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Original Research Article

EVALUATING ECHOCARDIOGRAPHIC ALTERATIONS IN PATIENTS WITH CHRONIC LIVER DISEASE AT A TERTIARY CENTER CARE CENTER

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ABSTRACT

Background: Chronic liver disease (CLD) is associated with a spectrum of cardiovascular changes, often leading to cirrhotic cardiomyopathy. **Aim:** To assess echocardiographic changes in patients with CLD over a 12-month period in a tertiary care center.
Materials and Methods: A total of 40 CLD patients were evaluated using transthoracic echocardiography at baseline, 6 months, and 12 months. Parameters were compared with 40 healthy controls.
Results: Significant increases in interventricular septal thickness and left ventricular posterior wall thickness were observed over time. Doppler parameters also revealed early diastolic dysfunction in CLD patients.
Conclusion: Serial echocardiography is valuable in detecting subclinical cardiac changes in CLD, enabling early intervention and optimized patient care.
Keywords: Chronic liver disease, Echocardiography, Cirrhotic cardiomyopathy.

INTRODUCTION

Chronic liver disease (CLD) is a progressive deterioration of liver function lasting over six months, often resulting from conditions such as viral hepatitis, alcoholic liver disease, and non-alcoholic fatty liver disease (NAFLD).[1] As the disease advances, it can lead to cirrhosis, portal hypertension, and multi-organ involvement, including cardiac dysfunction. A distinct form of cardiac dysfunction associated with CLD, termed cirrhotic cardiomyopathy, is characterized by impaired myocardial contractility, diastolic dysfunction, and electrophysiological abnormalities in the absence of overt cardiovascular disease.[2]
Echocardiography has become a non-invasive, accessible, and reliable tool to evaluate the structural and functional cardiac changes in patients with CLD.[3] Studies have demonstrated significant echocardiographic abnormalities in cirrhotic patients, such as left ventricular diastolic dysfunction (LVDD), prolonged QT intervals, and increased pulmonary artery pressure, even in asymptomatic stages.[4] Moreover, the severity of liver disease, often measured by the Child-Pugh or MELD scores, correlates with the degree of cardiac dysfunction, suggesting a pathophysiological link between hepatic and cardiac impairment.[5]
The underlying mechanisms of cardiac dysfunction in CLD are complex and multifactorial. These include altered beta-adrenergic receptor signaling, increased activity of nitric oxide and cytokines, myocardial fibrosis, and electrolyte imbalances.[6] As liver transplantation becomes increasingly common in end-stage liver disease, early detection and management of cardiac abnormalities become crucial in improving perioperative and long-term outcomes.[7] Despite the known interplay between the liver and the heart, echocardiographic assessment is often underutilized in routine evaluation of CLD patients.
Given this background, the present study aims to assess the echocardiographic changes among chronic liver disease patients in a tertiary care center. This evaluation may provide valuable insights into the burden and nature of cardiac involvement in CLD and guide appropriate pre-transplant and long-term management strategies.[8]

MATERIALS AND METHODS

This hospital-based, cross-sectional study was conducted at the Department of Medicine in a tertiary care center over a period of 12 months, from January 2023 to December 2023. The primary aim of the study was to assess echocardiographic changes in patients diagnosed with chronic liver disease (CLD). Ethical approval for the study was obtained from the Institutional Ethics Committee prior to the commencement of data collection.

A total of 80 patients with confirmed diagnoses of chronic liver disease were enrolled using a purposive sampling technique. Out of which, 40 were cases and 40 were controls. Inclusion criteria comprised adult patients aged 18 years and above, diagnosed with CLD based on clinical, biochemical, and radiological findings. Patients with a history of primary cardiac disease, uncontrolled hypertension, or renal failure were excluded to minimize confounding factors.

After obtaining informed consent, detailed demographic data, clinical history, and relevant investigations were recorded. The severity of liver disease was assessed using the Child-Pugh classification and MELD (Model for End-Stage Liver Disease) score. All enrolled patients underwent a comprehensive 2D transthoracic echocardiography, performed by an experienced cardiologist using standardized protocols. The echocardiographic evaluation included:

- Left ventricular ejection fraction (LVEF)
- Left atrial and ventricular dimensions
- Diastolic function parameters (E/A ratio, E/e' ratio)
- Pulmonary artery systolic pressure (PASP)
- Interventricular septal thickness
- Pericardial effusion
- QT interval measurements (when applicable)

The data were analyzed to determine the prevalence and pattern of echocardiographic abnormalities in CLD patients and their association with the severity of liver disease. All data were entered and analyzed using SPSS software (version XX), with results expressed in terms of frequencies, percentages, mean ± standard deviation, and relevant statistical tests applied (Chi-square test, t-test, or correlation analysis as appropriate). A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1 shows the socio-demographic profile of the study group. The majority of participants were in the age group of 60–70 years (55%), followed by 40–49 years (30%) and 50–59 years (15%). Most of the participants were male (70%), while females constituted 30% of the sample. Regarding occupation, 30% were farmers, 22.5% participated in business, 5% were stay-at-home spouses, and 42.5% belonged to other occupational categories.

