Left Ventricular Systolic Dysfunction among Stroke patients cross sectional study

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الخلاصة
أجريت دراسة على52 مريض(17 أنثى و35 ذكر) مصابين بطارئة وعائية دماغية لأول مرة وقدتم إدخالهم في مركز الفرات لمتوسط للعلوم العصبية وكانت أعمارهم تتراوح بين32-86(العمر بالمتوسط60.08)، وللفترة من شهر تشرين الثاني 2012 ولغاية شهر أيار 2013 وقد تم تصنيفهم إلى طارئة وعائية نزيفيه أو خثريه اعتمادا على فحص مفراس الدماغ اعتمد البحث على العلاقة بين الطارئة الوعائية الدماغية و عدم كفاءة البطين الأيسر للقلب وعلى مسببات الطارئة الوعائية الدماغية التي يمكن أن ترتبط بعدم كفاءة القلب كما في حالات ارتجاف الأذين والنقصان في وظيفة مضخة القلب. وقد تم الأخذ بنظر الاهتمام بعوامل ا لخطورة للطارئة الوعائية الدماغية التي تشترك مع عدم كفاءة القلب مثلا ارتفاع ضغط الدم، داء السكري ، تصلب الشرايين ، التدخين ،ارتفاع نسبة الدهون في الدم .
هدفا لدراسة بحث علاقة النقصان بالوظيفة الإنقباضية للبطين الأيسر للقلب في مرضى الطارئة الوعائية الدماغية لأول مرة.
وقد نتج عن البحث إن قلة كفاءة البطين الأيسر للقلب يمكن أن يعتبر كعامل خطر محتمل للطارئة الوعائية الدماغية.

Abstract
Background LVSD or HF associated with end organs problems such as arrhythmias' or thromboembolization. Previous studies showed that reduction in LV pump function(i.e. EF) is associated with increased incidence of stroke and high prevalence of LVSD among patients with stroke. Screening for LVSD is important in patients who had high cardiovascular risk factors such as hypertension, diabetes ,smoking and dyslipidemia .It had been suggested that should have screening for LVSD
Aim of the study is to look for the frequency of LVSD among patients suffering recent ischemic stroke who were who admitted to the neurological wards
Patients and Methods 52 patients with diagnosis of stroke and who were admitted in Middle Euphrates Neurological center were evaluated for their left ventricle (LV) systolic dysfunction .The mean age(60.08), (17 females and 35 males) The major risk factors of stroke as the hypertension,, diabetes the dyslipidemia. and smoking were recorded. The stroke was classified either hemorrhagic or ischemic by CT brain .Echocardiography with Doppler study and EF was recorded
Results The study confirmed the high incidence of LVSD among patients with stroke .There was a significant relation with stroke in cases with mild and moderate reduction in the EF.
Conclusion reduction in systolic left ventricle of the heart can be considered as possible risk factor for stroke.
Key Word :- Stroke ,Ejection Failure

Introduction
Heart failure is a complex clinical syndrome that can result from any structural or functional disorder that impair the ability of the ventricle to fill or to eject blood[1]. The heart was established as an important source for development of emboli when Gower in 1875 described a case of left middle cerebral artery and retinal artery emboli[2]. Cardiogenic embolism accounts for approximately 20% of ischemic stroke each year[3]. Cardiac emboli stroke is

