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Study of Electrocardiographic Findings in Alcoholic Chronic Liver Disease Patients and Its Relationship with Modified Child Pugh Turcotte Score

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Abstract Original Research Article

Background: Cardiac dysfunction in cirrhotic patients is well evident. Severity of cirrhosis is measured by Child Pugh Score (CPS). A low-voltage ECG is an important tool to evaluate the cardiac dysfunction. ***Aims and Objectives:*** To study the electrocardiographic findings and correlate it with modified CPS in patients of alcoholic chronic liver disease. ***Materials and Methods:*** Hundred subjects were studied after dividing them in to Cases (n=50, patients of chronic liver disease, the etiology of which is excessive long term alcohol intake) and Control (n=50, patients of chronic liver disease, the etiology of which will be non-alcoholic) in the Department of Medicine, J A Group of Hospitals, G.R. Medical College Gwalior (M.P.) from Nov 2016 to Aug 2018. Details of symptomatology, hemogram, liver function test, renal function test, lipid profile, blood sugar, blood albumin were estimated. All the subjects underwent ECG assessment after dividing them as per modified CPS. ***Results:*** Chronic liver disease was more prevalent among the age group of 31-50 years. Majority of the patients with swelling of legs, jaundice, abdominal pain, fever, altered sensorium, constitutional symptoms, hematemesis /malena and abdominal distension had Child PUGH Score of C. Majority of patients with icterus, ascites, oedema, clubbing, splenomegaly, asterixis, parotid enlargement, spider naïve, fetor hepaticus and loss of body hair had CPS of C. Majority of the patients with QT prolongation (p=0.024), chamber enlargement (p=0.025) and conduction defects (p=0.046) had CPS of C as compared to control groups. Patients with arrhythmias, ST-T changes, sinus bradycardia, sinus tachycardia and low voltage complex were equally distributed between all CPS class (p>0.05). ***Conclusion:*** Electrocardiographic changes in a form of QTc prolongation, chamber enlargement and conduction defects were significantly associated with CPS of C hence making an important tool in identifying the severity of liver cirrhosis.

Keywords: Child PUGH Score, cardiac abnormality, chronic liver disease, alcohol.

INTRODUCTION

Alcohol abuse is the leading cause of mortality in people aged 15–49 years, and the total expenditure amounts to billions of dollars. In developing countries, alcohol is the most common aetiology of cirrhosis [1]. Histological abnormalities occurring in alcoholic liver disease can range from steatosis to hepatocellular carcinoma (HCC).

The relationship between alcohol consumption and cardiovascular diseases is complex. Light to moderate drinking can have a beneficial impact on morbidity and mortality for ischaemic heart disease and ischaemic stroke. However, the beneficial cardio protective effect of drinking disappears with heavy drinking occasions. A recent meta-analysis reported that on average, light to moderate drinkers experienced no protective effect if they reported at least one heavy drinking occasion per month. Moreover, alcohol consumption has detrimental effects on hypertension, cardiac dysrhythmias and haemorrhagic stroke, regardless of the drinking pattern [2].

The correlations between alcohol consumption and cirrhosis of liver have been dealt with great detail. As with the many studies that have looked upon the mortality of the patients with cirrhosis, the speed of progression of the disease and the various situations in which the condition of the patient deteriorates, many have been inconclusive about the reason for death in patients of cirrhosis of liver as the disease progresses [3].

Kowalski *et al*. reported that patients with cirrhosis had abnormal cardiovascular function and a prolonged QT interval. Advanced liver cirrhosis is associated with an increase in blood volume, a reduction in systemic vascular resistance, and an increase in cardiac output. How this hyperkinetic circulation affects cardiac function and structure has been incompletely described. Evidence has been produced that left ventricular systolic function is usually normal at rest in cirrhotic patients; scanty information is available on whether this applies to diastolic function and cardiac structure as well [4].

In present study we tried to study the electrocardiographic findings and its relationship with modified Child Pugh Turcotte score in patients with alcoholic liver disease.

MATERIALS AND METHODS

Present case control study was performed on 100 subjects after dividing them in to cases (n=50, patients of chronic liver disease, the etiology of which is excessive long term alcohol intake) and control (n=50, patients of chronic liver disease, the etiology of which will be non-alcoholic) in the Department of Medicine, J A Group of Hospitals, G.R. Medical College Gwalior (M.P.) from Nov. 2016 to Aug 2018.

Chronic liver disease was defined on the basis of abdominal ultrasonography, fibroscan and clinical feature. Chronic excessive alcohol intake was defined as consumption of more than 40 g per day for more than 10 years in men and more than 20 g per day for more than 10 years in women.

