Section: General Surgery

Original Research Article

A STUDY OF CARDIAC FUNCTIONS IN ALCOHOLIC AND NON-ALCOHOLIC LIVER CIRRHOSIS

Pranam H J[1], Pushpa Satish Kumar[2], Ashwini D S[3], Nithya T[4]

[1]Senior Resident, Department of Internal Medicine, Dr B R Ambedkar Medical College, Kavalbyrasandra, Bengaluru, Karnataka, India
[2]Associate Professor, Department of General Surgery, Dr B R Ambedkar Medical College, kavalbyrasandra, Bengaluru, Karnataka, India
[3]Senior resident, Department of Internal Medicine, Dr B R Ambedkar medical College, kavalbyrasandra, Bengaluru, Karnataka, India
[4]Senior Resident, Department of General Surgery, Dr B R Ambedkar Medical College, Kavalbyrasandra, Bengaluru, Karnataka, India

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Corresponding Author:
Dr. Nithya T,
Email: nithyamagenta@gmail.com

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Abstract

Background: Liver cirrhosis, a significant cause of morbidity and mortality worldwide, is often complicated by cardiac dysfunction. This study aims to compare cardiac functions in patients with alcoholic and non-alcoholic liver cirrhosis and evaluate the prevalence of cirrhotic cardiomyopathy in these populations. **Materials and Methods:** This cross-sectional study was conducted for one and a half years a tertiary care hospital. A total of 100 patients diagnosed with liver cirrhosis were included in the study, with 84 having an alcoholic etiology and 16 non-alcoholic. Cardiac evaluations, including ECG and 2D echocardiography, were performed to assess systolic and diastolic functions. **Result:** The study found a mean age of 45.7 years among participants, with a male predominance (M ratio 3.54:1). Alcohol was the primary etiological factor, present in 84% of cases. QT prolongation was the most common ECG abnormality, seen in 31% of patients, while diastolic dysfunction was the most common echocardiographic abnormality, present in 41% of the subjects. **Conclusion:** QT prolongation and diastolic dysfunction are common cardiac abnormalities in liver cirrhosis, with significant prevalence in both alcoholic and non-alcoholic etiologies. Regular cardiac monitoring is recommended for cirrhotic patients to identify and manage potential cardiac complications early.

INTRODUCTION

Liver cirrhosis represents a significant global health burden, affecting millions of individuals worldwide. It is a chronic, progressive condition characterized by the replacement of normal liver tissue with fibrotic scar tissue, leading to impaired liver function. Cirrhosis results from various etiologies, including chronic viral hepatitis, alcohol abuse, non-alcoholic fatty liver disease (NAFLD), and autoimmune liver diseases.[1] Among these, alcohol-related liver disease remains one of the most prevalent causes, particularly in regions with high alcohol consumption. The condition is associated with a range of complications, including portal hypertension, hepatic encephalopathy, and hepatocellular carcinoma, all of which contribute to its high morbidity and mortality rates.[2,3]

One of the lesser-known yet significant complications of liver cirrhosis is its impact on cardiac function, a condition often referred to as cirrhotic cardiomyopathy. Cirrhotic cardiomyopathy is a unique form of cardiac dysfunction observed in patients with liver cirrhosis.[4] It is characterized by impaired cardiac contractility, diastolic dysfunction, and electrophysiological abnormalities, such as QT interval prolongation, all occurring in the absence of overt structural heart disease.[5] The condition is typically latent and may only become clinically evident under conditions of stress, such as infections, hemorrhage, or surgical procedures. The underlying pathophysiology of cirrhotic cardiomyopathy is complex and multifactorial, involving a combination of neurohumoral, inflammatory, and hemodynamic changes.[6,7]

Alcoholic liver cirrhosis, which is responsible for a substantial proportion of cirrhotic cases, has long been associated with an increased risk of cardiac dysfunction. Chronic alcohol consumption has direct cardiotoxic effects, leading to a condition known as alcoholic cardiomyopathy, which is characterized by dilated cardiac chambers and impaired systolic function.[8] However, in the context of cirrhosis, the cardiac dysfunction observed extends beyond the typical features of alcoholic cardiomyopathy, suggesting that cirrhosis itself contributes to the cardiac abnormalities. This raises important questions about the distinct and overlapping

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mechanisms of cardiac dysfunction in alcoholic versus non-alcoholic cirrhosis.[9]