largely preventable warranting efforts at primary prevention for major risk cardioembolic sources[4] .As likelihood of recurrence of these cardioembolic is high consequently the secondary prevention is also important. Stroke in patients with heart failure tends to be more sever and is associated with high rate of recurrence ,short term mortality and morbidity[5] .On other hand cardiac morbidity and mortality is also high in stroke patients[6]. Heart failure and ischemic stroke share similar risk factors .The underling mechanism of cardioembolic stroke is occlusion of cerebral vessels with debris from a cardiac source .An embolus may consist of platelet aggregates ,platelet thrombi ,cholesterol, calcium, bacteria[7] .The risk had been related to coexistence of vascular risk factors .Rotterdam study showed that the risk of stroke is strongly increased shortly after diagnosis of heart failure[2]. Although hypertension is the strongest risk factor for stroke epidemiological studies have found other important cardiovascular abnormalities such as coronary artery disease (CAD),HF and atrial fibrillation[3].In the Framingham study ,the age –adjusted 2 years- incidence of stroke was more than double in presence of CAD, more than triple in presence of hypertension, more than quadruple in the presence of HF and nearly quintupled when atrial fibrillation present[8].Atrial fibrillation is present in 10-50% of patients with heart failure with highest incidence in those with New York Heart Association(NYHA).Heart failure is categorized in two major types, one is systolic dysfunction and other is diastolic dysfunction .Systolic dysfunction is associated with impaired contractility so decrease the cardiac output. The most common causes of systolic dysfunction include coronary artery disease ,hypertension, Valvular heart disease and congestive cardiomyopathy ,the diagnosis of systolic dysfunction is established by measuring ejection fraction or by radioisotope scan .Diastolic LV dysfunction refers to impair relaxation as occurs with ventricular hypertrophy or ischemia, results in a stiff, noncompliant ventricle, leading to impaired ventricular filling and an increased ventricularpressure for any given diastolic volume[9].

Ejection fraction (EF) is an Echocardiographic study to measure the Left ventricular systolic function .The survivor and Ventricular Enlargement Study (SAVE) concluded that there is an increased of 18% of stroke risk for every 5% reduction in EF[10].It is not clear however within which limits this relation is valid ,Limitation of the study is that all patients had had myocardial infarction. The extension of study to involve patients with EF less than 35 in studies of left ventricular dysfunction (SOLVD)retrospective one found that there is increase of 58% of thromboembolic events for 10% decrease in EF and in women .Low EF and so the systolic function of the heart can affect the rehabilitation progress and outcome of stroke patients that includes the discharge total ,FIM(the functional independent measure) ,length of stay and discharge disposition[11].

Assessment of LV systolic dysfunction This is important in management of patients and in special those in intensive care unit (ICU) .This can be done in different methods and by using .

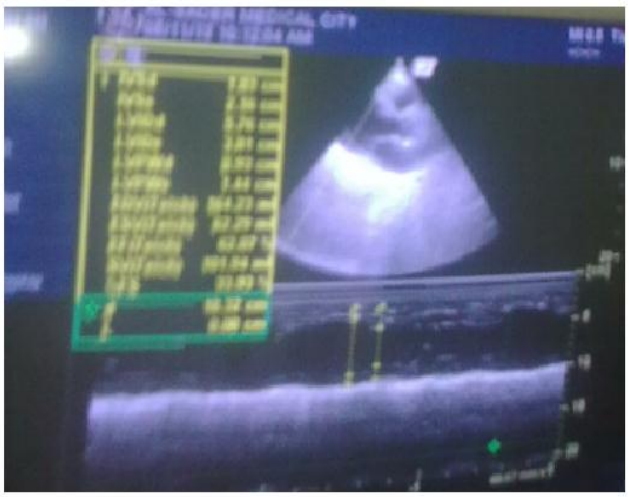

Figure (1) Estimation of the Ejection fraction by M-mode left ventricle dimension

Echocardiography

1.Measuring the EF by M-mode LV dimension by Sampson s.

2.Measurement of dp/dt mitral regurgitate jet through Doppler study.

3.Estimation of stroke volume and so the cardiac output .

