Thi-Qar Medical Journal (TQMJ):Vol.(26),No.(2),2023

Web Site: https://jmed.utq.edu Email: utjmed@utq.edu.iq

ISSN (Print):1992-9218

Transthoracic Echocardiographic Findings in Chronic Liver Disease Patients: A Single Center Study

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Abstract

Aim of study: to identify the structural and functional myocardial abnormalities in patients with chronic liver disease of various origin , by two dimensional trans thoracic Echo assessment

Patients and Methods:

This study is a cross sectional study conducted in AL-Hussain medical city in patients attending the gastrointestinal and hepatological center and patients admitted to medical ward in AL-ZAHRRA center of internal medicine from September 2019 , to February 2020 on sample of 34 chronic liver disease patients .The diagnosis was based on history , clinical examination ,biochemical investigations , abdominal ultrasound, Oesophagogastrodudenoscopy and in some patient histopathological findings ,those patients sent to transthoracic echocardiography study.

Conclusions:

There is significant correlation between chronic liver disease and echocardiographic changes and the most common finding is diastolic dysfunction.

Keywords:

Chronic liver disease ,Transthoracic echocardiography.

Introduction:

Chronic liver disease(CLD) represents a group of liver disorder of various causes and severity in which hepatic inflammation continues for more than six months and demonstrated by persistently abnormal serum levels of aminotransferase and histological abnormality .[1]

Milder forms are slowly progressive, while severe forms may be associated with progressive destruction by inflammation and regeneration of the liver parenchyma cells leading to cirrhosis.[1]

It has high incidence and prevalence worldwide . Among its major causes, Viral hepatitis in form of viral hepatitis B and C ,Non-alcoholic steatohepatitis(NASH) and alcoholic liver disease, to less common causes like Primary biliary cirrhosis ,Primary sclerosis cholangitis ,Wilson's disease , Hemochromatosis . [2]

The clinical presentation is highly variable, Most patients are asymptomatic and the diagnosis is made incidentally at abdominal ultrasound examination or at the time of surgery or at biochemical investigations for other reasons , others present with ascites , organomegally , leg pitting edema ,weight loss .[3]

When symptoms are present ,they are often non- specific and include weakness ,fatigue ,nausea, vomiting and abdominal pain . CLD may occasionally present because of dyspnea due to a large right size pleural effusion (hepatic hydrothorax) , or hepatopulmonary syndrome or portopulmonary hypertension. [3]

The liver and cardiovascular system interact in several different ways , Acute or chronic cardiac failure , especially in case of right side cardiac failure , may lead to many hepatic disorders , including the cardiac cirrhosis, or congestive hepatitis. On the other hand , chronic liver disease may affect the heart and the whole cardiovascular system, [4]

CLD associated with many cardiac abnormalities, which includes diastolic dysfunction, systolic dysfunction , pulmonary hypertension , pericardial effusion, increased wall thickness of cardiac chambers. [5],[6]

Pulmonary hypertension define as: sustained elevation of mean pulmonary artery pressure ($\geq$ 25mm Hg at rest or $\geq$ 30 during exercise).[7] occurs in an estimated 5% of patient with CLD and is present in around 16% of patient referred for liver transplant . The mechanism is not completely understood but probably relates to a hyper dynamic circulation ,high cardiac output , inflammatory mediators release , and development of recurrent thromboembolic events.[8]

CCM is define as any evidence of systolic or diastolic myocardial dysfunction in chronic liver disease patient after exclude of primary cardiac problems .[9]

Cirrhotic cardiomyopathy (CCM) was first described in 2005 on the annual expert consensus meeting of the World Gastroenterology Organization in Montreal as (Cardiac dysfunction in patients with liver cirrhosis) characterized by impaired contractile response to stress stimuli and/or change in diastolic relaxation with electrophysiological abnormalities in the absence of other cardiac disease, Diastolic dysfunction is the most common functional abnormality seen in cirrhotic cardiomyopathy. [10,11]

Liver function deterioration is marked by the increase in nitric oxide and other cytokines , which have been implicated in splanchnic vasodilation and reduced arterial compliance, acting in the pathophysiology of CCM while its development seems to be independent of the etiology of liver disease .[12]

Symptoms of obvious heart failure is rare because of the peripheral vasodilatation , in effect “auto treating” the ventricle by systemic vasodilatation reducing after load, and compensatory inhibition of inhibitory influences such as the cardiac muscarinic system.[13]

Some of cardiac changes may reverse after liver transplant like diastolic dysfunction , this put the echocardiography (Echo) one of important tools to evaluate cirrhotic patient before and after liver transplant.[14]

Patient and methods:

This study was conducted in Al-Hussein Medical city from September 2019 to February 2020 as cross section study with out control sample.

