

Article

An observational to evaluate the cardiac functions of chronic alcoholic patients by examining the relationship between electrocardiography and echocardiography

Dr. Rakesh Patel¹, Dr. Mohit Garg², Dr. Badri Vishal Singh³ and Dr. Pankaj Kumar Jain^{4,*}

¹ Associate Professor, Department of Medicine, Shyam Shah Medical College, Rewa M.P.

² Assistant Professor, Department of Medicine, N.S.C. Government Medical College, Khandwa, M.P.

³ Senior Resident, Department of Medicine, Shyam Shah Medical College, Rewa M.P.

⁴ Assistant Professor, Department of Medicine, N.S.C. Government Medical College, Khandwa, M.P.

* Correspondence: drpankajjain07@gmail.com

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Abstract: Background: Alcohol is the most frequently misused substance on a global scale. Research has demonstrated that it can elicit detrimental impacts on nearly all bodily organ systems. A number of medical conditions can be ascribed to the direct impact of alcohol, while others may be indirect consequences stemming from nutritional inadequacies or susceptibility to injury. The consumption of alcohol has been linked to a range of cardiovascular disorders. Consequently, this study was conducted to investigate the Electrocardiographic and Echocardiographic abnormalities in asymptomatic chronic alcoholic patients.

Materials and Methods: The present study, an analytical cross-sectional investigation, was conducted between April 1st, 2021 and September 30th, 2022. The study population consisted of 150 individuals with chronic alcoholism, aged between 21 and 40 years, who had been consuming more than 80 grammes of alcohol per day for a period exceeding 5 years. The participants' medical history was evaluated according to the definition of chronic alcoholism, and electrocardiography and echocardiography were employed as diagnostic tools. The study group excluded individuals with pre-existing conditions such as diabetes, hypertension, and cardiovascular disorders.

Results: Our study reveals that the incidence of cardiovascular abnormalities among individuals with chronic alcoholism is 37%. The predominant electrocardiogram (ECG) alterations observed are sinus tachycardia (18%) and non-specific ST-T changes (9%). The prevalent alterations observed in 2D ECHO were augmented thickness of the posterior wall (11%), succeeded by heightened thickness of the interventricular septum and diminished ejection fraction (<40%). The incidence of cardiovascular abnormalities is positively correlated with prolonged alcohol consumption and is also elevated in the elderly population.

Conclusions: The present investigation validates that a multitude of electrocardiographic and echocardiographic alterations manifest before the onset of symptomatic cardiac pathologies that are attributed to prolonged alcohol consumption, such as alcoholic cardiomyopathy. Early indicators of the ongoing effects of alcohol may be detected through non-invasive investigations such as Electrocardiography and Echocardiography. These indicators are likely reversible during the early stages but may progress to alcoholic dilated cardiomyopathy if left untreated.

Keywords: Cardiac Functions; Chronic alcoholic; Electrocardiography; Echocardiography.

1. Introduction

Ethanol is a frequently misused substance that has a high prevalence of use globally. Research has demonstrated that it can elicit detrimental impacts on virtually all bodily organ systems. Numerous medical conditions can be ascribed to the direct impact of alcohol, while others may be indirect consequences stemming from nutritional inadequacies or susceptibility to trauma. According to a cited source [1], a significant proportion of hospital admissions, ranging from 30% to 40%, are associated with alcohol consumption. Pathological electrocardiographic (ECG) changes are frequently observed in individuals

experiencing acute alcohol intoxication. The frequency of changes and their prognostic significance are higher in chronic alcoholics, individuals with ischaemic heart disease (IHD), and those with alcohol cardiomyopathy or other forms of organic heart disease [2]. It is widely recognised that prolonged consumption of alcohol can result in impaired cardiac function, particularly in the form of congestive cardiomyopathy [3–7].

Alcohol abuse is reported to affect a significant proportion of patients admitted to hospitals, with estimates ranging from 20 to 30%. The cardiovascular impacts of alcohol consumption exhibit a positive correlation with the amount of alcohol ingested. Additionally, genetic factors and age may also play a role in these effects. The manifestation of harm to the heart due to alcohol consumption becomes apparent when the intake surpasses 90 to 100 g/d. Excessive alcohol intake is associated with heightened susceptibility to sudden cardiac death and cardiac arrhythmias. A positive correlation was observed between alcohol consumption and mortality in individuals diagnosed with coronary heart disease [8]. The consumption of alcohol for an extended period of time without apparent malnutrition led to observable abnormalities in intraventricular conduction and morphology. These changes were found to be associated with the duration of alcohol ingestion, indicating a cumulative toxic impact of ethanol. This information is supported by previous research [9].

