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Echocardiographic Correlates of Abnormal Liver Function Tests in Patient with Acute Heart Failure

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Abstract: ***Background: Liver cytolysis caused by cardiac dysfunction is well recognized. The physiological changes that occur with both right heart failure and left heart failure have been studied with great interest. Studies of this hepatic dysfunction with echocardiography parameters and relationship with each variable were scanty. Therefore this study was done to prospectively correlate several selected parameters with echocardiography parameters in patients hospitalized with AHF and liver dysfunction. Method: Prospectively 30 patients admitted with AHF having liver dysfunction were studied. Echocardiography parameters of right heart and left heart function were analyzed statistically for correlation with liver dysfunction such as raised serum TB, and transaminase. Result: Elevated TB was found in 12 patients (30%) and transaminase in 24 patients (80%) among 30 cases collected. The most prevalent HF etiologies were ischemic (n=16, 53.3%) causes. LVEF which resembles the left function of heart showed a positive correlation of transaminases (AST/ALT P=0.013/0.010) elevation.RVD which resembles the right heart function in this study when compared with the variables had a significant correlation(r-.647: p=.000) with TB elevation. Conclusion: In this study we observed that total serum bilirubin and transaminases were often elevated in patient with AHF. Echocardiography indices of right heart failure significantly correlated with cholestatic LFT abnormalities and echocardiography indices of left heart failure significantly correlated with transaminases.***

Keywords: Acute heart failure, Tatol bilirubin, Transaminase, Echocardiography

Abbreviation: AHF: Acute Heart Failure, TB: Total Bilirubin, AST: Aspartate aminotransferase, ALT: alanine aminotransferase.

1. Introduction

Acute heart failure remains a challenging problem in every day clinical practice, with growing incidence and high morbidity and mortality**.** Abnormal liver function test are a common manifestation of AHF and CHF. Unlike chronic HF, there are only few studies relating, pattern and association of liver function parameters with echo-cardio graphic parameters in AHF.

Acute heart failure is defined as the new onset or recurrence of gradual or rapidly worsening signs and symptoms of heart failure, requiring urgent or emergent therapy[1].Cardiac failure has a negative impact on the function of all paranchymatous organs, based both on the low organ perfusion in the left sided forward failure and on the venous congestion in the right sided backward failure [2].most of the studies have been focused on cardiorenal syndromes ,however the impact of cardiac failure on liver function is also considerable[3,4].

Abnormalities in liver function have been recognized to accompany the natural course of chronic heart failure[5,6]. However, the data on the prevalence and clinical significance of abnormalities in LFTs in patient with AHF remain rather scare[7,8,9].on the basis of hemodynamic studies, elevated right atrial pressure causes hepatic venous congestion resulting in elevate bilirubin and decrease in cardiac output causes elevated transaminase[8,10-12].Few studies have been done on correlation of echocardiography parameters in patients of chronic heart failure. Study done by Lau g etal[13] on CHF patients demonstrated a significant positive correlation between serum bilirubin level and degree of tricuspid regurgitation. However there are very few similar studies which have been done in patient with acute heart failure. Therefore this study was done to prospectively correlate several selected parameters with echocardiography parameters in patients hospitalized with AHF and liver dysfunction.

2. Materials and Methods

Methods of collection

Patients

It is a single-center prospective study were patient admitted with acute heart failure and liver dysfunction to be randomly selected within inclusion and exclusion criteria over a period of 9 months. For all patients a thorough history taking will be followed by a complete physical examination. Additionally, clinical signs of heart failures such as rales, edema, as well as NYHA functional class will be determined

Inclusion criteria

a) Acute onset dyspnea, having two major criteria or one major and two minor criteria of Framingham of Acute heart failure
b) Abnormal LFT parameters on admission

Exclusion criteria

a) Known previous liver disease
   - Chronic viral/autoimmune/drug- related hepatitis
   - Liver malignancy
   - Biliary tract disease
b) Severe congenital heart disease
c) Known severe RV dysfunction
d) Hematological disease other than anemia of chronic disease

Biochemistry
Base line LFT will be measured on admission or <6hrs, which include serum total bilirubin, AST and ALT. The sample will be analyzed in the central laboratory using integrated chemistry system. Patients with abnormal LFT parameters will be selected. A total bilirubin of >1.2 mg/dl, AST > 40 U/L and ALT >56 U/L as abnormal levels for liver cytolysis.