Thirty four patients with chronic liver disease were included in this study collected from patients admitted to medical wards and patients attending Gastroenterological and hepatological Center in Al-Hussein Medical City.

This study consist of small sample (34 patients) because of short time of sample collection , highly restricted exclusion criteria .

Diagnosis of CLD was made on the basis of a complete history with full clinical examination have been done , biochemical investigations, abdominal ultrasonography, Oesophagogastroduodenoscopy(OGD), and in some patients histological evidence of cirrhosis or non_ invasive method like shear wave elastography.

Individuals that met one or more of the following criteria were excluded from the study :

1-Primary cardiac and /or Respiratory disease

2-Systemic arterial hypertension

3-Pregnancy

4-Chronic renal disease

5- diabetes mellitus

6-Malignancies

Fifteen patients were male (44.12%) and nineteen patient were female (55.88%), All the patients gave oral informed consent for the participation in the study.

All the patients were examined for features of CLD including : palmer erythema , dupuytrens contracture , finger clubbing , spider naevi , splenomegaly ,ascites ,leg edema and markers of itching ,ecchymosis. Two patients refused the investigations and echocardiographic study.

The patients were sent for complete list of investigations in form of complete blood count ,liver function test , Blood urea and serum-creatinine prothrombin time and international normalized ratio ,viral hepatitis B surface antigen and anti hepatitis C antibody , serum albumin ,serum electrolytes ,Fasting blood sugar, hemoglobinA1C, abdominal ultrasound, oesophagogastroscopy and Doppler study, chest x-ray , 12 leads Electrocardiography . Some patients had no final diagnosis of etiology of CLD because of they missed the histolopathological report or pending the result of work up of diagnosis.

Then trans-thoracic two-dimensional Echo study done by single expert by machine GE (VIVID E9), the machine available in Echo unit.

Echocardiographic examination determined chambers size, valve status ,regional wall motions and pericardial status by two-dimension, M-mode echo and color Doppler. pulmonary artery pressure assessed by tricuspid valve evaluation and inferior vena cava status in relation to collapsing response by valsalva maneuver, by putting the cursor at the direction of blood flow at the Tricuspid regurgitation which represent the pressure difference between right ventricle and right atrium.

E/A ratio used to assess diastolic status , LV systolic function assessed visually and by color M-mode method during left ventricular end-diastolic and end-systolic diameter. Simpsons method not used in this study.

Statistical analysis:

The collected data fed to excel sheet and then tabulated . All calculations were performed using SPSS program ver_23. In all analysis, $p<0.05$, was considered to be statistically significant

Results:

The mean age of the patients participating in the study was 48.91±12.11 year and the distribution was almost normal (figure 1).

When the patient age was grouped into decade categories the distribution showed that the majority of patients was in the age category 50-59 year (table 1).The mean age of males was higher than females (51 ± 12.80year vs. 47.26 ± 11.61 year, however t- test showed that the difference was not significant (p=0.380).

Females formed the majority of patients (55.9%, figure 2).

The diagnosis of cause of liver disease among this group of patients showed that viral hepatitis B , NASH, Alcoholic liver disease caused about 11.8% each , Primary Sclerotic Cholangitis was 8.8% of cases ,primary biliary cirrhosis 5.9% ,viral hepatitis C 2.9% ,while liver cirrhosis was 44.1% of the cases (table2,figure 3)

Trans-Thoracic ECHO Findings among this group of patients revealed that two fifths (41.2%), of patients showed Diastolic Dysfunction while about 9% of them showed either Systolic dysfunction, Pericardial Effusion, or tricuspid regurgitation , while no patient showed altered Ventricular Size (table 3, figure 4). Correlation analysis between patient age and different types of Trans-Thoracic Echo Findings showed high significant positive correlation with Diastolic Dysfunction (r=0.99, p<0.001). Similarly, age category was positively significantly associated with Diastolic Dysfunction (p<0.001). All patients aged 60 year or more showed Diastolic Dysfunction compared to 50% of those aged 50-59 year, and a minority of those younger (table 4). However, it was not significantly correlated between causes of liver disease and ECHO findings .

