Rom J Leg Med [32] 33-36 [2024]
DOI: 10.4323/rjlm.2024.33

HOLIDAY HEART SYNDROME

Anton Knieling[1,2], Andrei Scripcaru[1], Antonela Ostafie[1], Gina Toma[2,3,*], Mădălina Diac[1,2]

[1]Institute of Forensic Medicine, Iasi, [2]"Grigore T. Popa" University of Medicine and Pharmacy, Iași, [3]County Service of Forensic Medicine, Suceava, Romania

Abstract: Holiday heart syndrome is the name of a syndrome used in the occurrence of acute arrhythmia with excessive alcohol consumption as a trigger and in a person with no known pre-existing heart disease. This name "Holiday Heart Syndrome" (HHS) was given by Dr Philip Ettinger in 1978.

Dr. Ettinger proposed this name because after studying with his collaborators, that episodes of these cardiac arrhythmias usually occurred after weekends or holidays. Rhythm disturbances usually occur in people with no apparent signs of pre-existing heart disease and usually resolve spontaneously within 24 hours of stopping alcohol consumption.

Holiday heart syndrome usually has a clinically benign course.

Keywords: arrhythmias, ethyl alcohol, syndrome.

INTRODUCTION

Holiday Heart Syndrome is the name of a syndrome used in acute arrhythmia, triggered by excessive alcohol consumption, in a person with no known pre-existing heart disease. This name "Holiday Heart Syndrome" (HHS) was given by Dr Philip Ettinger in 1978.

Ettinger *et al*. first coined the term "Holiday Heart Syndrome" (HHS) in 24 patients hospitalized with AF after excessive weekend ethanol consumption. Although many of these were chronic alcohol users, subsequent studies showed that the syndrome also occurred in people who did not drink alcohol frequently. Interestingly, although many patients develop AF at the time of intoxication, others may develop AF 12 to 36 hours later [1].

In fact, a post-consumption state of ethanol may be just a manifestation characterized by sympathetic hyperactivity with an increased heart rate and has been observed in people who do not habitually consume ethyl alcohol, with an apparent good health 12 h after excessive alcohol consumption. Alcohol also has a diuretic effect, increased diuresis can lead to hydro-electrolyte disturbances; these further contribute to a proarrhythmic cardiac state. Acetaldehyde is a degradation metabolite of ethyl alcohol, is a potent cardiac toxin and has proarrhythmic effects that may persist in the immediate aftermath of excessive alcohol consumption.

Ethanol is one of the oldest known drugs and is the most widely used recreational drug in Europe. Alcohol may have health benefits when consumed in moderation as it appears to provide some degree of cardiovascular protection due to various mechanisms including activation of the fibrinolytic system, decreased platelet aggregation, antioxidant effects, improved lipid profile and improved endothelial function. These cardioprotective effects are known as the 'French paradox'. However, alcohol abuse can lead to several liver diseases, alcoholic dilated cardiomyopathy and even cancers of the digestive tract [12].

The relationship between alcohol consumption and the development of arrhythmias is not fully understood, but several theories have been proposed. One of them considers that the heart responds to the increased concentration of endogenous catecholamines (adrenaline and noradrenaline) caused by excessive alcohol consumption; the hyperadrenergic state occurring after ethyl alcohol consumption or during ethanol withdrawal may lead to altered autonomic heart rate control, with repolarisation abnormalities

*Correspondence to: Gina Mădălina Toma MD, "Grigore T. Popa" University of Medicine and Pharmacy, Iași, Romania, E-mail: toma_gina24@gmail.com

and prolonged QT intervals with worsening myocardial ischaemia; sleep apnoea may also occur under these conditions. Another theory refers to the arrhythmogenic effects of acetaldehyde. The primary metabolite of alcohol also appears to exhibit arrhythmogenic properties, possibly by increasing systemic and intramyocardial catecholamines.

