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Original Article

Study of ECG Changes in Chronic Liver Disease Patients in Association with Severity of Disease

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ABSTRACT

Introduction: Chronic liver disease is a common cause of mortality and morbidity worldwide. In majority of cases of chronic liver disease, cardiovascular complications develop as a subclinical condition which manifests only during stressful situations. Hence this study is conducted for early detection of cirrhotic cardiomyopathy by electrocardiographic changes in all patients of chronic liver disease thereby reducing the morbidity and mortality.

Aims & Objectives

1) To study ECG changes in cirrhotic patients.
2) To assess the relation between ECG changes & severity of disease in cirrhotic patients.

Materials And Methods: This Cross sectional study includes data collected from 100 chronic liver disease patients admitted at Krishna Rajendra Hospital, Mysore during the period of August 2022 to October 2022.The data was analysed by SPSS software version 2.0,and chi-square tests was applied for qualitative variables.

Results: The maximum number of patients were in the age group of 51-60 years and their mean age is 51years.This study had 96% males & 4% females, which shows male preponderance among cirrhotic patients. Among 100 patients, 96% were alcoholic and rest 4% with cirrhosis were due to viral etiology, thereby finding alcohol as one of the major cause for cirrhosis of liver. The mean value of resting heart rate in cirrhotic patients of Child Pugh Class C(92+/-4bpm) was significantly ($p<0.05$) higher compared to Class A (76+/-3bpm) & Class B (81+/-5bpm) So, there is a positive correlation between increasing heart rate and severity of disease, suggestive of parasympathetic damage. The mean value of R-R interval (in msec) was significantly lower in higher Child Pugh class (Class C–694 +/- 58msec, Class B– 809 +/-88msec, Class A-909 +/- 85msec), thereby correlating with increase in heart rate. QTc prolongation was seen in higher Child Pugh class, the mean value in each class being- Class A-372+/-20msec, Class B–393+/-25msec &Class C-433+/-28msec. So there is a positive correlation ($p<0.05$) between QTc prolongation and increase in severity of disease.QRS duration and PR interval in study group shows no statistical significance($p>0.05$).

Conclusion: This study infers that autonomic dysfunction is seen in cirrhotic patients and it increases with increase in severity of disease. Cirrhotic cardiomyopathy is a clinical entity with serious impact on prognosis of the disease. This study also highlights the importance of simple investigations like ECG in early detection of autonomic dysfunction, thereby reducing mortality rate by providing early intensive care.

Key Words: *Cardiomyopathy, Child-Pugh score, cirrhosis, QTc interval*

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INTRODUCTION

Chronic liver disease is a common cause of mortality and morbidity worldwide[1]. In majority of chronic liver disease cases, cardiovascular complications develops as a subclinical condition which manifests only during stressful situations. Hence this study was conducted for early detection of cirrhotic cardiomyopathy (CCM) by electrocardiographic changes in all patients of chronic liver disease. CCM is characterised by a hyperdynamic state, with both systolic & diastolic ventricular dysfunction, prolonged ventricular depolarization & an inappropriate chronotropic response to stress. Cirrhotic cardiomyopathy is a cardiac dysfunction characterised by the loss of stress-related contractile reaction accompanied by electrophysiological changes in the absence of known cardiac diseases[2].

Recent studies suggest that right ventricular dysfunction, enlarged right atrium, & higher systolic pulmonary arterial pressure are important markers of CCM & also should be introduced as a diagnostic criteria[3].

In 2019,certain new guidelines were released by Cardiomyopathy Consortium, thereby redefining CCM & the importance of diastolic dysfunction. The current proposed criteria includes assessment of systolic dysfunction by determining ejection fraction & also by determining several signs of diastolic dysfunction,while ECG & other biomarkers were considered to add supportive information to the diagnosis[3].

Electrocardiography(ECG) is the first indicator of CCM.Prolongation of QT interval is a common ECG finding in cirrhotic patients and is associated with high mortality rate in affected individuals. The mechanisms for prolonged QT interval includes dysfunction of membrane potassium channels & a hyperactivity of sympathetic adrenergic discharges, causing down regulation of beta adrenergic receptors. Other ECG changes includes low voltage complexes, tachycardia, short R-R interval[4].

MATERIALS AND METHODS

This Cross sectional study includes data collected from 100 chronic liver disease patients admitted at Krishna Rajendra Hospital, Mysore during the period of August 2022 to October 2022.