Alcoholic intoxication is commonly associated with alterations in electrocardiogram (ECG) readings, characterised by irregularities in heart rate resulting from either impaired electric impulse generation or conduction pathology. Individuals who lack clinical indications of heart disease are categorised as having 'holiday heart syndrome' [2]. There exist various theoretical mechanisms that may account for the arrhythmogenic effects of alcohol, which ultimately result in cardiac dysrhythmias [10]. Atrial fibrillation is the most prevalent type of rhythm disorder, with a typical conversion to normal sinus rhythm occurring within a 24-hour period [11]. Conversely, torsades de pointes (TdP) polymorphous ventricular tachycardia is less frequent, but its prognostic implications are considerably more significant.

Alcohol-induced sinus bradycardia is considered the most notable type of bradyarrhythmia, as it can result in repeated episodes of syncope. The prevalence of conduction abnormalities escalates in proportion to elevated blood alcohol concentration, occasionally culminating in unexpected cardiac fatalities [2]. Observations have been made indicating that prolonged exposure to alcohol can result in changes in echocardiography such as left ventricular mass, left ventricular dimensions, septal and left ventricular wall thicknesses, and left atrial dimension [12]. Early intervention can potentially halt and even reverse the cardiovascular effects of alcohol consumption. The condition of alcoholic heart disease can be reversed in its early stages, which can be detected through non-invasive investigations such as Electrocardiography and Echocardiography. Alcoholic cardiomyopathy is linked to immoderate alcohol intake, which manifests as cardiac enlargement, augmented left ventricular (LV) mass, and ventricular dysfunction [13]. Furthermore, the consumption of alcohol has been linked to hypertension, which is also a contributing factor to changes in both the structure and function of the heart [14]. On the other hand, a considerable body of research provides evidence for a safeguarding correlation between light to moderate alcohol consumption and the likelihood of developing coronary artery disease (CAD) as well as heart failure [15,16]. The cardiovascular mechanisms underlying the potential risks and benefits of alcohol consumption remain uncertain [17,18]. The issue of whether there are differences in the toxic and protective effects of alcohol between genders is still a matter of debate. It has been suggested that women may be more vulnerable to the harmful effects of alcohol on cardiac function, and may develop alcoholic cardiomyopathy at a lower total lifetime dose of alcohol than men [19].

2. Material and methods

The present investigation is an analytical cross-sectional study conducted between April 1st, 2021 and September 30th, 2022, which involved 150 individuals between the ages of 21 and 40 who had been diagnosed with chronic alcoholism. The participants had a daily alcohol consumption of more than 80 grammes for a period exceeding five years. The study excluded individuals with documented medical histories of diabetes, hypertension, and coronary heart disease. All historical information pertaining to the subject was collected, including the duration of their alcoholism. The subjects who were chosen for the study were subjected to a clinical examination conducted by a qualified medical professional. The diagnosis of diabetes was excluded based on the patient's medical history and the measurement of plasma glucose levels. The study participants underwent routine investigations such as CBC, LFT, RFT, among others, in order to exclude the possibility

of any underlying pathologies that may have confounded the study results. The study participants were categorised into two groups based on their alcohol consumption history, namely those who consumed alcohol for a duration of 5-10 years (32%) and those who consumed alcohol for more than 10 years (68%). Additionally, the participants were also classified based on their age into two groups, namely those aged between 20-30 years (34%) and those aged between 31-40 years (66%).

3. Results

The study's sample consisted of 150 individuals, where in 34% of the participants belonged to the age group of 21-30, while the remaining 66% belonged to the age group of 31-40, as presented in Table 1. The study's sample comprised 2% females and 98% males. The study revealed that 32% of the participants had a history of alcohol consumption that lasted between five and eight years, while the remaining 68% had a history of alcohol use that exceeded eight years.