An experimental study by Gallardo-Carpentier *et al* [2], using dog Purkinje fibres, showed that acetaldehyde has an arrhythmogenic effect, which appears to be caused by an increase in adrenergic activity. Therefore, acetaldehyde could cause arrhythmias to occur some time after alcohol ingestion. In contrast, arrhythmia was observed shortly after whisky consumption, just before significant amounts of acetaldehyde were produced. Toxic cardiac effects may also be related to an increase in free fatty acid levels; with alcohol consumption, there is an increase in plasma free fatty acids, which are thought to be arrhythmogenic in nature. Although the mechanisms are not yet fully understood, a recent review of the Cardiovascular Health Study found a significant association between elevated free fatty acids and AF in older people, which reinforces this theory [3]. Last but not least is the direct toxic action of ethyl alcohol on cells of the nodal excito-conducting system or myocardium (alcohol myotoxicity).

Alcohol-induced hypokalemia and hypomagnesemia can prolong the QT interval and lead to a polymorphic T wave that can cause AF. Importantly, subclinical myocardial damage caused by chronic excessive alcohol consumption with resultant myocardial fibrosis may contribute to conduction delays and thus form the substrate for reentrant arrhythmias. Holiday heart syndrome is also the result of a combination of factors not limited to alcohol consumption alone, including, caffeine, excessive consumption of fatty foods and high salt intake, and stress.

Atrial fibrillation is the most common arrhythmia associated with holiday heart syndrome, followed by atrial flutter and paroxysmal supraventricular tachycardia.

In 1984, Thorton *et al*. revised the notion accepted by the HHS; they presented several cases of acute AF associated with sporadic consumption of large amounts of alcohol. In all patients, spontaneous cardioversion was observed within 24 hours. A characteristic feature of HHS is the absence of new arrhythmic episodes during abstinence and recurrence after alcohol consumption [3].

Another study (Samokhvalov AV *et al*.) observed an increased risk of AF in women consuming more than 24 g of pure ethanol daily and in men ingesting more than 36 g. Lower amounts of alcohol did not increase the risk of arrhythmia [4].

In the Gallagher *et al*. meta-analysis, 5-10% of participants who consumed excessive amounts of alcohol were found to have AF, while low levels of ethanol consumption did not significantly influence the frequency of AF [5].

Klein *et al*. demonstrated that an ethanol concentration of 20% and higher inhibits cardiac sodium channels, leading to a stimulation of transmembrane sodium-calcium channels causing prolongation of action potential along with a repolarization period, leading to increased risk of arrhythmia [6].

Cardy *et al*. investigated 13 individuals aged 23 to 27 years consuming 0.95 g ethanol per kilogram of body mass. P-wave and QRS complex widening, reflecting conduction disturbances, was observed in each study participant [7].

T Mäki *et al*. showed an increase in beta-adrenoceptor density in lymphocytes during the period of alcohol consumption in patients with a history of alcohol-associated AF, but no change in density occurred in control subjects (age-matched controls with no history of alcohol-associated AF). The observed increased beta-adrenoreceptor density could be associated with an increased response to adrenergic stimuli. The study also showed a significantly higher concentration of catecholamines in patients with AF than in the control group [8].

Clinical diagnosis of HHS: the initial symptom of holiday heart syndrome is the sudden onset of intermittent or continuous palpitations. If the ventricular rhythm is rapid, the patient may experience dyspnoea, dizziness, fainting, irregular peripheral pulse or anginal chest pain.

Other revealing findings of the evaluation include a recent history of excessive alcohol consumption and signs of alcohol intoxication. A case was recently described of a 36-year-old man with no risk factors for coronary heart disease and a structurally normal heart; he suffered two episodes of cardiac arrest 5 years apart, both events occurring after significant alcohol consumption. Alcohol consumption can lead to potassium and magnesium deficiency, which can prolong the QT interval and result in a polymorphic T-wave in the form of torsade of the peaks.

Paraclinical diagnosis immune performing:

- The 12-lead ECG is essential to rule out ischemia or myocardial infarction; it should be performed during the initial evaluation and again after the heart rate returns to normal;

- Echocardiography can be used to assess structural changes such as cardiac chamber enlargement, existence of valvular disease and contractile dysfunction.

- Laboratory tests can help rule out electrolyte imbalance, infection, hyperthyroidism and myocardial infarction as potential causes for arrhythmia.

HHS treatment: because arrhythmia usually resolves spontaneously with alcohol abstinence, the patient will probably not need any specific treatment unless he or she develops rapid rhythm-related symptoms such as dyspnoea or chest pain.

If symptomatic, he may receive antiarrhythmic drugs such as beta-blockers and calcium channel blockers. These drugs block some of the excessive electrical impulses at the atrioventricular node, slowing the ventricular rhythm.