Trans-thoracic Echocardiography
Two dimensional trans-thoracic Echocardiography was performed <48hrs after admission by a single experienced physician. Parameters such as right heart function and left heart function will be collected prospectively within 48hours from admission.
From the data collected, Statistical analysis will be done to correlate, patterns and association of liver function tests with the echocardiography findings.

Study endpoint
Cases were collected over a planned duration of 9 months

Statistical Analysis:
Continuous variables were expressed as mean ± standard deviations (SD) and categorical variables were expressed as actual numbers and percentages. Independent groups were compared using the unpaired Student's t test. Categorical data were compared with the Fisher's exact test. Pearson correlation (r) test was used to assess the relation of two continues variables. Statistical analyses were performed using IBM SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). Statistical significance was set at $P < 0.05$.

3. Result

Baseline Characteristics
This study includes 30 patients presented with AHF. Among them there was 70% of males and 30% of females. Mean age of the patients was 60.6 years. The most prevalent HF etiologies were ischemic (n=16, 53.3%), valvular (n=7, 23.3%), dilated heart disease (n=5, 16.7%), idiopathic (n=2, 6.7%), and hypertension (n=1, 3.3%). Among them 21 patients (70%) had pre existing diabetes, 19 patients (63.3%) had hypertension, 15 patients (50%) had pre existing IHD. 21 patients (70%) among 30 were smoker and 10 patients (33.3%)with history of alcohol consumption.

Prevalence of LFTs Abnormalities in AHF
In this study 12 patients (40%) among 30 patients had elevated total bilirubin levels. The mean total bilirubin levels were 1.6 mg/dl. Elevated transaminases were present with 24 patients (80%) with high levels of AST and 20 patients (66.7%) with high levels of ALT. The mean AST and ALT levels were 254.9 U/L AND 224.4U/L respectively.

Correlation of Echographic Variables with LFTs in AHF Patients
The current study group was correlated with the reduced LVEF %. Reduced LVEF% statistically analyzed with clinical characteristic variables such as ischemic and valvular causes for AHF showed a significant p value of 0.002 and 0.003(table 1)

Table 1: Clinical and echocardiography characteristics of study population

Variables		LVEF %				P Value
		<50%		>50%		
		Count	Row N %	Count	Row N %	
Gender	Male	18	85.7%	3	14.3%	0.15
	Female	5	55.6%	4	44.4%	
HTN	Absent	7	63.6%	4	36.4%	0.37
	Present	16	84.2%	3	15.8%	
TYP2DM	Absent	6	66.7%	3	33.3%	0.64
	Present	17	81.0%	4	19.0%	
Smoking	Absent	4	44.4%	5	55.6%	0.01*
	Present	19	90.5%	2	9.5%	
Alcohol	Absent	14	70.0%	6	30.0%	0.37
	Present	9	90.0%	1	10.0%	
Ischemic	Absent	7	50.0%	7	50.0%	0.002*
	Present	16	100.0%	0	0.0%	
Valvular	Absent	21	91.3%	2	8.7%	0.003*
	Present	2	28.6%	5	71.4%	
Hypertensive	Absent	22	75.9%	7	24.1%	1
	Present	1	100.0%	0	0.0%	
Idiopathic	Absent	23	82.1%	5	17.9%	0.04*
	Present	0	0.0%	2	100.0%	
Dilated	Absent	18	72.0%	7	28.0%	0.3
	Present	5	100.0%	0	0.0%	

Table 3: Distribution of LFTs with reduced LVEF %

Group Statistics					
	LVEF %	N	Mean	Std. Deviation	P Value
TB	<50%	23	1.10	.45	.132
	>50%	7	1.42	.58	
AST	<50%	23	304.26	197.653	.013*
	>50%	7	93.00	119.601	
ALT	<50%	23	270.17	180.228	.010*
	>50%	7	75.86	69.705	
ALBUMIN	<50%	23	3.2	.63	.708
	>50%	7	3.17	.60	

Table 3 shows distribution of LFTs compared to LVEF which resembles the left function of heart. The distribution shows there is positive correlation of transaminases (AST/ALT P=0.013/0.010) to left heart dysfunction with both AST and ALT levels elevated in patients with reduced LVEF. The mean TB of patient with reduced LVEF was 1.10 mg/dl and had no significant relation with left heart function.