Table (1): The age category distribution of patients with liver disease

Age Category	Frequency	Percentage
Below 30 Year	4	11.8
30-39 Year	3	8.8
40-49 Year	8	23.5
50-59 Year	12	35.3
60 Year Or More	7	20.6
Total	34	100.0

Table (2): The distribution of the causes of chronic liver disease

Diagnosis	Frequency	Percentage
Liver Cirrhosis	15	44.1
NASH	4	11.8
Alcoholic Liver Disease	4	11.8
Primary Biliary Cirrhosis	2	5.9
Budd Chiari Syndrome	1	2.9
Hepatitis B	4	11.8
Primary Sclerotic Cholangitis	3	8.8
Hepatitis C	1	2.9
Total	34	100.0

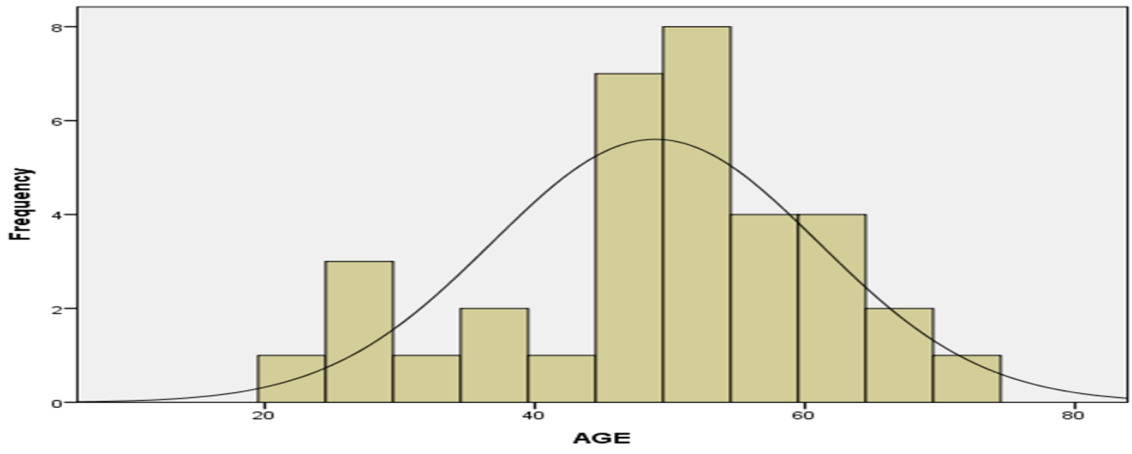

Figure (1): The age distribution of patients with liver disease .