Table 1. Demographic and clinical profile of participants

		No. of patients (N=150)	Percentage (%)
Age in years	20-30	51	34
	31-40	99	66
Sex distribution	Males	147	98
	Females	3	2
Duration of alcohol consumption in years	5-10	48	32
	>10	102	68
ECG changes	Sinus tachycardia	27	18.00
	Atrial fibrillation	1.5	1.00
	Atrial premature contractions	1.5	1.00
	Ventricular premature contractions	1.5	1.00
	Nonspecific ST-T changes	13.5	9.00
	Left ventricular hypertrophy	4.5	3.00
	RBBB	3	2.00
	Poor R wave progression	1.5	1.00
Echocardiographic changes	Increased Posterior wall thickness	16.5	11.00
	Increased Interventricular septum thickness	12	8.00
	Ejection fraction (<40%)	12	8.00
	Increased Left ventricular end systolic diameters	7.5	5.00
	Increased Left ventricular end diastolic diameters	7.5	5.00

Study participants' ECGs showed a variety of changes, the majority of which were sinus tachycardia (about 18%) and non-specific ST-T changes (about 9%).

The most prevalent electrocardiogram (ECG) alteration observed in patients who had a history of alcohol consumption for 5-10 years and over 10 years was sinus tachycardia. The presence of non-specific ST-T changes and left ventricular hypertrophy were observed in individuals with a history of alcohol consumption exceeding a decade, as evidenced by electrocardiogram readings. The most commonly observed changes in 2D ECHO were an increase in interventricular septum and ejection fraction (40%), followed by an increase in posterior wall thickness (11%) and interventricular septum, as shown in Table 2. The most prevalent alteration detected through 2D Echocardiography in patients with a history of alcohol consumption exceeding 10 years was an augmentation in posterior wall thickness. Patients who had consumed alcohol for a period exceeding 10 years exhibited additional alterations in their 2D ECHO results, such as an enlarged interventricular septum and a reduced ejection fraction of 40%.

Table 2. ECG changes among study participants

		Duration of alcohol 5-10yrs N=48	Percentage (%)	Duration of alcohol >10yrs N=102	Percentage (%)
ECG changes	Sinus tachycardia	7.4	15.50	20	19.12
	Atrial fibrillation	0	0	1.4	1.47
	Atrial premature contractions	0	0	1.4	1.47
	Ventricular premature contractions	0	0	1.4	1.47
	Nonspecific ST-T changes	1.4	3.11	12	11.77
	Left ventricular hypertrophy	0	0	4.4	4.41
	RBBB	1.4	3.11	1.4	1.47
	Poor R wave progression	0	0	1.4	1.47
Echocardiographic Changes	Increased Posterior wall thickness	3	6.24	13.4	13.23
	Increased Interventricular septum thickness	3	6.24	9	8.82
	Ejection fraction (<40%)	1.4	3.12	10	10.29
	Increased Left ventricular end systolic diameters	1.4	3.12	6	5.88
	Increased Left ventricular end diastolic diameters	1.4	3.12	6	5.88

4. Discussion

Alcohol is the substance that is most commonly abused. Toxic effects have been demonstrated in nearly every organ system within the human body. Alcohol consumption has been associated with various cardiovascular disorders. During the latter half of the 19th century, individuals who had indulged in excessive alcohol consumption were observed to exhibit symptoms of heart failure, while post-mortem examinations revealed the presence of cardiac enlargement. Apart from heart failure, the consumption of alcohol has been demonstrated to have a plethora of adverse impacts on the cardiovascular system. The occurrence of arrhythmia, specifically ventricular and atrial ectopic beats and atrial fibrillation, has been associated with this phenomenon. Hypertension and sudden death are additional adverse outcomes. The objective of this investigation was to ascertain the frequency of cardiovascular irregularities among individuals with alcoholism across different age groups and durations of the condition. The mean age (35.257.2) of the present study exhibits a correlation with the mean ages of Mahela et al. [20] (38.853.3) and Lazarevic et al. [21] (32.854.3). Among a sample of 100 individuals diagnosed with chronic alcoholism, a significant gender disparity was observed, with 98 of the individuals being male and only two being female. The reduced representation of female cases in this study could potentially be attributed to cultural factors in India, where the prevalence of alcohol consumption among females is comparatively lower. The age range of 31 to 40 years old encompasses the largest proportion of patients in this particular study, constituting 66% of the total sample. The age range of 20-30 years was represented by only 34% of the patient population. The most commonly observed electrocardiographic anomaly in patients is sinus tachycardia, which accounts for 18% of cases. Eleven percent of the patient population falls within the age range of 31 to 40, while seven percent of the patients are aged between 20 and 30. Ryan and Howes [22] conducted a study which revealed that sinus-tachycardia is the most commonly observed electrocardiogram (ECG) anomaly in individuals with chronic alcoholism. Sinus tachycardia was observed in 20% of the cases included in this study. The study conducted by Mahela and colleagues [20] reported a sinus tachycardia prevalence of 25%. The second most common anomaly detected in electrocardiograms (ECGs) is non-specific ST-T changes. As per the findings of Mahela et al.'s research [20], a proportion of 17.5% of individuals with chronic alcoholism exhibited non-specific ST-T alterations. Non-specific ST-T changes were observed in 9% of the patients included in our study. Individuals with chronic alcoholism often encounter ectopic beats. The two most commonly observed types of ectopic contractions are atrial and ventricular premature contractions. Within the scope of