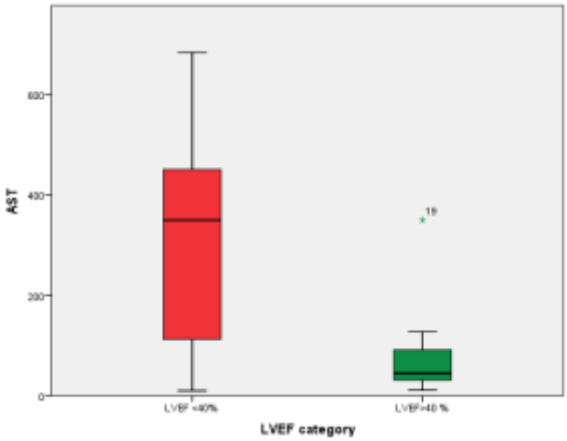

Diagram 1: AST Kruskal–Wallis test

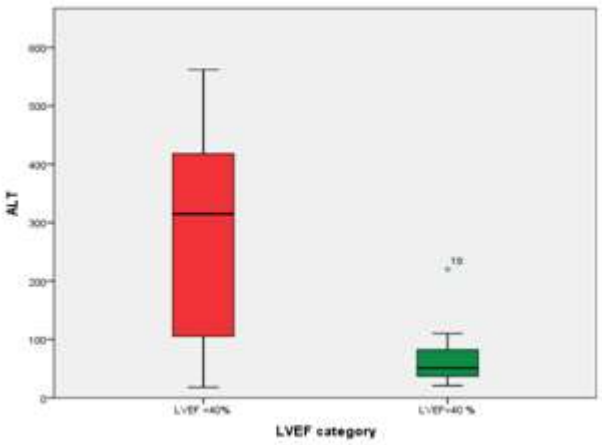

Diagram 2: ALT Kruskal–Wallis test

Table 4: Pearson's correlation of echocardiography parameters with LFTs

		TB	AST	ALT	ALBUMIN	AGE
LVEF	r	.030	-.635**	-.558**	.023	-.033
	P Value	.873	.000	.001	.905	.864
LEDD	r	.079	.354	.348	.151	-.235
	P Value	.677	.055	.060	.427	.210
RVD	r	.647**	-.025	-.113	-.047	.151
	P Value	.000	.896	.552	.804	.426

As shown in table 4, when other echocardiography parameters were correlated with LFT by Pearson's correlation method, there was a significant correlation(r-.647:p=.000) of RVD with TB elevation. It also shows that right heart pathology has a relation with increase in TB levels. Similarly the correlation coefficient of AST and ALT levels had negative correlation (AST r = -.635/ ALT r = -.558) to reduced LVEF.

4. Discussion

In this study prevalence of LFTs abnormalities were associated with echocardiography parameters for association of types of heart failure and morphological change of heart.

Elevated TB was found in 40% of the patients with no significant association with reduced LVEF. However when compared with the right heart functional parameters of heart by echocardiography (RVD) there was a significant association which owes to already known mechanism of hepatic venous congestion. One similar study done by Lau G etal[13] showed significant correlation of right heart abnormalities (tricuspid regurgitation) with increase in serum bilirubin level. However, due to lack of other echocardiography parameters of right heart function a definite etiology of right heart failure could not be found.

With regard to transaminases, 24 patients (80%) had high levels of AST and 20 patients (66.7%) had high levels of ALT. when the percent level of trsnsaminases of this study was compared with the other similar studies done by Klaudia etal[14], Nikolau etal[15]and Lau etal[13] showed higher incidence. This could be due to the high prevelane of patients in our study being admitted with ischemic (53.3%) cause of AHF and pre existing IHD (50%). LFTs when compared to reduce LVEF which resembles the left function of heart. The distribution shows there is positive correlation of transaminases (AST/ALT P=0.013/0.010) to left heart dysfunction with both AST and ALT levels. When the similar parameters of AST and ALT were compared with right heart variables of echocardiography, no association was found to be significant. However this study lacked data of the patient were on inotropic support or had baseline blood pressure low during admission. This concludes that the reason for rise in AST and ALT level could be due to hypoperfusion secondary to low output from heart.

5. Conclusion

In this study we observed that total serum bilirubin and transaminases were often elevated in patient with AHF. Echocardiography indices of right heart failure significantly correlated with cholestatic LFT abnormalities and echocardiography indices of left heart failure significantly correlated with transaminases.

6. Limitation

The study was a prospective study with time limitation; hence the number of cases collected was very low. Hence the prevalence of other cause of AHF was low. Another important limitation was no simultaneous collection of laboratory testing and echocardiography. The main limitation of this study which could have a great bias was lack of precise hemodynamic measurement of right heart function in our institute and the performed echocardiography parameters were assessed by different cardiologist which may lead to data inconsistence.

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