

Evaluation of Functional and Structural Cardiac Status of Adult Patients with Cirrhosis of Liver

Archit Dahiya¹, Parvati Nandy², Isha Nandal³

Authors Affiliation: ¹Senior Resident, Department of Medicine, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences or PGIMS, Rohtak, Haryana 124001, India. ²Professor, Department of Medicine, Sikkim Manipal Institute of Medical Sciences (SMIMS), Gangtok, Sikkim 737102, India. ³PG Trainee, SGT Medical College, Gurugram, Haryana 122505, India.

Abstract

Introduction: Cardiac abnormalities in patients with cirrhosis includes a combination of reduced cardiac contractility with systolic and diastolic dysfunction and electrophysiological abnormalities. This study will aim to evaluate the structural and functional abnormalities of cardiac function in patients with cirrhosis of liver, correlate such abnormalities with the severity of the cirrhosis such that, in future the cardiac aspects of cirrhosis of liver can also be catered to, during the patient's treatment. **Methods:** This hospital based observational study was conducted for a period of one year and included 100 cases of cirrhosis of liver. A 12-lead ECG and 2D ECHO was performed in all patients. The left ventricular mass was calculated using the formula known as the 'ASE- cube formula'. Patients were classified under MELD criteria. **Results:** In our study, 68% patients were having MELD score between 19-24. There was significant statistical correlation of MELD with QTc, LVEDD, LV mass and E/A ratio. This study showed that QTc prolongation is a frequent finding in patients with liver disease. The LVEF was normal ($\geq 55\%$) in all patients of the study group. The left atrial diameter and left ventricular end diastolic diameter was above normal limits in 100% and 17% of patients of the study group respectively. LV mass was more than the normal in 49% of the patients. The E/A ratio was ≤ 1.0 in 94% of the patients. **Conclusion:** Clinicians need to be aware of the occurrence of cardiac dysfunction in long standing patients of cirrhosis of liver, especially those who are decompensated with complications like ascites. Cardiac evaluation with non-invasive investigations like ECG and echocardiography should be included in the diagnostic algorithm of such patients to simultaneously identify cardiac compromise and to tailor therapy of such patients so as not to further worsen the cardiac overload and diastolic dysfunction.

Keywords: Cirrhosis; ECHO; ECG.

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Introduction

Cirrhosis is a chronic disease of the liver that leads to a number of complications, some of which

may eventually prove fatal. Cardiac abnormalities in patients with cirrhosis includes a combination of reduced cardiac contractility with systolic and diastolic dysfunction and electrophysiological abnormalities [1]. These changes occur in the absence of overt congestive ventricular failure and with only modest changes such as mild chamber dilatation.

Cirrhotic cardiomyopathy is a form of chronic cardiac dysfunction in patients with cirrhosis and include baseline increased cardiac output,

Corresponding Author: Archit Dahiya, Senior Resident, Department of Medicine, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences or PGIMS, Rohtak, Haryana 124001, India.

E-mail: dahiya.archit@gmail.com

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attenuated systolic contraction or diastolic relaxation and electrical conductance abnormalities (prolonged QT interval). These effects are more pronounced in patients with ascites compared to those without.

How this hyperkinetic circulation in cirrhosis affects cardiac function has not been described completely. This study gives a significance to early detection of cardiac abnormalities in cirrhosis and by managing them, can cardiac complications and morbidity due to cirrhosis be even slightly altered?.

Hence, this study will aim to evaluate the structural and functional abnormalities of cardiac function in patients with cirrhosis of liver, correlate such abnormalities with the severity of the cirrhosis such that, in future the cardiac aspects of cirrhosis of liver can also be catered to, during the patient's treatment.

Methods

This hospital based observational study was conducted at Department of Medicine, Central Referral Hospital, SMIMS, Tadong, Sikkim for a period of one year and included 100 cases of cirrhosis of liver.

Patients who do not give their consent were excluded or those with cirrhosis of liver but with predisposing factors for other cardiac diseases (like hypertension, COPD, Ischaemic heart disease, congenital heart disease, rheumatic heart disease, pericardial disease etc.) or patients with acute alcohol intoxication or with history of recent haemorrhage were excluded. Patients with severe anaemia, thyroid disorders and pregnancy were also excluded. A 12-lead ECG and 2D ECHO was performed in all patients.

Patients were classified under MELD criteria (Model for end stage liver disease).