All cases and controls were subjected to detailed clinical evaluation, including presenting symptomatology, duration of illness, history of alcohol consumption, hepatitis, co-morbid conditions, treatment and addiction history and family history, clinical examination, anthropometric measurements, routine investigations (Hemogram, LFT, RFT, Lipid Profile, Ultrasonography, PT-INR, Blood sugar level, Serum Albumin) and were subjected to standard 12 lead electrocardiogram. All patients were classified according to modified Child Pugh Turcotte Score.

Patient of CLD not receiving any cardiac drug or any drug that can affect the ECG parameter, age below 18 and above 60 years, documented or detected cases of coronary artery disease, pre-existing benign cardiac arrythmia, pre-existing cardiomyopathy secondary to non-cirrhotic and non-alcoholic etiology, chronic kidney disease, chronic inflammatory conditions, heart failure, hypertension, cerebrovascular disease, COPD and those who did not provide consent for the study were excluded from the present study.

All the data analysis was done using IBM SPSS ver. 20 Software. Cross tabulation and frequency distribution was used to prepare tables. Microsoft office 2010 was used to prepare the graphs. Paired sample t test and one way ANOVA was used to compare the mean where as categorical data was compare using Chi square test. Level of significance was assessed at 5%.

RESULTS

Majority of the patients belong to age group of 31-40 (n=16) and 41-50 years (n=19) among case and control respectively. There was equal distribution of ages among both the groups (p=0.068).

Majority of the subjects in both the groups had Child Pugh Score of C (n=45) followed by B (n=41) and A (n=14).Among Cases, majority of the patients had modified Child PUGH Score of C (n=24) followed by B(n=20) and A (n=6) whereas Modified Child PUGH Score B (n=21) and C (n=21) was equally distributed among control and in Modified Child PUGH Score A class there were 8 patients.

Majority of the patients has constitutional symptoms followed by abdominal distension (n=43), swelling over legs (n=32), abdominal pain (n=15) and fever (n=12) as compared to control where constitutional symptoms (n=45) followed by abdominal distension (n=43), swelling over legs (n=32), abdominal pain (n=15) and fever (n=12).

Table-1: Symptoms wise distribution according to modified Child PUGH Score

Symptoms	Group (A) Case (n=50)			Group B Control (50)			Total
	Modified Child PUGH Score			Modified Child PUGH Score			
	A	B	C	A	B	C	
Swelling over legs	0	14	18	1	18	19	70
Jaundice	0	4	7	1	8	10	30
Abdominal pain	0	7	8	0	8	11	34
Fever	0	6	6	0	9	9	30
Altered sensorium	0	3	6	1	7	7	24
Constitutional symptoms	5	18	22	7	20	21	93
Hematemisis /malena	0	4	5	0	8	6	23
Abdominal distension	1	18	24	3	21	19	86

Table-2: Sign wise distribution according to modified Child PUGH Score

Signs	Group (A) Case (n=50)			Group B Control (50)			Total
	Modified Child PUGH Score			Modified Child PUGH Score			
	A	B	C	A	B	C	
Icterus	0	2	6	2	2	6	18
Ascites	0	17	23	2	14	20	76
Oedema	2	17	20	4	14	16	73
Clubbing	0	4	7	0	5	4	20
Splenomegaly	0	5	18	0	6	13	42
Asterixis	0	1	8	0	2	5	16
B/L Parotid enlargement	0	2	4	0	1	2	9
Spider naïve	2	3	7	2	3	5	22
Fetor Hepaticus	0	4	5	0	2	3	14
Loss of Body Hair	2	8	9	2	9	4	34

All grades of anemia were almost equally distributed between both the groups (p=0.615), Leucocytosis and Leucopenia was also equally distributed (p=0.853) similarly serum bilirubin (p=0.235), hypoalbumunimia (P=0.410), PT (p=0.414), blood urea (p=0.218) and serum creatinine (p=0.218) were equally distributed among both the groups. Thrombocytopenia was significantly higher among cases (n=28) and compared to control (n=18) (p=0.045).

