

Sudden death after ethyl alcohol intoxication in chronic alcoholics: two case reports

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Abstract

Chronic alcohol consumption represents a significant social and public health concern, as it is associated with an elevated risk of sudden death. Examination of the bodies of individuals who were known to be chronic drinkers and died suddenly is common in the forensic pathology settings. The primary causes of mortality in chronic alcoholics include liver and cardiac dysfunction; however, metabolic disturbances such as alcoholic ketoacidosis and acute alcohol intoxication can be also important contributors. This paper presents two cases of sudden death in individuals with a history of chronic alcohol abuse. Based on autopsy and histopathology findings, along the results from toxicological examinations, the deaths of two chronic alcoholics were certified to acute alcohol intoxication. This highlights the complex relationship between tolerance, intoxication, and the increased vulnerability of chronic drinkers, making it an important subject for further study in forensic pathology.

Key words: chronic alcoholics, acute alcohol intoxication, sudden death

Introduction

Since ancient times, ethyl alcohol (alcohol) has been known to be part of the human diet. Moderate consumption of alcohol contributes to feelings of well-being and happiness, and may reduce the risk of some diseases, but heavy drinking exerts deleterious effects on various body organs (Ahmed, 1995). Alcohol's adverse effects on brain function include drowsiness, moderate and anxiolytic disinhibitory effects, motor incoordination, sedation, emesis, amnesia, hypnosis, unconsciousness (Varghese and Dakhode, 2022), and even brain cell destruction (Mukherjee, 2013). Chronic alcohol consumption raises the risk of liver disorders such as steatosis, steatohepatitis

and cirrhosis (Ciorca-Nedelcu et al., 2021). There have been reports of structural damage to the cardiovascular (CV) system, particularly the heart itself, as well as complicated impacts on CV health, such as mitochondrial dysfunction and alterations in circulation, oxidative stress, inflammatory response, and programmed cell death (Piano, 2017). Furthermore, alcohol increases the risk of several cancer types, including cancers of the upper aerodigestive tract, liver, colorectum, and breast (Rumgay et al., 2021). Recently, the World Health Organization acknowledged there is no level of safe alcohol consumption for human health (WHO, 2023). In 2019, alcohol consumption was responsible for 2.6 million deaths globally, with 2 million of these occurring among men and 0.6 million among women (WHO, 2024). Chronic excessive alcohol

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consumption has been identified as a risk factor for an increased incidence of sudden death compared to the general population (Bowker et al., 2003). A variety of metabolic disturbances triggered by excessive alcohol intake and an insufficient caloric intake resulting in cardiac arrhythmia as well as fatty change of the liver and cirrhosis are included in the mechanism of death (Templeton et al., 2009). Acute alcohol intoxication in individuals with chronic alcohol abuse more commonly results in the development of acute alcoholic hepatitis (Agarwal et al., 2004). Over time, chronic alcoholics may develop a certain level of tolerance (Elvig et al., 2021), which can mask the severity of acute intoxication. However, when faced with excessive alcohol intake, they may experience sudden and extreme physiological disturbances, such as respiratory depression, asphyxia, or cardiac arrhythmias, which can be fatal. Cardiac arrest or respiratory depression are typical clinical manifestations for acute alcohol intoxication (Mirijello et al., 2023), which can lead to sudden death in chronic alcoholics after intake of large amounts of alcohol. In this paper two cases of sudden death by acute alcohol intoxication with a history of chronic abuse of alcohol are presented, including pathophysiology, autopsy findings and the results of toxicology analyses.

Material and methods

The findings of two cases at the Institute of Forensic Medicine, Criminology and Medical Deontology, Medical Faculty at the Ss. Cyril and Methodius University in Skopje, for which “ethyl alcohol intoxication” was the cause of death, were analyzed. Post-mortem analyses of alcohol in different biological samples (blood, urine, gastric content, vitreous humor) were performed using head space gas chromatography with flame ionization detector (HS-GC/FID) (Shimadzu, Japan) in a concentration range 0.1-4 g/L according to the previously published method (Bujaroska Perkovicj et al., 2022). All samples taken for toxicology analyses were stored at 4 °C before testing.

Case presentation

Case 1

The first case is a 36-year-old woman who was found dead by her common-law partner in the bedroom of their family home. She was found lying on her stomach on the

bed, with no signs of life, and blood was flowing from her mouth and nose onto the pillow. The previous day, she had drunk two liters of brandy and had been intoxicated all day. She was addicted to daily alcohol consumption and was a chronic alcoholic. After being found, her partner immediately called emergency medical assistance, which confirmed her death. Through the forensic autopsy, external examination showed that the fingertips and nails were purple, which was sign of acrocyanosis. The corneas were hyperemic. Histopathological findings were: hematoma of the aponeurotic galea, hematoma of the parietals bone periosteum, brain edema, esophageal edema, pulmonary edema, atherosclerosis of the aorta, liver steatosis, glomerulonephritis. Results of the toxicology analyses for ethyl alcohol concentration in blood, urine and gastric content are presented in Table 1.

Case 2

The second case, a 64-year-old man addicted to alcohol use, has been visiting his friend's house. He was in a visibly intoxicated state, and after the other guests had left, he became unwell and has fallen to the floor in the living room. The owners of the house called an ambulance, but the physicians only confirmed his death. Through the forensic autopsy, external examination showed that the cyanosis was observed on the head and neck area. The conjunctivae were hyperemic, pinkish-reddish. The lips were pale purple-grayish, cyanotic. The post-mortem findings showed: hematoma of the right lumbar region, hematoma of the right leg, brain edema, pleural adhesion, pulmonary edema, myocardial fibrosis, liver steatosis, punctate hemorrhages in the submucosal part of the stomach, universal stasis in the internal organs. Results of the toxicology analyses for alcohol levels in blood, urine, gastric content and vitreous humor are presented in Table 1.