Non-alcoholic liver cirrhosis, on the other hand, encompasses a broad spectrum of etiologies, including chronic viral hepatitis, autoimmune hepatitis, and NAFLD. These conditions are also associated with systemic inflammation, altered cardiac hemodynamics, and metabolic disturbances, all of which can adversely affect cardiac function. Despite these associations, the cardiac effects of non-alcoholic cirrhosis have been less extensively studied compared to alcoholic cirrhosis, leaving a gap in our understanding of the full spectrum of cirrhotic cardiomyopathy.[10]

Given the increasing recognition of cirrhotic cardiomyopathy as a significant contributor to the morbidity of liver cirrhosis, there is a need for further research to elucidate the prevalence and characteristics of cardiac dysfunction in different etiological subtypes of cirrhosis. Understanding these differences is crucial for the development of targeted strategies for the early detection and management of cardiac complications in cirrhotic patients.

This study aims to address this knowledge gap by systematically comparing cardiac functions in patients with alcoholic and non-alcoholic liver cirrhosis. Through a comprehensive analysis of electrocardiographic (ECG) and echocardiographic parameters, we seek to identify the prevalence of specific cardiac abnormalities in these populations and explore potential differences in the patterns of cardiac dysfunction. By doing so, we hope to provide insights that could inform clinical practice, particularly in terms of routine cardiac monitoring and risk stratification in patients with liver cirrhosis.

Furthermore, this study will contribute to the growing body of evidence on cirrhotic cardiomyopathy and its implications for the overall management of liver cirrhosis. By highlighting the cardiac risks associated with both alcoholic and non-alcoholic liver cirrhosis, we aim to emphasize the importance of a multidisciplinary approach to the care of these patients, integrating hepatology, cardiology, and general medicine.

MATERIALS AND METHODS

Study Design: This cross-sectional, observational study was conducted at a tertiary care hospital over two years, from January 2021 to December 2023.

Study Population: A total of 100 patients diagnosed with liver cirrhosis were included in the study. Patients were divided into two groups based on the etiology of cirrhosis: alcoholic (84 patients) and non-alcoholic (16 patients).

Inclusion Criteria

- Patients aged 18 years and above
- Diagnosed cases of liver cirrhosis based on clinical, biochemical, and radiological evidence
- Willingness to participate in the study

Exclusion Criteria

- Patients with pre-existing cardiac disease
- Hypertensive patients
- Diabetics with long-term complications
- Patients with chronic renal disease
- Those on cardiotoxic drugs

Data Collection: Data on demographic characteristics, clinical history, and laboratory findings were collected using a structured proforma. Cardiac evaluations included:

- Electrocardiography (ECG): To assess rhythm abnormalities, particularly QT prolongation.
- 2D Echocardiography: To evaluate systolic and diastolic functions, focusing on left ventricular ejection fraction (LVEF) and diastolic dysfunction markers.

Statistical Analysis: The data were analyzed using SPSS version 27. Descriptive statistics were used to summarize the data. Chi-square tests were employed to evaluate associations between categorical variables, and independent t-tests were used for continuous variables. A p-value of <0.05 was considered statistically significant.

RESULTS

Demographic and Clinical Characteristics: The mean age of the study population was 45.7 years (range: 25-73 years), with a significant male predominance (78%). The majority of patients (68%) were within the 36-55 age group. Alcohol was identified as the primary etiology in 84% of the cases.

Etiological Distribution: The study found that alcohol was the predominant cause of cirrhosis, either alone (73%) or in combination with viral hepatitis (11%).

ECG Findings: QT prolongation was observed in 31% of patients, making it the most common ECG abnormality. Sinus tachycardia was noted in 12% of patients.

Echocardiographic Findings: Diastolic dysfunction was the most common echocardiographic abnormality, observed in 41% of the patients, followed by systolic dysfunction in 7%.

Correlation with Etiology: A comparison of ECG and echocardiographic findings across different etiologies showed that alcohol-related cirrhosis was associated with a higher prevalence of both QT prolongation and diastolic dysfunction.

Table 1: Age Distribution of Patients.