Table-3: Haemogram wise distribution according to modified Child PUGH Score

Blood Parameters		Group (A)Case (n=50)			Group BControl (50)			Total
		Modified Child PUGH Score			Modified Child PUGH Score			
		A	B	C	A	B	C	
Hb%	Normal	2	0	2	2	0	2	8
	Mild	2	3	1	2	3	1	12
	Moderate	2	10	5	4	10	9	40
	Severe	0	7	16	0	8	9	40
TLC	Normal	3	14	13	4	12	10	56
	Leucocytosis	2	5	7	3	8	7	32
	Leucopenia	1	1	4	1	1	4	12
Platelet	Normal	4	12	6	7	13	12	54
	Thrombocytopenia	2	8	18	1	8	9	46
Serum bilirubin	Normal	4	19	18	5	19	12	77
	Elevated	2	1	6	3	2	9	23
Hypoalbuminimea	Yes	2	6	14	2	5	11	40
	No	4	14	10	6	16	10	60
Prothrombin time	Normal	6	14	9	7	15	11	62
	Deranaged	0	6	15	1	6	10	38
Blood Urea	Normal	5	20	17	7	21	18	88
	Elevated	1	0	7	1	0	3	12
Serum Creatinine	Normal	5	20	1	7	21	18	72
	Elevated	1	0	7	1	0	3	12

Patients with abnormal ECG were significantly higher among cases (n=38) as compared to control group (p=0.012).

Majority of the Cases with abnormal ECG had Child PUGH Score of C (n=18) as compared to control group where abnormal ECG was equally distributed across all Child PUGH Score types. Patients with QT prolongation (p=0.023), chamber enlargement (p=0.025) and conduction defects (p=0.046) were significantly higher among the cases as compared to control groups. Patients with arrhythmias, ST-T Changes, sinus bradycardia sinus tachycardia and low voltage complex were equally distributed between groups (p>0.05).

Table-4: ECG finding in study population

ECG findings	Case (Child Pugh Score)			Control (Child Pugh Score)			P value
	A	B	C	A	B	C	
QTc prolongation	1	4	18	0	2	8	0.024
Chamber enlargement	0	3	6	0	2	0	0.025
Conduction defects	0	5	3	0	1	1	0.046
Arrhythmias	0	2	3	0	2	2	0.727
ST-T Changes	0	4	4	0	3	3	0.564
Sinus Bradycardia	0	0	4	0	1	0	0.169
Sinus Tachycardia	1	3	0	1	4	0	0.727
Low voltage complex	0	3	3	3	0	3	1.00

DISCUSSION

Alcoholic liver disease, a leading cause of morbidity, mortality, and cirrhosis, can range from simple steatosis to hepatocellular carcinoma. Multiple mechanisms such as oxidative stress, mitochondrial dysfunction, and alteration in gut-liver axis have been proposed for the pathogenesis of alcoholic liver disease. Alcohol consumption is responsible for 3.8% of global mortality and 4.6% of disability adjusted life-years (DALYs) lost due to pre- mature death [5].

In present study we tried to evaluate the spectrum of cardiovascular involvement in patients with chronic liver disease specific to alcoholic etiology and to elucidate the association with disease severity utilizing the modified Child Pugh Turcotte Score.

In present study majority of the patients belong to age group of 31-40 (n=16) and 41-50 years (n=19) among case and control respectively. There was equal distribution of ages among both the groups (p=0.068). Dubey *et al*. assessed cardiac changes in chronic liver disease patients including 60 patients reported that there were 39 male and 21 female patients, and their aged ranged between 18 years to 60 years [6]. Mahant *et al*. studied 100 patients with cirrhosis (alcoholic and non-alcoholic) for Echocardiography and reported that the mean age of the patients in our study was around 43 years and subjects in the age group 30-70 years [7].

Majority of the subjects in both the groups had modified Child Pugh Score of C. Cirrhotic patients of Mahant *et al*. study had liver dysfunction of early, intermediate & late severity, 15 patients (30%) were in Child-Pugh class A, 16 patients (32%) were in Child-Pugh class B, 19 Patients (38%) were in class C. In our study there was no significant correlation between the severity of hepatic dysfunction and cardiac changes [7].

Among cases, majority of the patients had modified Child PUGH Score of C (n=24) followed by B (n=20) and A (n=6) whereas Modified Child PUGH Score B (n=21) and C (n=21) was equally distributed among cases and in Modified Child PUGH Score A class there were 8 patients. Child-Pugh class C patients are considered the conventional candidates for the liver transplantation procedure [8]. Child Pugh class B patients can be considered a heterogeneous group as their clinical condition may remain stable for more than a year or rapidly deteriorate [9].

In present study when we compared the symptoms with Modified Child PUGH Score among case and control we found that majority of the patients with swelling of legs (n=18), jaundice (n=7), abdominal pain (n=8), fever (n=6), altered sensorium (n=6), constitutional symptoms (n=22), hematemisis/malena (n=5) and abdominal distension (n=24) had Child PUGH Score of C, whereas among Control group there was equal distribution of symptoms among different Child PUGH Score. All signs were equally distributed among cases and control (p>0.05).All grades of anemia were equally distributed between both the groups (p=0.615). Blood parameters were equally distributed across all Child PUGH Score class among control group.