In rare cases, the arrhythmia may last for more than 24 hours or lead to more severe signs and symptoms such as hypotension. The doctor may then decide to perform electrical cardioversion. Cardioversion, if necessary, should be done within the first 48 hours of the onset of dysrhythmia, as the risk of atrial thrombi increases after 48 hours. Patients who have been in AF for more than 48 hours should not undergo cardioversion until they have started anticoagulant therapy, which reduces the risk of thromboembolism and stroke once sinus rhythm is restored.

Although there is a link between chronic alcohol abuse and alcoholic cardiomyopathy, which is known to lead to cardiac arrhythmias, there has been extensive research, including epidemiological studies that have shown an association between chronic alcohol consumption and an increased risk of AF in people with alcoholic cardiomyopathy. This link between arrhythmia and heart damage appears to be stronger for heavy abuse, but less clear for moderate and light alcohol intake.

HHS is most likely an underdiagnosed condition, as many patients do not present to hospital or sometimes may die suddenly; also, some of the cardiac arrhythmias such as AF, Atrial Flutter may occur frequently without major clinical symptoms.

Research has shown that there is a genetic background associated with greater susceptibility to the arrhythmogenic effects of alcohol. For example, Ettinger *et al*. reported a case in which the patient had drunk only one glass of alcohol before the onset of cardiac symptoms. Such reports are also common in everyday forensic practice.

There are several types of drinks: beer, wine and distilled drinks such as vodka and whisky. It is therefore important to be aware if some of these types of drinks confer an increased risk of HHS. For example, beer was more commonly associated with AF than wine or spirits in the study by Mandayam *et al.* [9].

There are some questions that need to be answered in further studies

- is there a threshold BAC above which the risk of HHS increases significantly?

- does the amount of alcohol consumed in a unit of time influence the risk of developing HHS? Does high ethanol consumption in a short period of time increase the risk of HHS?

- is there a different risk if excessive alcohol consumption occurs during the intermeal or immediate postprandial period?

Experimental studies

Greco *et al*. [10] conducted a study on the role of RyR2 (Ca^{2+}-gated Ca^{2+} release channel) dysfunction in alcohol-induced atrial fibrillation in a rat model and evaluated the antiarrhythmic potential of dantrolene, a RyR channel blocker. The rat model of "Holiday Heart Syndrome" used in this study shares similar characteristics with previously published mouse and rabbit models, including arrhythmia-mediated atrial remodeling as well as susceptibility to develop atrial fibrillation after excessive alcohol consumption [11,12]. It is noteworthy that patients with HHS often present to an emergency department 12–36 hours after cessation of alcohol consumption, the blood alcohol content having already been cleared by that time. This proves that alcohol intoxication triggered an increase in the concentration of catecholamines and that the body's sympathetic response may have been diminished. This was indeed confirmed by Greco *et al*., as they found that the level of norepinephrine in the bloodstream was at a minimum in their rat model of HHS 24 hours after the last binge drinking episode. In response to alcohol exposure, ventricular function may be altered, which could have led to the development of AF. The authors provided a detailed ventricular functional characterization, including echocardiographic dimensions of the cardiac chambers as well as a hemodynamic assessment, and demonstrated that cardiac function was unchanged, a finding that overlaps with findings in mouse and rabbit models of HHS, suggesting the improbability of

a contribution from ventricular remodeling in alcohol-triggered atrial arrhythmogenesis. Therefore, there are other mechanisms involved in the development of AF after excessive alcohol intake, mechanisms that need to be further investigated.

In conclusion, alcohol has a definite role in causing cardiac arrhythmias, either through chronic abuse or excessive alcohol consumption. It is important for physicians to recognize HHS and be aware of the role of alcohol in its genesis, sparing patients complex investigations when there is no clinical evidence of cardiac pathology.

During admission of a patient with palpitations or other symptoms associated with cardiac arrhythmias, a high suspicion of HHS should occur if the patient shows signs of alcohol intoxication.

After confirming cardiac arrhythmias and ruling out obvious cardiac disease, the physician should explain the syndrome to the patient and recommend abstinence from alcohol in an attempt to prevent further episodes of HHS.

Conflict of interest

The authors declare that they have no conflict of interest.

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