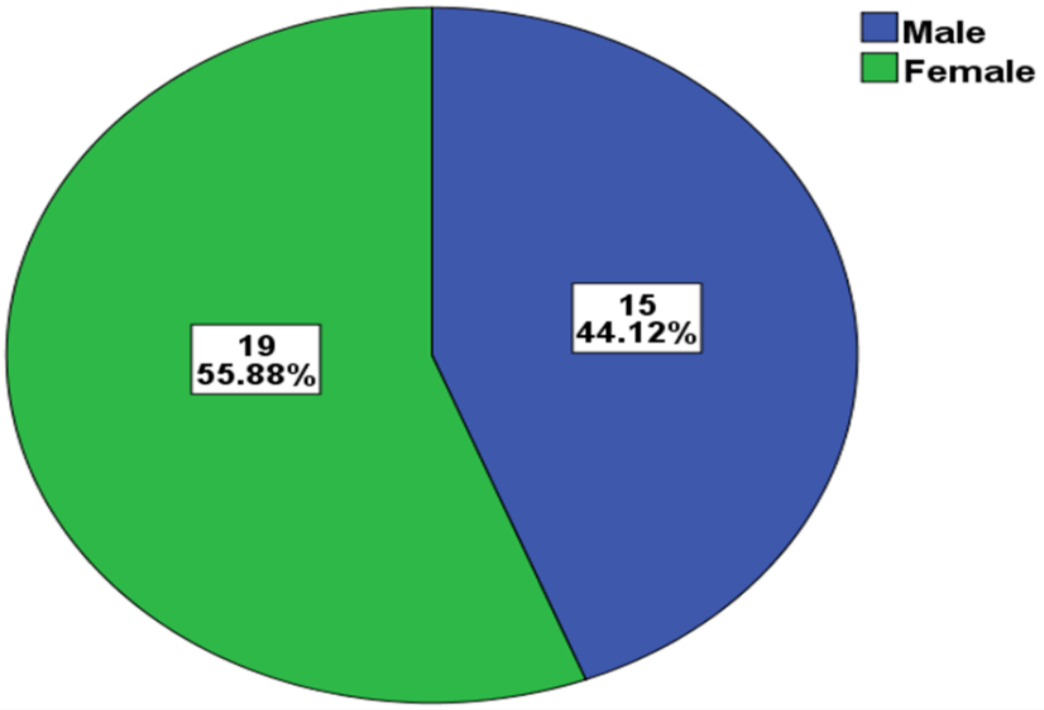

Figure (2): The gender distribution of patients with chronic liver disease

Table (3): The distribution of ECHO Findings among patients with chronic liver disease

Variable	Positive		Negative	
	Frequency	Percentage	Frequency	Percentage
Diastolic Dysfunction	14	41.2	20	58.8
Pulmonary Hypertension	2	5.9	32	94.1
Systolic Dysfunction	3	8.8	31	91.2
Pericardial Effusion	3.0	8.8	31.0	91.2
Tricuspid regurgitation	3.0	8.8	31.0	91.2
Ventricular internal dimension	0	0	34	100

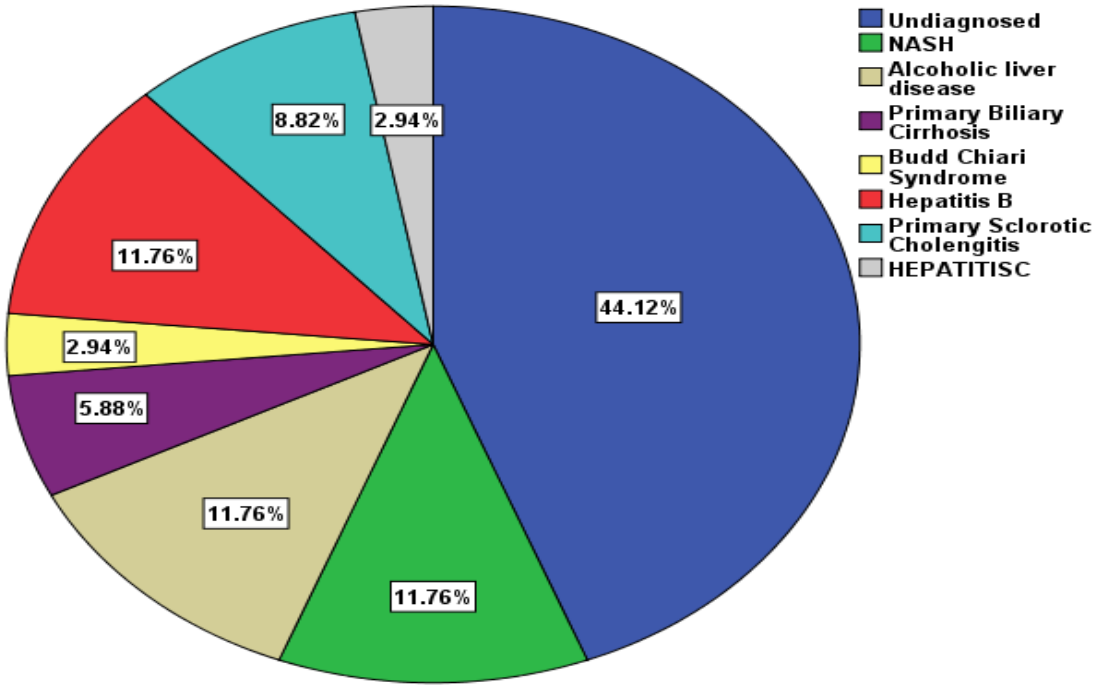

Figure (3): The distribution of causes of chronic liver disease .