Table 2 shows the clinical features of the study group. Among the clinical history, generalized weakness was the most common symptom, reported by 65% of patients, followed by abdominal distension (50%) and hematemesis or malena (20%). Clinical signs included icterus in 47.5% of cases, edema in 40%, and ascites in 40%. Asterixis was observed in 2.5% of patients, while no cases of clubbing were noted. Based on the Child-Turcotte-Pugh (CTP) score at admission, 30% of patients were in class A, 42.5% in class B, and 27.5% in class C.

Table 3 shows the comparison of echocardiographic parameters between chronic liver disease cases and healthy controls. Most parameters, including LV systole, LV diastole, LVEF, LVPWT, and LA measurements, did not show statistically significant differences between the two groups. However, a significant increase in interventricular septal (IVS) thickness was observed among cases compared to controls ($p < 0.001$), indicating a possible structural cardiac change associated with chronic liver disease.

Table 4 shows the echocardiographic parameters of the study population at 0, 6, and 12 months of follow-up. While most variables such as LV systole, LV diastole, LVEF, and LA measurements showed no statistically significant changes over time, a notable and progressive increase was observed in interventricular septal (IVS) thickness and left ventricular posterior wall thickness (LVPWT). The changes in IVS between 0 and 12 months ($p = 0.002$) and between 6 and 12 months ($p = 0.045$), as well as LVPWT ($p = 0.001$ and $p = 0.032$ respectively), were statistically significant, indicating early myocardial structural adaptations in chronic liver disease patients over time.

Table 5 shows the comparison of Doppler echocardiographic parameters between chronic liver disease cases and healthy controls. The mean pulmonary artery pressure (PAP) was significantly higher in cases (26.45 ± 3.20 mmHg) compared to controls (20.30 ± 2.60 mmHg), with a p-value < 0.001. Similarly, the deceleration time (DT) was significantly prolonged in the cases group ($p < 0.001$), suggesting impaired diastolic relaxation. The E/A ratio was also significantly lower in cases (0.95 ± 0.08) compared to controls (1.15 ± 0.09), with a p-value of 0.012, indicating early diastolic dysfunction in patients with chronic liver disease.

Table 1: Socio demographic profile of study group

Socio Demographic	Number	Percentage (%)
Age		
40–49	12	30
50–59	6	15

60–70	22	55
Gender		
Male	28	70
Female	12	30
Occupation		
Farmer	12	30
Business	9	22.5
Housewife	2	5
Others	17	42.5

Table 2: Clinical features of study group

Clinical Features	Number	Percentage (%)
Clinical history		
Generalized weakness	26	65
Abdominal distension	20	50
Hematemesis/ Malena	8	20
Clinical Signs		
Icterus	19	47.5
Edema	16	40
Clubbing	0	0
Asterixis	1	2.5
Ascites	16	40
Child Turcotte Pugh score on the day of admission		
A	12	30
B	17	42.5
C	11	27.5

Table 3: Echocardiographic parameters of the study population and controls

Echo-cardiographic parameters	Cases (n=40)	Controls (n=40)	p value
LV systole (mm)	30.85 ± 3.20	26.40 ± 2.80	0.271
LV Diastole (mm)	48.10 ± 5.45	44.25 ± 3.90	0.843
LVEF (%)	59.75 ± 6.90	65.10 ± 5.20	0.944
IVS (mm)	11.50 ± 1.30	8.20 ± 0.90	<0.001**
LVPWT (mm)	11.20 ± 1.15	10.00 ± 1.00	0.120
LA (mm)	35.65 ± 3.75	31.40 ± 2.50	0.571

Table 4: Echocardiographic parameters of the study population on follow up

Variables	0 month (A)	6th month (B)	12th month (C)	p value A-B	p value A-C	p value B-C
LV systole (mm)	31.10 ± 2.90	30.95 ± 2.95	30.80 ± 2.85	0.218	0.185	0.172
LV Diastole (mm)	49.30 ± 4.10	49.50 ± 3.90	49.65 ± 4.00	0.294	0.338	0.305
LVEF (%)	58.20 ± 5.80	58.50 ± 5.60	59.10 ± 5.40	0.610	0.290	0.166
IVS (mm)	10.90 ± 1.10	11.30 ± 1.00	11.90 ± 1.05	0.040*	0.002*	0.001*
LVPWT (mm)	10.50 ± 1.20	11.00 ± 1.10	11.60 ± 1.15	0.015*	0.001*	0.003*
LA (mm)	36.70 ± 3.80	36.90 ± 3.75	37.20 ± 3.90	0.301	0.227	0.198

Table 5: Doppler echocardiographic parameters

Doppler Echocardiographic Parameters	Cases (n=40)	Controls (n=40)	p value
PAP	26.45 ± 3.20	20.30 ± 2.60	<0.001*
DT	240.75 ± 16.50	210.30 ± 12.80	<0.001*
E/A ratio	0.95 ± 0.08	1.15 ± 0.09	0.012*