Ejection fraction refers to the percentage of the end diastolic volume of the blood that is ejected out of the LV during systole. The normal EF is above 50%.It is widely used method to detect the cardiac contractility

Patients and methods

The study was done to patients who had a recent first stroke 52patients were admitted to Neurological inpatient wards in period November 2012 to May 2013 with age 32-86 years(mean 60.8 years),(35male) and(17female),all patients had their computed tomography (CT) radiologically classified either infracted stroke or hemorrhagic stroke one. The patients had their blood pressure recordings, their electrocardiogram (ECG) and clinical evidences of ischemic cardiac problem and specially Myocardial infarction or any evidence of peripheral vascular disease . The Fasting blood sugar (FBS) was done and a note was done to smoke patients . Every patient had undergo an Echocardiological examination with GE LOGIQ 3 and estimation of the LV systolic function was done and so the EF

Estimation of the EF by M-mode LV dimension (figure 1) was done first by obtaining a parasternal long axis view and M-mode curser is placed through septal and posterior LV wall just beyond the tip of mitral leaflets .In the resultant the M- mode image take measurement of right ventricular (RV) internal cavity ,the interventricular septum thickness, LV internal dimension and LV posterior wall thickness at end diastole (timed on ECG or point of largest LV internal dimension)and at end systole(ECG timed or point of smallest LV internal dimension) so one can estimate the EF Teicholz equation the normal level 50%-75% .Fractioning shortening (LVEDd-LVESd)/LVEDd expressed as

Results

Mean age 60.08 years 45 patients(28 male ,17 female) had ischemic stroke while 7(5 male , 2 female) had hemorrhagic type .The association between hypertension and stroke is a significant with p value 0.04 .(Total 34 hypertensive patients.) Total diabetic patients 19 and the association with stroke is significant p value 0.03 (all diabetic patients had ischemic rather than hemorrhagic stroke) .There was not statically significant relation with smoking or with the dyslipidemia . In this study the number who had Myocardial infarction[10] and relation with stroke was not significant with p value 0.74 The number of patients who had peripheral vascular disease(2) is limited and the relation with stroke was not significant p value 0.65 . Low EF (less than 50%) shows a significant relation with stroke with p value o.017. This was related mainly with mild decrease in EF(40-49%) and with moderate decrease EF (30-39%) and the relation of low EF whether mild or moderate one and the type of the stroke was significant and p value 0.029 percentage which is normally (30%-45%)

Statistical methods Statistical package for social science version 20 analytic tests used was chi test and Fischer exact test for categorical and mean and standard deviation for numerical variable

Table(1) The mean of age &standard deviation of patients with stroke

	N	Minimum	Maximum	Mean	Std. Deviation
Age	52	32	86	60.08	12.469
Valid N (list wise)	52				

Table(2) Sex& stroke type

a)Cross tabulation

Count

		stroke type		Total
		I	h	
sex	F	17	2	19
	M	28	5	33
Total		45	7	52

The association between gender & stroke type, was not significant (0.49)

b) Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.221[a]	1	.638		
Continuity Correction[b]	.002	1	.961		
Likelihood Ratio	.228	1	.633		
Fisher's Exact Test				1.000	.493
N of Valid Cases	52				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.56.

b. Computed only for a 2x2 table

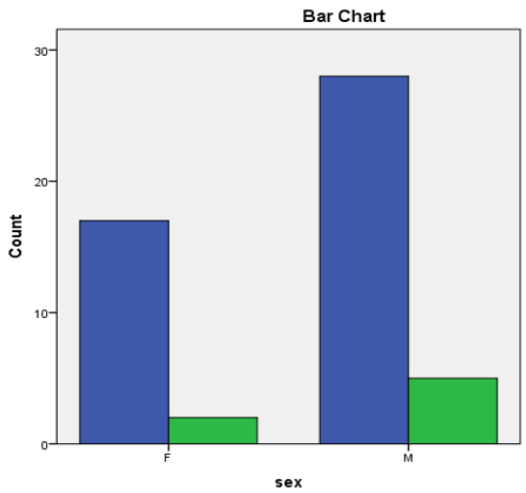

Figure (2)

The association between gender & stroke type

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between hypertension & type of stroke was significant(0.04)

