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Left Ventricular Diastolic Dysfunction in Chronic Liver Disease: Prevalence, Clinical Correlation, and Prognostic Significance

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Abstract: ***Left ventricular diastolic dysfunction (LVDD) in chronic liver disease patients results from splanchnic vasodilation, triggering the renin-angiotensin-aldosterone system and creating a hyperdynamic state. This condition can lead to increased risk of hepatorenal syndrome and poor prognosis. This study aims to determine the prevalence of LVDD in chronic liver disease patients at a tertiary care centre and to correlate its grades with clinical parameters and prognostic markers. In this observational study of 83 patients, LVDD was found in 76% of cases, with grades I, II and III occurring in 65 %, 28.6% and 6.4 % of patients, respectively. Higher-grade LVDD was associated with complications such as acute kidney injury, hepatic encephalopathy, and higher CTP and MELD-Sodium scores. These findings emphasize the need for early cardiac evaluation in chronic liver disease patients to mitigate adverse outcomes.***

Keywords: Diastolic dysfunction in cirrhosis, Left Ventricular dysfunction, chronic liver disease, cirrhosis, echocardiography, prognosis

1. Introduction

Chronic liver disease is typically characterised by cirrhosis of the hepatic parenchyma. Progressive worsening of liver cirrhosis leads to increased intrahepatic resistance and portal hypertension which stimulates the release of many vasodilatory mediators. The renin- angiotensin-aldosterone system and sympathetic nervous system get activated, leading to a hyperdynamic state characterised by increased heart rate and cardiac output [1]. Prolonged hyperdynamic state causes cardiac hypertrophy and other micro-structural changes like patchy fibrosis and subendothelial oedema which lead to reduced compliance of the left ventricle and cardiac dysfunction [2].

Left ventricular diastolic dysfunction (LVDD) is an early cardiac disturbance detected in cirrhotic patients and is also a predictor of poor survival in patients with advanced liver disease and Hepatorenal syndrome [3,4].

Also, the presence of cardiac diastolic dysfunction has greater significance in the post-liver transplant period as it may lead to worse outcomes [5].

The prevalence of LVDD varies from 25.7% - 81.4% according to various studies [6,7] in the western population. But the causes of liver cirrhosis vary among western and Indian population. Few studies have been conducted on Indian population to assess the true extent of diastolic dysfunction and whether it has an impact on prognosis. This study was formulated to assess the same. Understanding the correlation between LVDD and chronic liver disease complications can help improve early diagnosis and management strategies, potentially reducing morbidity and mortality in these patients.

Aims / Objectives:

1) To detect prevalence of left ventricular diastolic dysfunction in chronic liver disease patients presenting to a tertiary care centre in South India.
2) To correlate the grades of diastolic dysfunction with clinical parameters and prognostic indices of chronic liver disease.

2. Methodology

Study Design & Setting:
This was an observational study conducted in the department of Medical Gastroenterology in a tertiary care centre in South India during a period of 6 months.

Study Population:
A total of 100 patients with diagnosed chronic liver disease who presented to our tertiary health care centre were screened.

- Inclusion Criteria: All chronic liver disease patients above 18 years of age irrespective of aetiology of cirrhosis were included.
- Exclusion Criteria: Patients less than 18years of age, pregnant patients and those with prior cardiac problems or cardiac surgeries were excluded.

After applying these exclusion criteria, a total of 84 patients were included in the study.

Data Collection
Patient data was collected using a standardised data collection form. A detailed medical history taking and examination of the patient was done. Demographic details like age, gender along with presenting clinical characteristics like ascites, pedal oedema, jaundice, variceal bleed, altered sensorium and oliguria secondary to acute kidney injury were collected. The Child-Turcotte-Pugh (CTP) scores and Model for End Stage Liver Disease (MELD) scores were calculated for each grade of diastolic dysfunction. An echocardiogram was done for all patients by a competent echocardiography technician and cardiac diastolic dysfunction was diagnosed based on the American Society of Echocardiography (ASE) / European Association of Cardiovascular Imaging (EACVI) guidelines. All collected data was tabulated in Microsoft excel and data validation was performed to ensure accuracy.

Statistical analysis:
Statistical analysis was performed using SPSS software, version 28. Continuous variables were expressed as mean ± standard deviation, categorical variables were expressed as frequencies and percentages and P value was calculated.

