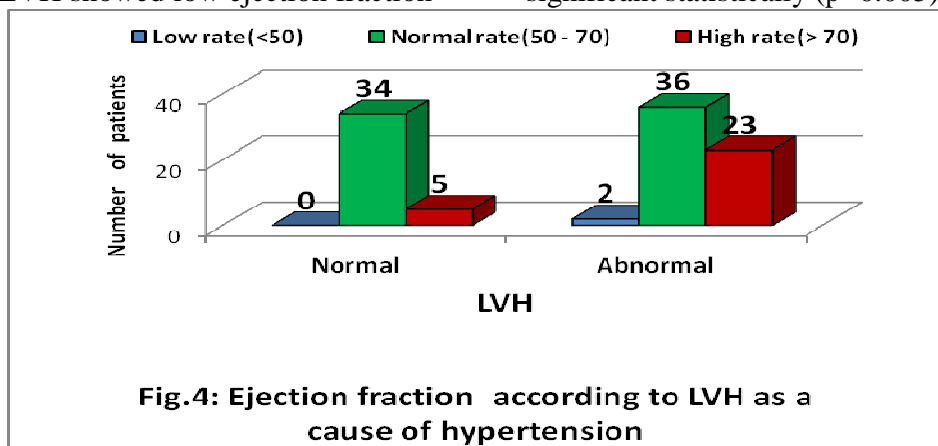


Fig.4: Ejection fraction according to LVH as a cause of hypertension

Table7: LVH groups distributed by age groups of studied sample

Age groups	LVH groups		Total	P value of difference
	Normal	Abnormal		
<50 years	10 76.9%	3 23.1%	13 100%	* $\chi^2=9.0$, P=0.01Sig.
50 - 65 years	20 33.3%	40 66.7%	60 100%	
66-80 years	9 33.3%	18 66.7%	27 100%	
Total	39 39%	61 61%	100 100%	

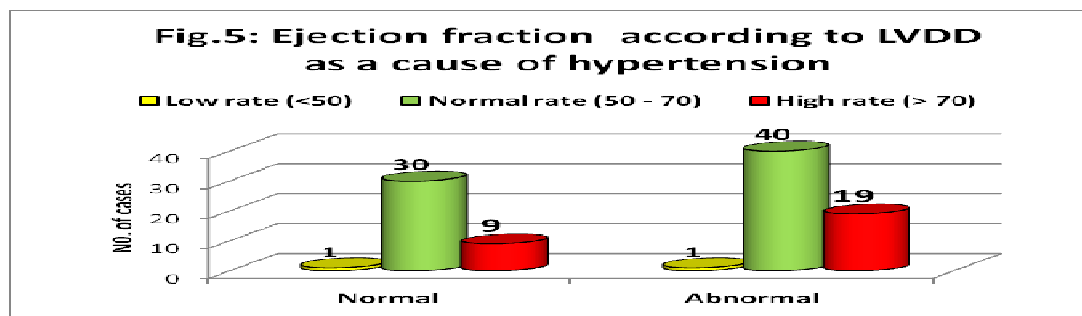
Table8: LVH groups distributed by gender of studied sample

Gender	LVH groups		Total	P value of difference
	Normal	Abnormal		
Male	14 28%	36 72%	50 100%	* $\chi^2=5.1$, P=0.02Sig.
Female	25 50%	25 50%	50 100%	
Total	39 39%	61 61%	100 100%	

Table9: Ejection fraction groups distributed by LVDD as a cause of hypertension

	Ejection fraction groups			Total N=100	P value
	Low rate(<50) N=2	Normal rate(50-70) N=70	High rate(>70) N=28		
LV diastolic dysfunction:	1	30 75%	9	40	0.58* NS
NIL	2.5%	40 66.7%	22.5%	100%	
LVDD	1		19	60	
	1.7%		31.7%	100%	

* Likelihood ratio



Discussion

In this study more than half of samples (60%) were in age between 50-60 years .while 27 % were in age between 66-80 years and only 13% were in age <50 years. This mean that most of hypertensive were above 50 years of ages or that means few patients were in age <50 years than were hypertensive. The study showed that, the ejection fraction of studied sample, in more than two thirds of hypertensive patients were of normal rate (70%). While 28% were with high rate and only 2% were of low output.

The study indicated that EF of study groups, the patients with age <50 years (13) patients, (76%) of them have normal EF of cardiac output, while 15.4% have high EF only (7.7%) have low EF.

The totals of patients in age between 50-65 years were 60 pts . They represented a lot of age group distributed as More than two thirds were normal EF of cardiac output (71.7%). while (26.7%)of them were high EF of cardiac output & only (1.7%) of them were low EF of cardiac output.

The total of patients in age 66-80 years were 27 pts. Also more than half were normal EF of cardiac output(63%).While (37%)of them were high EF of cardiac output & no low EF of cardiac output represented(0%).

Table 5 demonstrates EF of cardiac output according to main causes of HTN like Left Ventricle Hypertrophy & Left Ventricle Diastolic Dysfunction (LVH & LVDD).

More than two thirds of HTN pts with normal LV were normal EF of cardiac output (87.2%). While (12.8%) were high EF of cardiac output & no pts with low EF of cardiac output (0%) .

More than half of HTN pts with abnormal LV (LVH) were normal EF (59%) . While (37%) were high EF of cardiac output & only 3.3% were low EF of cardiac output.

Normal EF percentage is decreased in HTN patients who suffering from LVH more than

EF percentage of the HTN patients with normal LV may be due to the affecting of LVH although all of them were normal.

High EF percentage in some HTN patients who have abnormal LV more than HTN patients who have normal LV may be due to affecting this patients with Hypertrophy cardiomyopathy (HCM) because the high EF is related to (HCM) specially this patients suffering from HTN that can cause (HCM) .

And very few of HTN patients with LVH have low percentage of low EF (3.3%) may be this due to they were suffering from heart failure (HF) because the low EF is related to HF specially this patients suffering from HTN that can lead to HF.

There were differences between the percentages of normal EF for HTN patients with LVH (59%) than HTN patients with left ventricle diastolic dysfunction (LVDD) (66.7%) may be due to the relation between LVDD & LVH . Means any HTN patients have LVDD does not mean have LVH because LVDD is considered the first problem of HTN (occur before of LVH) & lead to LVH later .So although the number of HTN patients with LVH were lower than number of who with LVDD.

Although the numbers of HTN patients with abnormal LV (LVH) were high comparing with numbers of HTN patients with normal LV that have the EF rate of cardiac output were lower percentage (59%) than normal LV (87.2%) may be due to affecting of LVH that affecting in EF rate because the total number of HTN patients with normal LV were lower than numbers of HTN patients with LVH .

Although the numbers of HTN patients with abnormal LV diastolic dysfunction (LVDD) were high comparing with numbers of HTN patients with normal LVD function the EF percentage were lower (66.7%) than normal LV(75%) .

Conclusion and Recommendation

Echocardiography is a noninvasive method of quantifying ejection fraction of the heart, two dimensional (2D) ultrasound with Doppler measurements are used together to calculate ejection fraction. This study showed that a low EF is indicated cardiac failure, and high EF is indicated hypertensive cardiomyopathy (HCM). The EF found to be decrease as the LVH increases and LVDD decreases in HTN patients, the EF can be normal in both cases. Even with normal ejection fraction, over all cardiac function may not be normal. More studies are required in this field and extensive training for operator of echo and cardiologist to minimize variations in result reports.

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