Table(3) Bp code & stroke type

a)Cross tabulation

Count

		Stoke type		Total
		I	h	
Bp code	normal	18	0	18
	hypertension	27	7	34
Total		45	7	52

b) Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.282[a]	1	.039		
Continuity Correction[b]	2.697	1	.101		
Likelihood Ratio	6.512	1	.011		
Fisher's Exact Test				.081	.040
N of Valid Cases	52				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.42.

b. Computed only for a 2x2 table

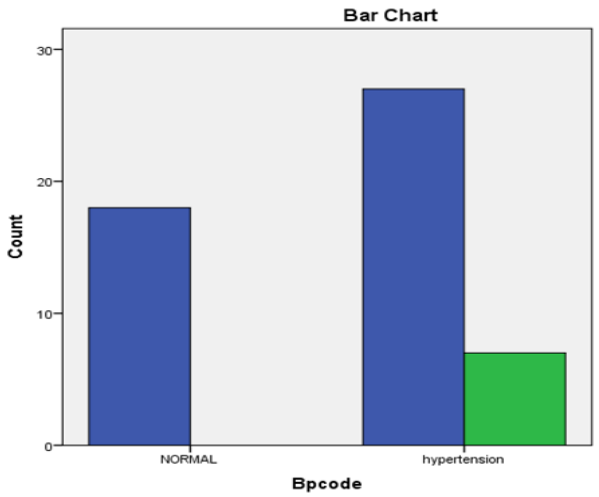

Figure (3)

The association between hypertension & type of stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between DM(patients with diabetes) & stroke was significant(0.03)

Table(4) DM code& stroke type
Cross tabulation
Count

		Stoke type		Total
		I	h	
DM code	No DM	26	7	33
	DM	19	0	19
Total		45	7	52

b) Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.657[a]	1	.031		
Continuity Correction[b]	3.014	1	.083		
Likelihood Ratio	6.981	1	.008		
Fisher's Exact Test				.039	.032
N of Valid Cases	52				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.56.
b. Computed only for a 2x2 table

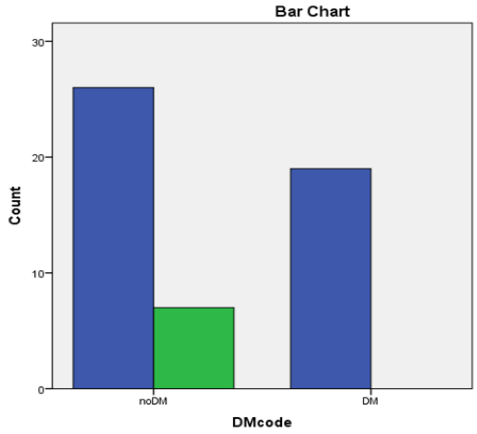

Figure (4)

The association between DM(patients with diabetes) & stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between Dyslipidemia & type of stroke was not significant (0.46)

Table(5) Lipid code & stroke type
a)Cross tabulation
Count

		stroke type		Total
		I	h	
Lipid code	normal	9	2	11
	Dyslipidemia	36	5	41
	Total	45	7	52

b) Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.267[a]	1	.605		
Continuity Correction[b]	.000	1	.985		
Likelihood Ratio	.251	1	.617		
Fisher's Exact Test				.630	.462
N of Valid Cases	52				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.48.
b. Computed only for a 2x2 table

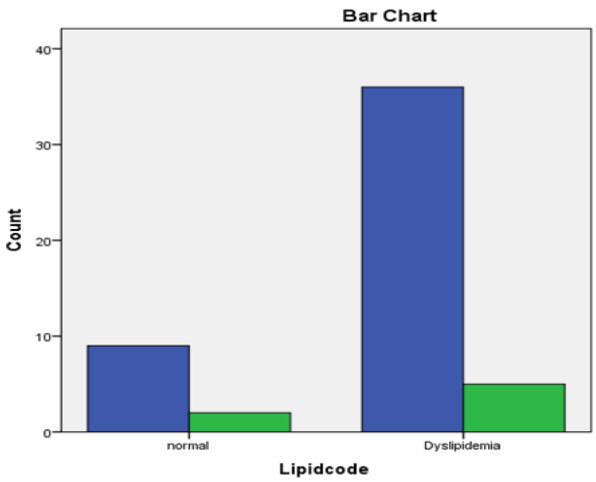

Figure (5)