our investigation, a mere 1% of the subjects exhibit APC, while an equivalent proportion of 1% display VPC. Atrial fibrillation is the most commonly observed rhythm disturbance in individuals with chronic alcoholism. Typically, it resolves spontaneously. The predisposition towards alcohol binge drinking, commonly referred to as holiday heart syndrome, is a recognised phenomenon. Atrial fibrillation was observed in 1% of the participants in our study. According to a study, the western population experienced 5-10% of new cases of atrial fibrillation due to alcohol consumption. According to a study conducted at JLN Medical College in AJMER, a prevalence of 2% was observed for right bundle branch block among the patients. The research conducted by Mahela et al. [20] reported the observation of RBBB in 5% of cases. According to the study conducted by Krasniqi et al. [23], a prevalence of greater than 5% of right bundle branch block (RBBB) was observed. Poor R wave progression was observed in 1% of the patients. The age bracket ranging from 31 to 40 years exhibited the highest prevalence of ECG irregularities. Consequently, the consumption of alcohol during the ageing process yields a greater incidence of abnormalities. The Framingham Cohort Study has conducted an investigation into the correlation between the manner in which alcohol is consumed and clinical outcomes, as well as alterations in cardiovascular risk. The research revealed a positive correlation between prolonged alcohol consumption and advanced age groups with an escalation in cardiovascular irregularities. Prolonged alcohol consumption has been found to be positively correlated with an increased incidence of electrocardiogram (ECG) abnormalities in individuals with chronic alcoholism. There exists a direct correlation between prolonged alcohol consumption and electrocardiogram (ECG) abnormalities. The study findings indicate that patients who consumed alcohol for a duration of 5-10 years exhibited an ECG abnormality rate of 21.80%, whereas those who consumed alcohol for more than 10 years demonstrated a higher abnormality rate of 42.67%. The present investigation revealed that the prevailing echocardiographic alterations were augmented thickness of the posterior wall (11%), augmented thickness of the interventricular septum (8%), and reduced ejection fraction (8%). Patients exhibiting reduced Ejection fraction demonstrate greater dimensions in both left ventricular end systolic and end diastolic diameters. The age range of 31-40 years encompasses the majority of these patients. Two discrete investigations conducted in diverse geographical regions. Mahela et al. [20] conducted a study at JLN Medical College and reported that 15% of patients exhibited thicker posterior walls and interventricular septa, while 12.5% showed lower ejection fractions after a period of 5-10 years of alcohol consumption. MP Gautam et al. [24] observed comparable enhancements in left ventricular echocardiographic parameters in a distinct investigation. The prevalence of echocardiographic abnormalities among males and females is 17.89% and 20%, respectively. The elevated incidence can be attributed to the greater cardiotoxicity observed in females. There was a correlation observed between the duration of alcohol consumption and alterations in echocardiography. The study revealed that a proportion of 21.87% of patients who had consumed alcohol for a duration of 5-10 years and 44.11% of patients who had consumed alcohol for over 10 years exhibited echocardiographic abnormalities.

5. Conclusion

As per the findings of our research, a significant proportion of individuals diagnosed with chronic alcoholism, specifically 37%, exhibit cardiovascular abnormalities. The study findings indicate that a significant proportion of the patient population (66%) fell within the age range of 31 to 40 years. Additionally, the gender distribution of patients revealed that the overwhelming majority (98%) were male, while the remaining 2% were female. A significant proportion of the study participants, comprising 68% of the sample, were found to have a history of alcohol consumption spanning over a decade. The prevalent alterations observed in the 2D ECHO were augmented thickness of the posterior wall (11%) and amplified interventricular septum and ejection fraction (40%). The predominant electrocardiogram (ECG) alterations observed are sinus tachycardia, accounting for 18% of cases, and non-specific ST-T changes, which are present in 9% of cases. The incidence of cardiovascular anomalies is more pronounced among individuals in advanced age cohorts and escalates with prolonged periods of alcohol consumption.

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