Age Group (Years)	Frequency	Percentage
25-35	14	14%
36-45	34	34%
46-55	34	34%
>55	18	18%

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Total	100	100%

Table 2: Gender Distribution

Gender	Frequency	Percentage
Males	78	78%
Females	22	22%
Total	100	100%

Table 3: Etiological Distribution

Etiology	Frequency	Percentage
Alcohol Only	73	73%
HBsAg Positive	6	6%
HCV Positive	4	4%
Alcohol + HBsAg	2	2%
Alcohol + HCV	9	9%
Others	6	6%
Total	100	100%

Table 4: ECG Findings

ECG Finding	Frequency	Percentage
Normal Sinus Rhythm	51	51%
QT Prolongation	31	31%
Sinus Tachycardia	12	12%
Others (LBBB, RBBB)	6	6%
Total	100	100%

Table 5: 2D Echocardiography Findings

Echocardiographic Finding	Frequency	Percentage
Normal	48	48%
Diastolic Dysfunction	41	41%
Systolic Dysfunction	7	7%
Dilated Cardiomyopathy	4	4%
Total	100	100%

Table 6: Correlation Between ECG Findings and Etiology

Etiology	QT Prolongation	Sinus Tachycardia	Normal ECG	Total
Alcohol	24	5	39	73
HBsAg Positive	2	2	2	6
HCV Positive	2	0	2	4
Alcohol + HBsAg	0	1	1	2
Alcohol + HCV	3	2	4	9
Others	0	2	4	6
Total	31	12	51	100

Table 7: Correlation Between Echocardiographic Findings and Etiology

Etiology	Diastolic Dysfunction	Systolic Dysfunction	Normal	Total
Alcohol	28	4	38	73
HBsAg Positive	4	0	2	6
HCV Positive	2	1	1	4
Alcohol + HBsAg	1	0	1	2
Alcohol + HCV	5	2	2	9
Others	1	0	4	6
Total	41	7	48	100

DISCUSSION

The findings of this study underscore the significant prevalence of cardiac dysfunction in patients with liver cirrhosis, highlighting the importance of recognizing cirrhotic cardiomyopathy as a serious complication associated with this condition. The study demonstrates that both alcoholic and non-alcoholic liver cirrhosis are associated with specific cardiac abnormalities, with QT prolongation and diastolic dysfunction being the most common findings. These results align with the growing body of literature that identifies cirrhotic cardiomyopathy as a distinct clinical entity with important implications for the management of cirrhotic patients.[11,12]

Cirrhotic Cardiomyopathy: Pathophysiology and Clinical Implications

Cirrhotic cardiomyopathy is characterized by a combination of systolic and diastolic dysfunction, along with electrophysiological abnormalities such as QT interval prolongation. The pathophysiology of cirrhotic cardiomyopathy is multifaceted, involving complex interactions between the heart and liver. In cirrhosis, there is a state of chronic systemic inflammation, neurohormonal activation, and

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autonomic dysfunction, all of which contribute to impaired cardiac function. Elevated levels of pro-inflammatory cytokines, such as tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6), have been implicated in the development of myocardial inflammation and fibrosis, leading to both systolic and diastolic dysfunction.[13,14]

The neurohormonal alterations in cirrhosis, including increased activity of the renin-angiotensin-aldosterone system (RAAS) and sympathetic nervous system, also play a crucial role in the pathogenesis of cirrhotic cardiomyopathy. These changes result in altered cardiac contractility, impaired relaxation during diastole, and increased susceptibility to arrhythmias. The QT interval prolongation observed in cirrhotic patients is particularly concerning, as it predisposes to the development of life-threatening ventricular arrhythmias, such as torsades de pointes.[15]

Alcoholic vs. Non-Alcoholic Cirrhosis: Cardiac Dysfunction

The comparison between alcoholic and non-alcoholic liver cirrhosis in this study reveals important differences in the prevalence and types of cardiac abnormalities. Alcoholic cirrhosis is associated with a higher prevalence of both QT prolongation and diastolic dysfunction, suggesting that chronic alcohol consumption exacerbates the cardiac burden in cirrhotic patients. This finding is consistent with the known cardiotoxic effects of alcohol, which include direct myocardial injury, mitochondrial dysfunction, and the promotion of oxidative stress. Alcoholic cardiomyopathy, characterized by dilated cardiac chambers and impaired systolic function, is well-documented in the literature. However, the present study highlights that even in the absence of overt alcoholic cardiomyopathy, patients with alcoholic cirrhosis are at increased risk for cardiac dysfunction.[16]