The association between Dyslipidemia & type of stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between smoking & type of stroke was not significant (0.32)

Table(6) Smoker code & stroke type
a)Cross tabulation
Count

		Stroke type		Total
		I	h	
Smoker code	No smoking	27	3	30
	smoking	18	4	22
Total		45	7	52

b) Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.729[a]	1	.393		
Continuity Correction[b]	.196	1	.658		
Likelihood Ratio	.720	1	.396		
Fisher's Exact Test				.438	.326
N of Valid Cases	52				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.96.

b. Computed only for a 2x2 table

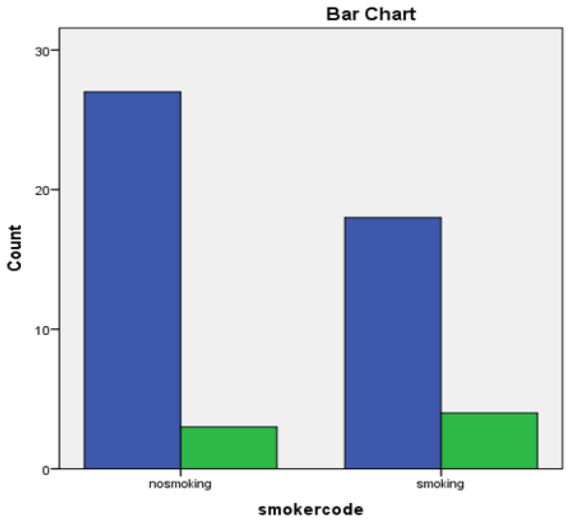

Figure (6)

The association between smoking & t of stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between patients with peripheral vascular disease(PVD)& type of stroke was not significant(0.74)

Table(7)pvd & stroke type

a)Cross tabulation

Count

		stroke type		Total
		I	h	
pvd	no pvd	43	7	50
	pvd	2	0	2
Total		45	7	52

B) Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.324[a]	1	.569		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.591	1	.442		
Fisher's Exact Test				1.000	.747
N of Valid Cases	52				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .27.

b. Computed only for a 2x2 table

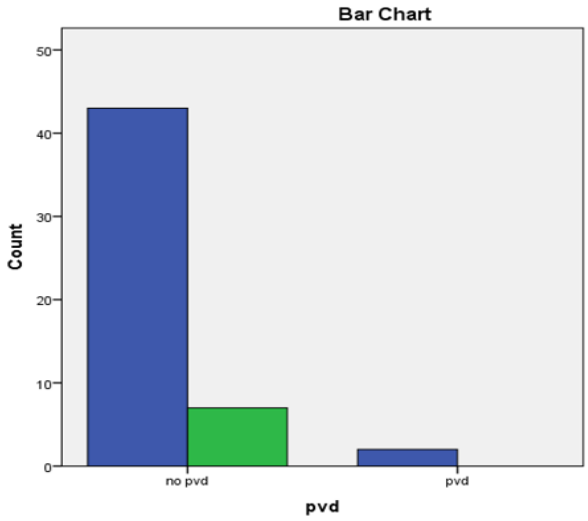

Figure (7)

The association between patients with peripheral vascular disease(PVD) & type of stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between patients with myocardial infarction(MI)& type of stroke was not significant (0.65)

Table(8) MI & stroke type

A)Cross tabulation

Count

		stroke type		Total
		I	h	
MI	no MI	37	6	43
	MI	8	1	9
Total		45	7	52

B) Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.052[a]	1	.820		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.054	1	.817		
Fisher's Exact Test				1.000	.651
N of Valid Cases	52				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.21.