The inclusion criteria includes,

- Age more than 18 years,
- Patients with evidence of chronic liver disease of any etiology like alcohol or viral etiology.

The exclusion criteria includes,

- Patients with prior history suggestive of heart diseases-congenital, ischemic heart diseases, congestive cardiac failure.
- Patients with comorbid diseases which can affect on heart like diabetes and hypertension.

ETHICALAPPROVAL:

Ethical approval was obtained from Mysore medical college and research institute Ethics Committee and the ethical protocols of the declaration of Helsinki (1967) including the ethical principles of informed consent, voluntary participation and withdrawal, privacy and confidentiality, were followed.

DATA ANALYSIS AND STATISTICS

Data obtained from the study has been entered in excel sheets and analyzed using SPSS(Statistical package for social sciences) software version 20, and has been presented as descriptive statistics in the form of frequency, tables, figures and graphs.

●Descriptive statistics of the explanatory and outcome variables were calculated by mean, Standard deviation for quantitative variables, frequency and proportions for qualitative variables.

●Inferential statistics like-

1) Chi-square test was applied for qualitative variables. Numerical variables were expressed as mean +/- standard deviation.

2) Independent sample t test will be applied to compare the quantitative variables between the groups. The level of significance is set at 5%. A ‘p’ value of <0.05 is considered statistically significant.

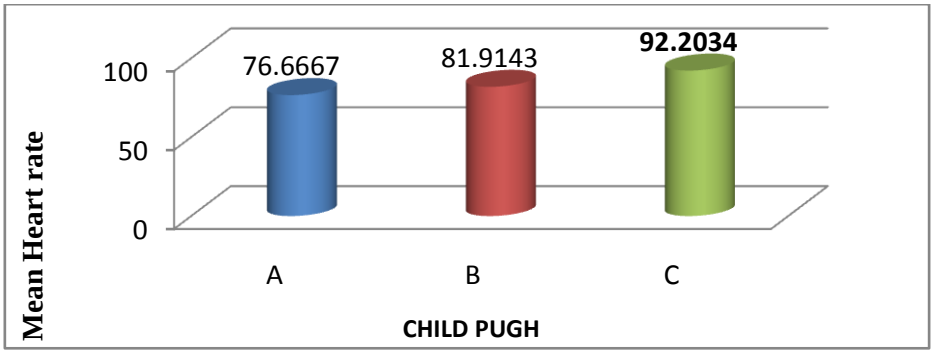
RESULTS

The maximum number of patients were in the age group of 51-60 years and their mean age is 51years. This study had 96% males & 4% females, which shows male preponderance among cirrhotic patients. Among 100 patients, 96% were alcoholic and rest 4% with cirrhosis were due to viral etiology, thereby finding alcohol as one of the major cause for cirrhosis of liver.

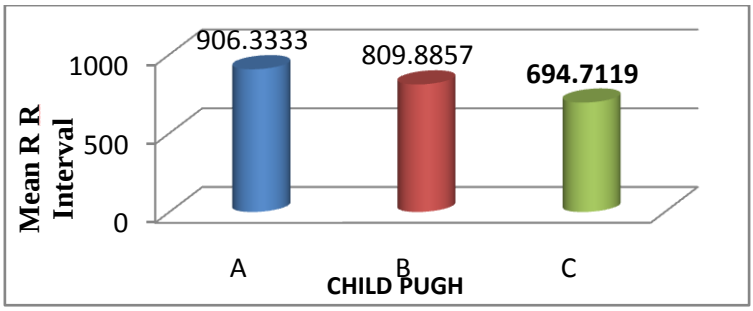
The mean value of resting heart rate in cirrhotic patients of Child Pugh **Class C(92+/-4bpm**) was significantly ($p<0.05$) higher compared to Class A (76+/-3bpm) & Class B (81+/-5bpm) So, there is a positive correlation between increasing heart rate and severity of disease suggestive of parasympathetic damage.