In contrast, non-alcoholic cirrhosis, which encompasses a broad spectrum of etiologies including viral hepatitis, autoimmune hepatitis, and NAFLD, also demonstrates a significant prevalence of cardiac dysfunction, albeit with some differences in the patterns of abnormalities. The lower prevalence of QT prolongation in non-alcoholic cirrhosis may be related to differences in the underlying pathophysiology. For instance, in viral hepatitis-related cirrhosis, the cardiac effects may be more closely linked to systemic inflammation and immune-mediated mechanisms rather than direct cardiotoxic effects.[17]

Diastolic Dysfunction in Cirrhosis

Diastolic dysfunction was the most common echocardiographic finding in this study, observed in 41% of the patients. Diastolic dysfunction in cirrhosis is characterized by impaired ventricular relaxation and increased ventricular stiffness, leading to elevated filling pressures and a reduction in cardiac output during periods of increased demand. This type of dysfunction is often subclinical and may not manifest with overt symptoms until the patient is exposed to stressors, such as surgery, infection, or fluid overload. The high prevalence of diastolic dysfunction in cirrhotic patients underscores the need for routine echocardiographic monitoring, particularly in those undergoing procedures or experiencing acute decompensation.[18]

QT Prolongation: Clinical Significance and Management

The observation that 31% of the study population exhibited QT prolongation is clinically significant. Prolongation of the QT interval is a well-known risk factor for the development of ventricular arrhythmias, which can lead to sudden cardiac death. In cirrhotic patients, QT prolongation may result from a combination of factors, including electrolyte imbalances (such as hypokalemia and hypomagnesemia), autonomic dysfunction, and the effects of medications commonly used in this population. Given the increased risk of arrhythmias, cirrhotic patients with QT prolongation should be closely monitored, and electrolyte abnormalities should be promptly corrected. Additionally, the use of QT-prolonging medications should be minimized, and alternative therapies should be considered where possible.[19]

Implications for Clinical Practice

The findings of this study have several important implications for clinical practice. First, the high prevalence of cardiac abnormalities in cirrhotic patients, particularly in those with alcoholic cirrhosis, highlights the need for routine cardiovascular assessment as part of the comprehensive management of liver cirrhosis. Early detection of cirrhotic cardiomyopathy through ECG and echocardiography can facilitate timely interventions, such as the optimization of medical therapy, avoidance of potential triggers for cardiac decompensation, and careful monitoring during periods of stress.[20]

Second, the study emphasizes the importance of a multidisciplinary approach to the management of cirrhotic patients, involving collaboration between hepatologists, cardiologists, and general practitioners. Such an approach is essential for the early identification and management of cardiac complications, which can significantly impact the overall prognosis and quality of life of cirrhotic patients.

Third, the differential impact of alcoholic versus non-alcoholic cirrhosis on cardiac function suggests that specific etiological factors should be considered when assessing the risk of cardiac dysfunction in cirrhotic patients. Tailoring the cardiovascular assessment and management plan based on the underlying etiology of cirrhosis may improve patient outcomes and reduce the burden of cardiac complications in this population.

Limitations and Future Research

While this study provides valuable insights into the cardiac dysfunction associated with liver cirrhosis, there are several limitations that should be acknowledged. The study was conducted at a single

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tertiary care center, which may limit the generalizability of the findings to other populations. Additionally, the cross-sectional design of the study precludes the ability to assess the temporal relationship between cirrhosis and the development of cardiac dysfunction. Longitudinal studies are needed to better understand the progression of cirrhotic cardiomyopathy and the impact of various interventions on cardiac outcomes.

Future research should also explore the molecular and cellular mechanisms underlying cirrhotic cardiomyopathy, particularly in relation to different etiological subtypes of cirrhosis. Such studies could provide insights into potential therapeutic targets for the prevention and treatment of cardiac dysfunction in cirrhotic patients. Furthermore, the role of novel biomarkers in the early detection of cirrhotic cardiomyopathy warrants investigation, as these could enhance the ability to identify high-risk patients and initiate appropriate interventions.

CONCLUSION

This study demonstrates that cardiac dysfunction, particularly QT prolongation and diastolic dysfunction, is common in patients with liver cirrhosis, regardless of the underlying etiology. Alcoholic cirrhosis is associated with a higher prevalence of these abnormalities, highlighting the need for heightened vigilance in this group. Regular cardiac assessment should be integrated into the management protocol for cirrhotic patients to mitigate the risk of cardiac complications.

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