b. Computed only for a 2x2 table

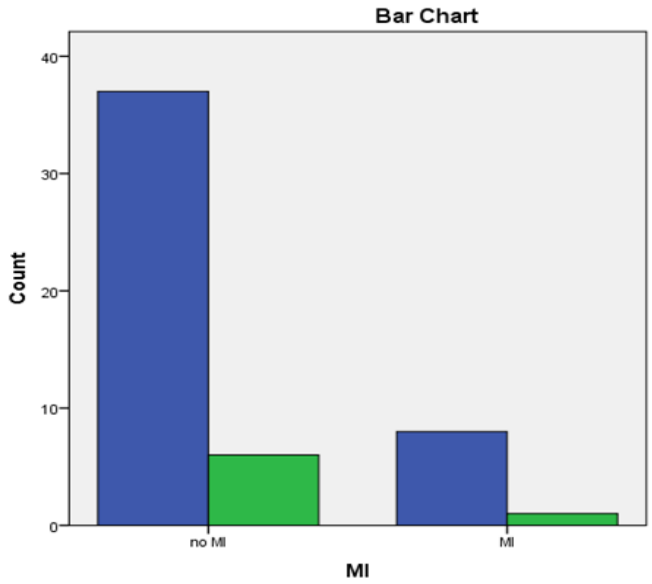

Figure (8)

The association between patients with myocardial infarction (MI) & type of stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between Ejection fraction(EF)& type of stroke was significant(0.017)

Table(9)EF & stroke type

a)Cross tabulation

Count

		stroke type		Total
		I	h	
EF	normal	16	1	17
	mild	27	3	30
	mod	2	3	5
Total		45	7	52

b)Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.443[a]	2	.005
Likelihood Ratio	7.245	2	.027
Linear-by-Linear Association	5.722	1	.017
N of Valid Cases	52		

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .67.

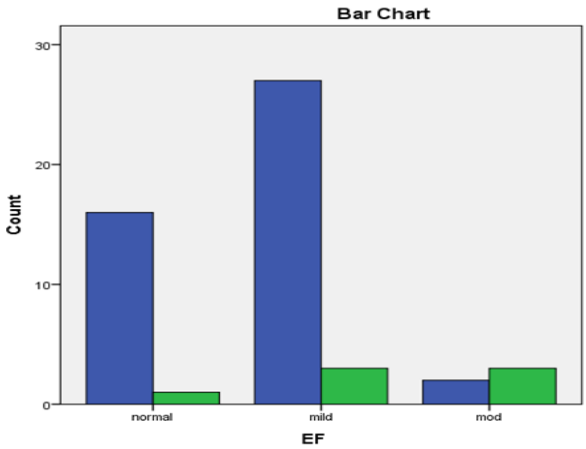

Figure (9)

The association between Ejection fraction(EF) & type of stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

The association between Ejection fraction (mild & moderate) &type of stroke was statistically significant (0.029)

Table(10)Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	7.235[a]	1	.007		
Continuity Correction[b]	4.222	1	.040		
Likelihood Ratio	5.667	1	.017		
Fisher's Exact Test				.029	.029
Linear-by-Linear Association	7.023	1	.008		
N of Valid Cases	34				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is .88.
b. Computed only for a 2x2 table

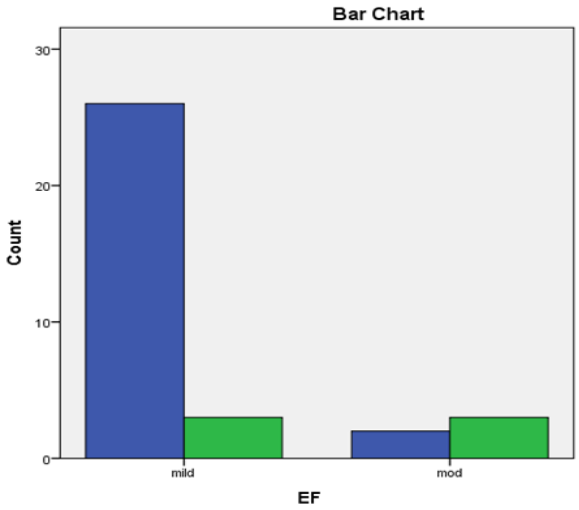

Figure (10)