Comparison of male and female patients through chi-square test showed that no significant difference was found (p,0.05) for all the above mentioned pathologies.

Table (4): The distribution of diastolic dysfunction to the age (frequency and percentage in brackets, n=34)

Age category	Diastolic Dysfunction		Total
	Negative	Positive	
Below 30 year	4 (0)	0 (0)	4 (100)
30-39 year	3 (0)	0 (0)	3 (100)
40-49 year	7 (82.5)	1 (12.5)	8 (100)
50-59 year	6 (50)	6 (50)	12 (100)
60 year or mor	0 (0)	7 (100)	7 (100)
Total	20 (58.5)	14 (41.5)	34 (100)

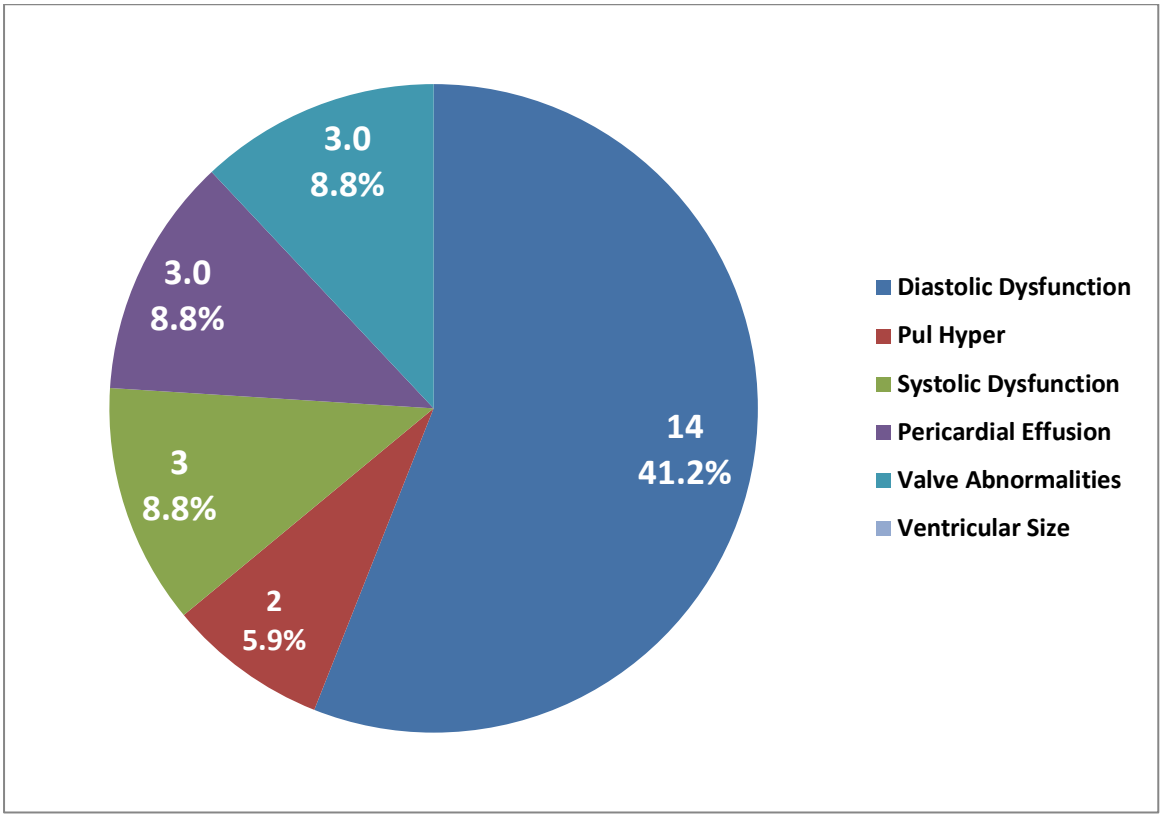

Figure (4): The distribution of Echo Findings among patients with chronic liver disease

Discussion

This study consisting of 34 patients with CLD, out of 34 cases 55.88% were female, The mean age of the patients was 48.91±12.11 year (Table 1) .the number of patient was concordant to other studies, like (Ferreira et al, 2009)[15] cross sectional study in brazil , 28 patients (19 men and 9 women),with mean age 47.5 years . and (Kazankov et al, 2011)[16] cross section study in the Denmark on 44 patients (27 men and 17 women) with mean age 53 ± 9 years.