Discussion

In forensic pathology, it is common to examine the corpses of individuals suspected to have died from alcohol abuse. In the period of 2010-2020, 11-year overview of post-mortem data at the Institute of Forensic Medicine, criminology and medical deontology, Medical Faculty at the Ss. Cyril and Methodius University in Skopje, has shown that fatal alcohol intoxications account for a large proportion of all intoxication cases (27.91%), with an

Table 1. Results of the post-mortem analysis of alcohol concentration in biological samples using gas chromatography.

Ethyl alcohol (g/L)	Case 1	Case 2
Blood	3.60	4.01
Urine	3.32	4.97
Gastric content	14.85	3.85
Vitreous humor	n/a	4.60

n/a – not applicable

average age of victims of 47.92 years (Bozhinowska et al., 2022). Among all cases where acute alcohol intoxication was the cause of death, particular interest lies in individuals with a history of chronic alcohol consumption. Chronic alcoholics with alcoholic liver disease usually exhibit a prolonged QT interval, and are at risk of sudden death, which may also result from alcoholic ketoacidosis or cardiac rhythm disturbances (Milroy et al., 2014; Templeton et al., 2009). Notably, as reported by Milroy et al. (2014), chronic alcoholics may experience sudden death due to intoxication, trauma, or preexisting disease. Wang et al. (2020) have also reported that acute alcohol poisoning related death is often associated with a history of heavy drinking. Myocardial fibrosis resulting from excessive fibrillar collagen deposition is known to have a critical contribution to left ventricular remodeling and heart failure in chronic alcoholic consumers (Wang et al., 2005). In the presented cases, atherosclerosis of the aorta was observed in the first case and myocardial fibrosis in the second case, by chronic alcohol consumption. Forensic investigators are continuously facing a number of challenges in resolving the cause of death in chronic alcoholics. Post-mortem findings often showed only liver steatosis that is the earliest stage of heavy drinking and is characterized by the deposition of fat in hepatocytes (Osna et al., 2017) as was found in both examined cases. When forensic pathologists are analyzing the direct cause of death after alcohol intake, other features are suggested to be considered, including eventual presence of different drugs and their toxicological effects and additional factors known to influence the post-mortem lethal blood alcohol concentrations (age, sex, body weight, drinking habits, the stage of decomposition) (Li et al. 2017; Wang et al., 2020). Estimates of the lethal blood alcohol concentration associated with acute alcohol poisoning vary among authorities, ranging between 3.50 and 4.00 g/L (Wang et al., 2020). High ethyl alcohol concentrations of 3.60 and 4.01 g/L in blood (Table 1) were determined for first and second case, respectively, exceeding 3.50 g/L, align with the reported lethal blood alcohol concentration range. High blood alcohol concentration led to depression of the respiratory and cardiac centers, resulting in disruption and cessation of vital organ functions. It is known that alcohol can inhibit the central nervous system (CNS), cause respiratory depression and, probably, lead to death by asphyxia in acute alcohol poisoning (Wang et al., 2020). Both cases presented exhibited asphyxia as important sign of acute alcohol intoxication, such as cyanosis, the hyperemic conjunctivae and pulmonary edema. Further, submucosal hemorrhages of the stomach suggesting significant damage to the gastric mucosa, which is a possible consequence of excessive alcohol consumption (Bode and Bode, 1997), were found in the second case. Based on autopsy and histopathology findings and the results of toxicological analyses (Table 1), intoxication is an evident cause of death in both cases studied. Thus, the deaths of two chronic alcoholics were attributed to acute

alcohol intoxication, which is contrary to expectations regarding the tolerance that develops with chronic alcohol consumption. Chronic alcoholics, although can tolerate higher alcohol levels, they may have organs that are more vulnerable, increasing the risk of fatal alcohol-related complications.

Conclusion

This study presents two cases of chronic alcoholics who developed liver steatosis, a condition commonly associated with chronic alcohol consumption. However, the autopsy findings and toxicology analyses showed that both individuals experienced sudden death due to asphyxia as a result of acute alcohol intoxication.

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Резиме

Ненадејна смрт на хронични алкохоличари по интоксикација со алкохол: два прикази на случај

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Клучни зборови: хронични алкохоличари, акутна интоксикација со алкохол, ненадејна смрт

Хроничната консумација на алкохол претставува значаен социјален и јавен здравствен проблем бидејќи го зголемува ризикот од ненадејна смрт. Во судската медицина вообичаено е да се обдуцираат тела на ненадејно починати лица кои биле хронични алкохоличари. Кај хроничните алкохоличари примарни причини за смрт се дисфункција на црниот дроб и срцето, но сепак метаболичките нарушувања како што се алкохолната кетоацидоза и акутната алкохолна интоксикација неретко може да бидат причина за смрт. Во овој труд се прикажани два случаи на ненадејна смрт кај лица кои хронично злоупотребувале алкохол. Базирано од наодот на обдукцијата, хистолошката анализа и токсиколошките резултати, акутна интоксикација со етил алкохол е констатирана како причина за смрт кај двата случаи. Ваквите случаи ја истакнуваат сложената врска меѓу толеранцијата, интоксикацијата и зголемената чувствителност на хроничните алкохоличари, од каде произлегува потребата за понатамошни истражувања на оваа тема во судската медицина.