Table 1 – Mean value of Heart rate,R-R interval and QT interval in each Child Pugh Class

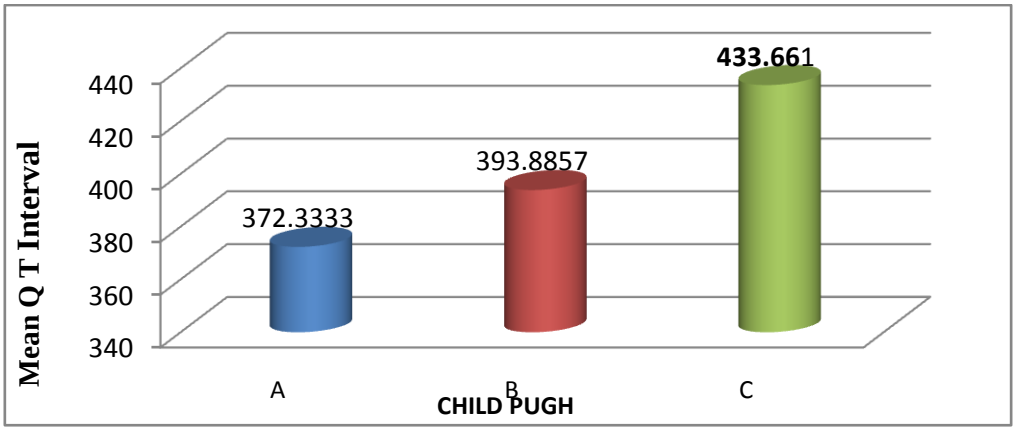
	CHILD PUGH CLASS	N	Mean	P VALUE
HEART RATE	A	6	76.6667	0.0001
	B	35	81.9143	
	C	59	**92.2034**	
R-R INTERVAL	A	6	906.3333	0.0002
	B	35	809.8857	
	C	59	**694.7119**	
QT INTERVAL	A	6	372.3333	0.0002
	B	35	393.8857	
	C	59	**433.6610**	



- The mean value of R-R interval (in msec) was significantly **lower** in higher Child Pugh Class (**Class C–694 +/- 58msec**, Class B– 809 +/-88msec, Class A-909 +/- 85msec), thereby correlating with increase in heart rate.



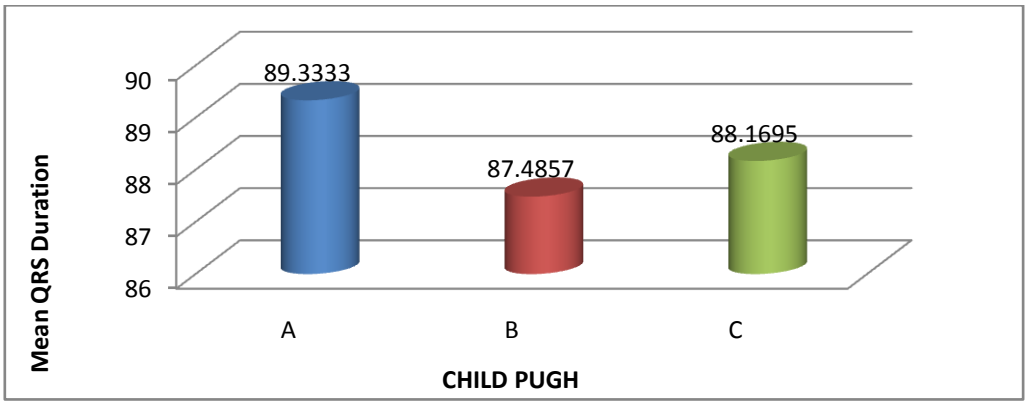
- QTc prolongation was seen in higher Child Pugh Class, the mean value in each class being- Class A-372+/-20msec, Class B–393+/-25msec, &**Class C-433+/-28msec**. So there is a positive correlation ($p<0.05$) between QTc prolongation and increase in severity of disease.QRS duration and PR interval in study group shows **no** statistical significance ($p>0.05$).

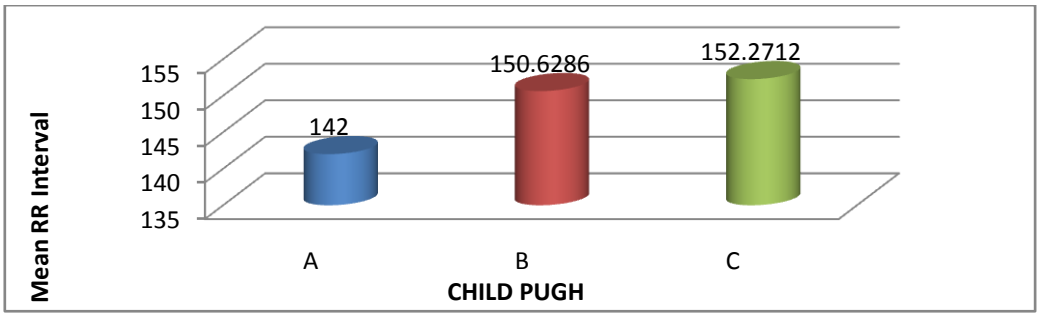


- QRS duration and PR interval in study group shows **no** statistical significance($p>0.05$).