Ethical considerations:
This was a purely observational study conducted in accordance with the Declaration of Helsinki and written informed consent was obtained from all participants.

3. Results

Among the 84 patients included in the study, 21 had normal cardiac diastolic function and 63 patients were detected to have cardiac diastolic dysfunction. The prevalence of left ventricular diastolic dysfunction was thus calculated to be 76%.

These patients with diastolic dysfunction were then graded according to the American Society of Echocardiography (ASE) / European Association of Cardiovascular Imaging (EACVI) guidelines.

The demographic details like age, gender and clinical features were studied in each grade of diastolic dysfunction. Child-Turcotte-Pugh (CTP) scores and Model for End Stage Liver Disease (MELD) scores were calculated for each grade and results tabulated as shown in Table 1.

Table 1: Characteristics of study population

	Grade 1 diastolic dysfunction	Grade 2 diastolic dysfunction	Grade 3 diastolic dysfunction	P value
Number of patients	41	18	4	
Percentage (%)	65	28.6	6.4	
Mean age (years)	56	58	64	0.002
Male : Female ratio	3.25	5.25	2	0.603
Clinical Features :				
Ascites	32 (78 %)	16 (88%)	3 (75%)	0.775
Pedal oedema	17 (41%)	8 (44%)	2 (50%)	0.271
Jaundice	9 (22%)	3 (16%)	1 (25%)	0.242
Variceal bleed	16 (39%)	6 (33%)	3 (75%)	0.162
Altered sensorium	20 (49%)	12 (66%)	4 (100%)	0.124
AKI/ HRS	7 (17%)	4 (22%)	3 (75%)	0.009
Prognostic scores :				
Mean CTP Score	8	9	11	
Mean MELD – Sodium Score	18	20	24	

Among the 63 patients with diastolic dysfunction, 65 %, 28.6% and 6.4 % had grades I, II and III diastolic dysfunctions respectively. The majority of patients with chronic liver disease had grade 1 diastolic dysfunction.

The Mean Age of the patients in this study was 55 ± 11.75. Mean age calculated in each grade of diastolic dysfunction showed a significant difference (p value – 0.002) with grade 3 diastolic dysfunction present in the older age group.

On analysing the symptoms of these patients, those with grade 3 diastolic dysfunction had a higher occurrence of variceal bleeding, altered sensorium, and acute kidney injury compared to those with grade I diastolic dysfunction, though only the presence of acute kidney injury was statistically significant (p-value 0.009). There was not much difference among the three groups in terms of occurrence of ascites, pedal oedema and jaundice.
The mean CTP and MELD - Sodium scores were significantly higher in the grade 3 diastolic dysfunction group when compared to the other two grades.

4. Discussion

The prevalence of left ventricular diastolic dysfunction in this study was 76 % which was much higher when compared to the general population where it was only as high as 27.3% [8], but comparable to other studies conducted on cirrhotic patients where the prevalence was 25.7% - 81.4% [6,7]. This shows that the presence of left ventricular dysfunction is quite significant in liver disease patients.

Among the patients with left ventricular diastolic dysfunction in this study, 65% had grade I diastolic dysfunction, 28.6% had grade II diastolic dysfunction and 6.4 % had grade III diastolic dysfunction. A similar study conducted on North Indian population showed similar results of 58.6 %, 27.5 % in grade I and Grade II diastolic dysfunction respectively but had higher levels of grade III diastolic dysfunction of 13.7 %. [4]. This could be attributed to a stricter exclusion criterion in our study where all patients with previous and co-existing cardiac disorders were excluded. Our finding was further supported by a systematic review which showed that prevalence of Grade III diastolic dysfunction was only 5.1 %. [10].

In this study, acute kidney injury secondary to hepatorenal syndrome was present in a significant proportion (75%) of patients with grade 3 diastolic dysfunction. The reason for this is, in severe diastolic dysfunction there is significant reduction of effective arterial blood volume, which can lead to decrease in renal perfusion and thus contribute to the pathogenesis of hepatorenal syndrome [4,11].

Altered sensorium secondary to hepatic encephalopathy was also higher in grade III diastolic dysfunction compared to grades I and II. This finding was also seen in other studies [4,12], thus indicating the correlation between severity of diastolic dysfunction and complications of chronic liver disease.