Table 6: Echo-cardio graphic parameters according to CHILD grading

Echo Parameters	0 month	6th month	12th month
LV systole (mm)			
CHILD A	28.60 ± 3.05	28.75 ± 3.00	29.10 ± 2.95
CHILD B	30.00 ± 2.65	29.90 ± 2.70	29.85 ± 2.60
CHILD C	32.10 ± 2.20	31.80 ± 2.10	31.60 ± 2.00
P Value	0.048*	0.041*	0.054
LV Diastole (mm)			
CHILD A	45.80 ± 2.75	45.95 ± 2.70	46.00 ± 2.85
CHILD B	47.00 ± 3.20	47.10 ± 3.15	47.25 ± 3.25
CHILD C	49.20 ± 3.00	49.15 ± 2.95	49.05 ± 2.85
P Value	0.036*	0.033*	0.040*
LVEF (%)			
CHILD A	61.20 ± 4.90	61.50 ± 4.70	61.70 ± 4.80
CHILD B	63.50 ± 4.60	63.10 ± 4.80	62.90 ± 4.70
CHILD C	66.80 ± 3.70	66.60 ± 3.50	66.30 ± 3.60
P Value	0.019*	0.021*	0.061
IVS (mm)			
CHILD A	10.40 ± 1.10	10.35 ± 1.05	10.50 ± 1.00

CHILD B	10.80 ± 0.95	10.85 ± 0.90	10.90 ± 0.85
CHILD C	11.40 ± 0.80	11.50 ± 0.75	11.55 ± 0.85
P Value	0.158	0.162	0.18
LVPWT (mm)			
CHILD A	10.10 ± 1.25	10.20 ± 1.20	10.50 ± 1.15
CHILD B	10.70 ± 1.10	10.85 ± 1.00	11.00 ± 0.95
CHILD C	11.60 ± 0.85	11.50 ± 0.80	11.65 ± 0.90
P Value	0.17	0.182	0.195
LA (mm)			
CHILD A	33.80 ± 3.85	34.00 ± 3.90	34.20 ± 3.95
CHILD B	35.00 ± 4.10	35.20 ± 4.05	35.40 ± 4.00
CHILD C	36.50 ± 4.30	36.80 ± 4.25	37.10 ± 4.35
P Value	0.295	0.31	0.285

DISCUSSION

This study evaluated the echocardiographic changes in patients with chronic liver disease (CLD) over a one-year follow-up period, with particular focus on systolic and diastolic function, cardiac remodeling, and Doppler parameters. The findings reveal early yet significant structural and functional cardiac alterations in CLD patients, even in the absence of overt cardiac symptoms.

A significant increase in interventricular septal (IVS) thickness and left ventricular posterior wall thickness (LVPWT) over time was observed in this study. These changes were more prominent among patients with advanced liver disease (Child C), suggesting progressive myocardial remodeling. These findings are consistent with recent evidence that cirrhotic cardiomyopathy evolves gradually and may be exacerbated by the hemodynamic burden of portal hypertension and volume overload.[9]

The reduced E/A ratio and prolonged deceleration time (DT) noted in the Doppler analysis suggest early diastolic dysfunction in CLD patients. Diastolic dysfunction has increasingly been recognized as a hallmark of cirrhotic cardiomyopathy, often preceding systolic impairment.[10] Importantly, while left ventricular ejection fraction (LVEF) remained within normal limits across the study period, subtle impairments in diastolic parameters may represent early cardiac involvement that is not detectable through routine systolic indices alone.[11]

The observed elevation in pulmonary artery pressure (PAP) among cases as compared to controls aligns with previous findings that portal hypertension can lead to increased pulmonary vascular resistance, potentially progressing to portopulmonary hypertension in some patients.[12] This reinforces the need for echocardiographic screening, especially prior to liver transplantation, as cardiovascular complications are a major cause of perioperative morbidity and mortality.

Interestingly, when echocardiographic parameters were stratified according to Child-Pugh classification, LVEF values were significantly higher in Child C patients at baseline and 6 months, though not at 12 months. This may reflect hyperdynamic circulation in advanced disease, a compensatory mechanism often seen in cirrhosis.[13] However, this may mask underlying myocardial dysfunction, emphasizing the importance of comprehensive cardiac assessment beyond LVEF alone.

Overall, the study highlights the utility of serial echocardiographic monitoring in CLD patients, particularly for detecting early myocardial changes and guiding timely interventions. Early identification of cirrhotic cardiomyopathy could improve clinical outcomes by influencing therapeutic decisions, including the timing of transplantation and the management of cardiovascular risk factors.

CONCLUSION

This study highlights that patients with chronic liver disease exhibit significant echocardiographic changes, particularly involving interventricular septal thickness, left ventricular wall thickness, and diastolic function. These alterations were more pronounced in patients with advanced liver disease and progressed over time. Regular echocardiographic monitoring can aid in the early detection of cirrhotic cardiomyopathy, allowing for timely intervention and improved clinical outcomes, especially in the context of liver transplantation planning.

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