Incidence of liver cirrhosis was found to be 44.1% , in compare with two study in Iraq (Almohana, Sadiq 2011)[17] form AL-Sader teaching hospital in AL-Najaf on thirty patients with CLD 30% were liver cirrhosis, while in (Saeed, Basil N., et al)[18] liver cirrhosis cases were 80% .

The incidence of Nonalcoholic steatohepatitis ,viral Hepatitis B, Alcoholic liver disease 11.8% were for each one , these compatible with study of (Almohana , Sadiq 2011)[17] in which Alcohol liver disease ,NASH and viral hepatitis B were (16.6% , 10%,13.3%) respectively .

Among the Echocardiographic abnormalities, the incidence of diastolic dysfunction (14cases) was found to be highest (41.2 %)

Diastolic dysfunction in the form of increased deceleration time and increase E/A ratio this is different with the study of (P. Punekar) [19] was carried on 100 indoor patients with cirrhosis and the diastolic dysfunction classified according to child pugh classification system (A/13.9%,B/35.5%, C/83.3%). In our study we didn't classified the patients according to child-pugh classification.

Incidence of pulmonary hypertension was different with study of (Saeed, Basil N., et al)[18]. This study done on 50 cases of chronic liver disease and the result was 15 cases (30%) from the total number were having features suggesting pulmonary hypertension ,the authors Classified chronic liver disease with pulmonary hypertension according to the child-Pugh staging. And the value increase with the severity of liver disease stage A ,B,C were (6%,8%,16%) respectively , in our study we didn't classified the patients according to child-pugh classification .

Incidence of Systolic dysfunction was similar to study of (echocardiography in chronic liver disease, systematic review). [21] The search based on descriptors and free terms obtained 204 articles . were selected for systematic review in November 2011 to study of CCM. Other study concordant with our findings (P. Punekar) [19] the systolic dysfunction was 6%.

pericardial effusion was different to the study of Zeki Karasu et al.[22] 2004. This study demonstrated The prevalence of pericardial effusion was 30% in advance liver disease . in our study the incidence was lower than this and our explanation we didn't classified the patient according to severity and majority of patient were on diuretics .

Correlation analysis between patient age and diastolic dysfunction showed high significant positive correlation ($p<0.001$).

We then tried to find an explanation why the diastolic dysfunction in this study increase with age ,its age related or CLD related?

In compare with other studies that done on healthy elderly individuals (Alves-Silva, Luiz Sérgio) [23],this study done on seventy three healthy individuals (64% women, aged 60 and more) with the result of a total of 33 patients (45%) presented with diastolic dysfuncion while large proportion of individuals (60 - 80 years) present normal diastolic function(55%).

While on our study 100% of patient age 60 and more showed diastolic dysfunction ,this mean the diastolic dysfunction presents with higher incidence in elderly patients with CLD in compare with healthy elderly .

Other study enhance our finding was (Kuznetsova, Tatiana, et al)[24] this study curried on randomly population sample (n539; 50.5% women; mean age, 52.5 years) with prevalence of LV diastolic dysfunction in a random sample of a general population, as estimated from echocardiographic measurements, was as high as 27.3% . while in our study higher percent of diastolic dysfunction and again our explanation is CLD .

Conclusion :

There is significant correlation between echocardiographic changes and chronic liver disease ,with higher Incidence of diastolic dysfunction in elderly CLD in compare to healthy elderly . CCM is underdiagnosed in patients with CLD, because, most of the time, the diagnosis of CCM is only established in the terminal phases of CLD

Recommendation:

1-Because of cirrhotic cardiomyopathy is underestimated we recommended the Echocardiography should be part of work up of patients with CLD especially elderly patients.

2- We recommended liver disease screen to all patients with unexplained heart failure especially elderly patients.

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