Formula for calculating the same was:

$$\text{MELD} = 3.78 [\text{Ln serum bilirubin (mg/dL)}] + 11.2 [\text{Ln INR}] + 9.57 [\text{Ln serum creatinine (mg/dL)}] + 6.43$$

The left ventricular mass was calculated using the formula known as the 'ASE- cube formula'

$$\text{LV Mass (g)} = 0.8\{1.04\{[(\text{LVEDD} + \text{IVS} + \text{LVPW})^3 - \text{LVEDD}^3]\} + 0.6$$

Where,

LV = left ventricle

LVEDD = Left ventricular end diastolic diameter

LVPW = Left ventricular posterior wall thickness

IVS = Interventricular septal wall thickness

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean \pm SD (Min-Max) and results on categorical measurements are presented in Number (%). P-value was obtained either using Chi-square test or Fisher's exact test, depending upon the sample size. A p-value <0.05 was considered to be significant statistically. Significance is assessed at 5% level of significance.

Results

In our study, 68% patients were having MELD score between 19-24 and mean MELD score was 23. Severity of cardiac abnormalities increased with increase in the MELD score. There was significant statistical correlation of MELD with QTc, LVEDD, LV mass and E/A ratio. 56% patients were having ECG changes. Of the 56 cases with ECG changes, 54 had long QTc intervals and the other two had nonspecific ST and T-Wave changes. This study showed that QTc prolongation is a frequent finding in patients with liver disease. The prolongation of QTc interval correlated with the severity of liver damage and occurred independent of etiology.

The LVEF (left ventricular ejection fraction) was normal ($\geq 55\%$) in all patients of the study group with mean LVEF of 61.34%. The LAD (left atrial diameter) was above normal limits in all patients of the study group with mean LAD of 39.85 mm. The LVEDD (left ventricular end diastolic diameter) was above normal limits in 17% of patients of the study group with mean LVEDD of 45.85 mm. LV mass (left ventricular mass) was more than the normal limits (male >200 gm and female >150 gm) in 49% of the patients, with a mean value of 169.9 ± 31.50 gm. The E/A ratio was ≤ 1.0 in 94% of the patients with mean value of E/A ratio of 0.89 ± 0.16 .

Discussion

A study done by Chawla YK et al. [2] reported mean MELD score of 17.7 in their study and concluded that MELD score has maintained excellent diagnostic accuracy in both alcoholic and non-alcoholic groups of patients with cirrhosis of liver. Our study reported mean MELD score of 23.

Josefsson A et al. [3] and Tarek A et al. [4] reported long QTc intervals in 31.5% and 40% of patients respectively in their studies. Long QTc is associated with sudden death due to arrhythmias [3]. Careful cardiac evaluation of those with long QTc intervals

is important due to high risk of arrhythmias and caution should be used while administering drugs which can cause prolonged QTc interval (like sotalol, amiodarone, procainamide, domperidone, furosemide).

A study done by Wong et al. [5] reported mean E/A ratio of 0.9 ± 0.1 gm. E/A ratio normalizes in patients after receiving liver transplantation [6]. The paradoxical normal LVEF value in the face of diastolic dysfunction could probably be because of normal preload and after load of the cirrhotic heart as explained by Muller et al. [6].

Wong et al. [5] also reported mean LV mass of 171.4 ± 20 gm. Ventricular remodeling could be related to the trophic effects of activated neurohormonal systems such as noradrenaline, or angiotensin II with or without the synergistic effects of endothelin-1 [7,8]. It may also be due to myocardial adaptation to a chronically elevated blood volume.

Thus, we see that there is a significant alteration in the ECG and echocardiographic features of patients with cirrhosis of liver with ascites, with mean MELD score of 23, and the cardiac abnormalities, although subclinical had a tendency to rise with rising MELD score, with significant statistical correlation of MELD with QTc, LVEDD, LV mass and E/A ratio.

Conclusion

Clinicians need to be aware of the occurrence of cardiac dysfunction in long standing patients of cirrhosis of liver, especially those who are decompensated with complications like ascites. Cardiac evaluation with non-invasive investigations like ECG and echocardiography should be included in the diagnostic algorithm of such patients to simultaneously identify cardiac compromise and to tailor therapy of such patients so as not to further worsen the cardiac overload and diastolic dysfunction. All patients with cirrhosis of liver should be screened for structural

and functional cardiac abnormalities, irrespective of age, sex or cause of cirrhosis. The presence of the cardiomyopathy should be suspected in patients with worsening hemodynamics, and such patients may benefit from more aggressive monitoring and treatment of the underlying pathology leading to decompensation, with close monitoring during procedures likely to cause decompensation (i.e., TIPS, paracentesis, and transplant).

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