The prognostic indices used in this study were CTP and MELD – Sodium scores both of which showed a significant

positive correlation with the severity of diastolic dysfunction i.e greater the diastolic dysfunction, higher were the CTP and MELD-Sodium scores indicating a worse prognosis. Various other studies and meta-analysis [9,10,11,12] also reported similar findings indicating that diastolic dysfunction indeed has a significant impact on the mortality and prognosis of chronic liver disease patients. This makes the evaluation of cardiac diastolic dysfunction extremely important in all patients with chronic liver disease.

5. Conclusion

This study highlights the significant prevalence of left ventricular diastolic dysfunction in chronic liver disease patients, particularly its association with complications such as hepatorenal syndrome and hepatic encephalopathy. Higher grades of LVDD correlate with worse prognostic markers, emphasizing the importance of early cardiac evaluation in cirrhotic patients. While this study provides valuable insights, large multicentric studies are needed to further establish these findings and guide clinical interventions.

References

[1] Timoh T, Protano MA, Wagman G, Bloom M, Vittorio TJ. A perspective on cirrhotic cardiomyopathy. Transplant Proc 2011; 43:1649-1653.
[2] Moller S, Henriksen JH. Cardiovascular complications of cirrhosis. Gut. 2008; 57:268–278. doi: 10.1136/gut.2006.112177.
[3] Ruiz-del-Árbol L., Serradilla R. Cirrhotic cardiomyopathy. World Journal of Gastroenterology. 2015;21(41):11502–11521. doi: 10.3748/wjg.v21.i41.11502.
[4] Premkumar M, Devurgowda D, et al. Left Ventricular Diastolic Dysfunction is Associated with Renal Dysfunction, Poor Survival and Low Health Related Quality of Life in Cirrhosis. J Clin Exp Hepatol. 2019 May-Jun;9(3):324-333. doi: 10.1016/j.jceh.2018.08.008. Epub 2018 Aug 30. PMID: 31360025; PMCID: PMC6637070.
[5] Fouad TR, bdel-Razek WM, Burak KW, Bain VG, Lee SS. Prediction of cardiac complications after liver transplantation. Transplantation. 2009; 87:763–770. doi: 10.1097/TP.0b013e318198d734
[6] Farouk H, Al-Maimoony T, Nasr A, El-Serafy M, Abdel-Ghany M. Echocardiographic assessment of the left ventricular diastolic function in patients with non-alcoholic liver cirrhosis. Cor et Vasa. 2017; 59: 540–545
[7] Kalambokis G, Christaki M, et al. Association of left ventricular diastolic dysfunction with inflammatory activity, renal dysfunction, and liver-related mortality in patients with cirrhosis and ascites. Eur J Gastroenterol Hepatol. 2024 Jun 1;36(6):775-783. doi: 10.1097/MEG.0000000000002762. Epub 2024 Mar 19. PMID: 38526935.
[8] Tatiana Kuznetsova, Lieven Herbots et al. Prevalence of Left Ventricular Diastolic Dysfunction in a General Population. Circulation: Heart Failure, Volume 2, Number 2, 2009.doi: 10.1161/ CIRCHEARTFAILURE. 108.822627
[9] Solanki R, Sreesh S, Attumalil TV, Mohapatra SD, Narayanan V, Madhu D, Chakravorty A, Pal R, Nair ANKK, Devadas K. A case-cohort study of left ventricular diastolic dysfunction in patients with cirrhosis: the liver-heart axis. Ann Gastroenterol. 2023 Nov-Dec;36(6):678-685. doi: 10.20524/aog.2023.0837. Epub 2023 Oct 30. PMID: 38023969; PMCID: PMC10662073.
[10] Stundiene I, Sarnelyte J, Norkute A, Aidietiene S, Liakina V, Masalaite L, Valantinas J. Liver cirrhosis and left ventricle diastolic dysfunction: Systematic review. World J Gastroenterol. 2019 Aug 28;25(32):4779-4795. doi: 10.3748/wjg.v25.i32.4779. PMID: 31528101; PMCID: PMC6718042.
[11] Arbol R. D., Achecar L., Serradilla R., et al. Diastolic dysfunction is a predictor of poor outcomes in patients with cirrhosis, portal hypertension and a normal creatinine. Hepatology. 2013;58(5):1732–1741. doi: 10.1002/hep.26509
[12] Behera MK, Swain SN, Sahu MK, et al. Diastolic dysfunction is a predictor of poor survival in patients with decompensated cirrhosis. Int J Hepatol 2021; 2021: 5592376.