Patients with abnormal ECG were significantly higher among cases as compared to control group (p=0.012). Majority of the cases with abnormal ECG had Child PUGH Score of C as compared to control group where abnormal ECG was equally distributed across all Child PUGH Score type. Patients with QT prolongation (p=0.023), chamber enlargement (p=0.025) and conduction defects (p=0.046) were significantly higher among the cases as compared to control groups. Patients with arrhythmias, ST-T changes, sinus bradycardia sinus tachycardia and low voltage complex were equally distributed between groups (p>0.05). Electrophysiological abnormalities including prolonged repolarization time and impaired excitation-contraction coupling have been found in cirrhotic patients [10]. Prolonged QTc can be associated with increased risk of ventricular arrhythmias [11]. Exact mechanisms are still unclear. In present study majority of the patients with QT prolongation (p=0.024), chamber enlargement (p=0.025) and conduction defects (p=0.046) had Child Pugh Score of C (18, 6 and 3 patients respectively) as compared to control groups. Patients with arrhythmias, ST-T Changes, sinus bradycardia sinus tachycardia and low voltage complex were equally distributed between all Child Pugh Score class (p>0.05). Alireza *et al*. [12]

determined the correlation between QTC prolongation and echocardiographic findings in end stage liver cirrhosis and reported that several hypotheses related to liver dysfunction, alcohol intake, portal hypertension, systemic circulatory disturbances, autonomic dysfunction, porto-systemic shunt, and functional alteration in ion channels have been suggested in clinical studies[13, 14]. Moreover, some studies have claimed that severity of cirrhosis has some relations with QTC prolongation [15]. Although the mechanism of QTC prolongation in cirrhotic patients is not clear yet, there seems to be a strong correlation between QTC prolongation and cirrhosis suggesting QTC interval as the best ECG finding in CCM. Tevethia *et al*. reported that alcohol consumption did not correlate with the cardiac changes further proving that cardiac changes in alcoholic cirrhosis is due to cirrhosis per se and not due to alcohol[16]. Alexander *et al*. compared alcoholic and non alcoholic groups and found no correlation between alcohol and the cardiac findings. Lee *et al*. also stated that cardiac changes are due to cirrhosis per se rather than alcohol. However contrary to that in present study we found QT prolongation (p=0.024), chamber enlargement (p=0.025) and conduction defects (p=0.046) were significantly higher among the cases having Child Score of C. Tevethia *et al*. reported that electrocardiogram showed QT prolongation in 25 % whereas 21.9% had low voltage complexes[16]. In agreement to present study Bernardi et al stated QT prolongation as the major ECG abnormality in cirrhotic patients which parallels with the severity of liver disease [17]. The author showed a prevalence of 42.9% in alcoholic and 47.1% in non alcoholic cirrhosis. Samuiullah *et al*. reported 21.6 % of the study population had prolongation of QT interval which correlated with the severity of liver disease [18] Trivesani *et al*. showed that acute gastrointestinal bleed further prolongs the QT interval which itself is an independent marker for mortality[19] Sun *et al*. demonstrated diastolic dysfunction in 48.8% of cirrhotics [20]. The author also associated the cardiac changes with Child score. Ruiz-Del-Arbol *et al.* also found diastolic dysfunction in patients with cirrhosis [21]. Author found that class C diastolic dysfunction had an increased mortality and higher risk of developing hepatorenal syndrome type 1. Similar reports were revealed in present study where diastolic dysfunction were significantly higher in cases having child score C. Merli *et al*. detected 64% to have diastolic dysfunction at rest [22]. But the author did not find any association between the cardiac abnormalities detected and cirrhosis of liver.

CONCLUSION

Liver cirrhosis is associated with electrocardiographic changes in form of QTc prolongation, chamber enlargement and conduction defects and was associated with Child Pugh Score of C.

Based on the findings we conclude that electrocardiography should be part of screening of patients, because patients are at high risk of mortality and morbidity and we recommend echocardiography evaluation in all child B and C cirrhotic patients for early intervention.

The present study emphasize that once the patients develop clinical picture of chronic liver disease which can be graded on the basis of modified Child PughTurcotte score from A to C, in such patients ECG to be done on the regular basis to plan the better management of the patient and also to reduce the morbidity. Such patient should be motivated to quit the alcohol to retard the further progression of disease.

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