Table 2 – Mean value of QRS duration and PR interval in each Child Pugh Class

	Child Pugh Class	N	Mean	P VALUE
QRS DURATION	A	6	89.3333	0.555
	B	35	87.4857	
	C	59	88.1695	
PR INTERVAL	A	6	142	0.132
	B	35	150.6286	
	C	59	152.2712	





DISCUSSION

Cirrhotic cardiomyopathy is a clinical entity with serious impact on the evolution & prognosis of patients with liver disease. As it is usually asymptomatic in a resting state, it can promote overt heart failure under stressful conditions. Autonomic damage may be asymptomatic and thus be detected incidentally, even if symptomatic, the condition goes unnoticed for a considerable period of time partly because of the vagueness of many of early symptoms. The proportion of asymptomatic subjects increases with increasing duration of the disease.

The features of cardiac autonomic neuropathy includes - Exercise intolerance, Postural hypotension, Resting tachycardia, Fixed heart rate &Silent myocardial infarction.

Chronic liver disease has been shown to be associated with autonomic neuropathy (AN) as well as hemodynamic and circulatory disturbances.

The QT interval is an approximate measure of ventricular electrical recovery after excitation. A prolonged QT interval identifies patients at increased risk for sudden cardiac death in a variety of clinical situations, in patients with alcohol-related liver disease (ALD) who continue to drink to excess, QT prolongation is associated with sudden death due to arrhythmias. Prolonged QT interval correlated positively with increasing severity of liver disease, as indicated by the Child-Pugh score.

This study had maximum number of patients in the age group of 51-60 years, with mean age of 51 years with a male preponderance of about 96% & the most common etiology of cirrhosis was alcoholism which contributes to about 96%, rest 4% were due to viral etiology. In the study conducted by Sharma KRD, Kavya et al[5]majority of the patients were

in the age group of 41-50 years (88%), with a mean age of 47.22±11.43 years. Out of 100 patients 83% were males, suggesting male preponderance among cirrhotic patients.80% of the patients had history of alcoholism as the cause for chronic liver disease, 5% had HBsAg positivity and 1 patient had HCV infection.11% patients had combined history and 3% of the patients had unknown etiology for chronic liver disease.

In this study,59% patients belong to Child Pugh Class C, 35 % in Child Pugh Class B, and 6% in Child Pugh Class A. QTc prolongation was seen in higher Child Pugh class, the mean value in each class being- Class A-372+/-20msec, Class B–393+/-25msec, &**Class C-433+/-28msec**. So there is a positive correlation ($p<0.05$) between QTc prolongation with increase in severity of disease. In a study conducted by Bhardwaj A, Joshi S, Sharma R, Bhardwaj S, Agrawal R, Gupta N. et al[6] had 61% in Child Pugh Class C, 35 % in Child Pugh Class B, & 4% in Child Pugh Class A, &the prolongation of QTc interval was significantly affected as the disease progressed in severity from Child Pugh Class A to C ($P<0.01$).Also in another study conducted by TadelleAmanuel, Banjaw Zelalem, et al[7] .47% patients were in Child Pugh Class B and 53% patients were in Child Pugh Class C,& no patients in Class A.Among QTc prolongation, 15.4% was in Child Pugh Class B, 97.7% was in Child Pugh Class C.

LIMITATIONS

Our study comprised a relatively small sample size, and was a single centred study done in short duration span.

CONCLUSION

This study infers that autonomic dysfunction is seen in cirrhotic patients and it increases with increase in severity of disease. Cirrhotic cardiomyopathy is a clinical entity with serious impact on prognosis of the disease, which can remain clinically silent for many years. Hence this study proves to be a useful one and acts as a diagnostic tool to determine severity of cirrhosis and at the same time, it also highlights the importance of simple investigations like ECG in early detection of autonomic dysfunction, thereby reducing mortality rate by providing early intensive care.

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