The association between Ejection fraction (mild & moderate) & type of stroke

*The green color is hemorrhagic stroke

* The blue color is ischemic stroke

Discussion

In this study we studied mainly EF and so the systolic dysfunction and pump function of the heart . It is cleared in the study that is even in mild and moderate reduction in EF there is a significant risk association with the stroke and actually even in mild cases(as many of our cases the EF was 40-49%) In previous studies concerned about the sever and low EF(that is one below 30%) there was significant association with risk of stroke[7]. This was similar to the Peter Appelres study[10] .The stroke mechanism in HF may be either an embolus or a hypoperfusion[12] .LV dysfunction causes increase in the LV end diastolic volume that promotes blood stasis both in LV and left atrium increases the risk of thrombus formation and so the embolic stroke[13]. A varity of factors associated HF may play role in thrombosis and include vascular pathology ,increase couguability and impaired flow. Patients with HF have increased plasma fibrinopeptide A, D dimmer, von Well brand factor, fibrinolytic products, beta – thromboglobulin and endothelial procoagulant. These homeostatic abnormalities that predispose to thrombo embolic events have been associated with neuroendocrine activation[14] .However ,stroke in HF might be also due to cerebral hypoperfusion. Patients with low EF have increase in the LV filling pressure and reduced stroke volume, and this causes a reduction of systemic blood flow. In patients with adequate cerebrovascular reactivity lowering cerebrovascular resistance through dilatation of the brain arterioles compensate for reduced cardiac output[15]. Auto regulation maintains cerebral blood flow through a wide range of systemic blood pressure. Therefore a reduction in EF should not affect the cerebral blood flow in a patient with intact autoregulation[16].However ,patients with HF may easily decompensate

hemodynemically and may become hypotensive secondary to cardiac ischemia ,arrhythmia or overmedication with hypotensive drugs. This would limit the potential for further dilation, resulting in the altered cerebrovascular reserve capacity observed in patients with HF. Increased severity of HF indicated by NYHA grade and decreasing EF are correlated with decreased cerebrovascular reactivity and decreased global cerebral blood flow. In our study we did not find thrombus inside LV cavity and we did not detect atrial fibrillation during our Echocardiological study and as the cases were in majority with EF more than 30% making the possibility of second cause of cerebral hypoperfusion the most explanation to our study .

In this study the hypertension as expected shows significant association with stroke whether ischemic or hemorrhagic .This is similar to the different studies[17] .In hypertensive patients there is usually LV hypertrophy and usually the EF shows normal range of EF with diastolic LV dysfunction HF type, and this is not caused reduction in the EF until late in the disease so a reduction in the EF in the study not correlate with the hypertension risk of stroke. The effect of Diabetes Mellitus on atherosclerosis and on heart function whether systolic or diastolic function is well established and the association with stroke risk was a significant[18]. Although the smoking is a well known cause for atherosclerosis this depends on the amount and smoke index an duration[19]. In this study we had limited number of Myocardial infarction and the peripheral vascular disease and so the relation with stroke as the risk show no significant relation

Conclusion and Recommendation

EF reduction even in mild or moderate and hence the systolic dysfunction has a significant relation with stroke and may be considered as a risk factor that raise concern about the primary prevention and the type of treatment needed for prevention. Further studies are needed in that field to evaluate the best management .Stroke prevention in HF represent an opportunity to prevent morbidity and save many lives in this highly fatal disease.

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