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CLINICAL VIGNETTE

Acquired Polymorphic Ventricular Tachycardia in a Patient Admitted for Alcohol Withdrawal

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Introduction

Chronic alcoholics with acute alcohol intoxication can be a diagnostic and treatment challenge for emergency physicians. The evaluation may initially be limited by altered mentation leaving providers with the difficult task of deciding between a brief or extensive evaluation. Early anchoring from recognition of a patient as a heavy emergency room utilizer or labeling by providers as "just another drunk" may lead physicians away from a comprehensive evaluation. Providers should maintain a methodical approach, removing barriers to treatment while keeping a high index of suspicion for occult illnesses commonly associated with chronic alcoholism. These patients may have dynamic clinical courses with rapid changes during ED evaluation. It is important to resist the urge to place them in unmonitored settings. We present a case of alcohol withdrawal syndrome (AWS) with occult severe hypomagnesemia, which led to torsades de pointes (TdP) and subsequent cardiac arrest.

Case

A 45-year-old man with a history of severe alcohol withdrawal was brought in for "detox." He admitted to months of heavy daily vodka consumption and reported a few episodes of vomiting. He had associated headache as well as tremulousness. He denied any blood in his vomit, melena or bright red blood per rectum. He also denied any chest or abdominal pain. He was not prescribed any outpatient medications. On physical exam his Initial vital signs were 37C, BP 137/104, HR 110, RR 16, 100% on RA. He was atraumatic, sober with a clear sensorium, but mildly diaphoretic. He had no evidence of an acute toxidrome. No chest wall crepitus and his lungs were clear to auscultation. Abdominal examination was nonperitoneal and there was no stigmata of liver cirrhosis.

He was given two intravenous doses of ondansetron 4mg upon presentation for active severe vomiting. The initial ECG, showed sinus tachycardia with QTc 527ms. Subsequent ECG showed QTc 498ms. Providers attributed his long QT to ondansetron administration. Remarkable labs included a basic metabolic panel showing an anion gap of 27mmol/L, potassium of 3.2mmol/L, and bicarbonate of 20mmol/L. He was admitted for management of AWS.

While boarding in the emergency department, he became unresponsive and was found to have pulseless ventricular fibrillation. He received one round of CPR with defibrillation after which he regained full consciousness. A retrospective review of his rhythm strip revealed runs of polymorphic ventricular tachycardia prior to his arrest. Empiric magnesium repletion was begun for suspected TdP. Post-arrest labs revealed magnesium 0.8mg/dL. After electrolyte repletion, his QTc decreased to 460ms.

Discussion

Chronic alcohol abuse is a leading preventable cause of death in the United States.[1] It has been associated in 10% of deaths among working age adults, as well as development of various medical conditions.[2] Patients with unhealthy alcohol use are at risk for cardiovascular disease, pancreatitis, gastritis, liver disease, bone marrow suppression, and chronic infectious diseases. As a result, it is important to develop a methodical approach to all patients presenting with a history of chronic alcohol consumption with or without acute intoxication. Providers should focus their initial survey towards ruling out the following life-threatening conditions:

- Traumatic intracranial hemorrhage
- Cardiomyopathy and arrhythmias
- Gastrointestinal bleeding or perforated stomach ulcer
- Acute pancreatitis
- Pneumonia
- Co-ingestion with risk of respiratory depression
- Electrolyte abnormalities.

We aim to focus attention on the importance of evaluating patients for electrolyte abnormalities, specifically hypomagnesemia, and long QT. Patients with AWS should routinely be evaluated for risk factors associated with malignant arrhythmias.

Chronic alcoholics commonly develop electrolyte disturbances, with their clinical significance usually determined by the amount and duration of alcohol consumption. The interconnectedness of all the major electrolytes reinforces why some, if not all, are usually depleted in this patient population. For example, magnesium deficiency can lead to renal phosphate wasting just as hypophosphatemia can cause inappropriate magnesiuria.[3] Hypomagnesemia is prevalent in about a third of admitted alcoholic patients.[3] These magnesium derangements are related to a variety of factors including decreased intake,

decreased absorption, abrupt intracellular shifts, and increased excretion.

The development of hypomagnesemia in alcoholics is a multifactorial process. A diet that relies on alcohol as the primary source of calories is unlikely to contain magnesium-enriched foods. Alcoholic patients are unlikely to eat balanced meals or take dietary supplements. Recurrent nausea and vomiting from alcoholic gastritis, pancreatitis, or AWS may result in decreased nutrient intake. Ethanol ingestion has a direct effect on gastrointestinal morphology, function, and motility.[4] The morphological changes seen in the stomach and small intestine include erosions, inflammatory cell infiltration and reduced villous height with reduced mucosal surface area.[4] These changes promote the secretion of water and electrolytes while inhibiting the absorption of nutrients, which in turn results in diarrhea and malabsorption. Acid-base disorders triggered by the ingestion of alcohol as well as the autonomic overactivity from alcohol withdrawal, contribute to hypomagnesemia through a transient intracellular shift of circulating serum magnesium.[5,6] Lastly, acute alcohol consumption has a direct effect on the renal tubules and promotes urinary wasting of magnesium for up to 30 days following consumption.[3,7]

Acquired Long QT Syndrome (LQTS) is a potentially life-threatening condition that can degenerate into polymorphic ventricular tachycardia known as TdP. TdP is often heralded by QT-interval prolongation with QTc >500ms associated with the greatest risk of developing TdP.[8] Acquired LQTS is most commonly precipitated by certain medications, but hypokalemia, hypomagnesemia, and bradycardia also contribute. Interestingly, some patients who develop acquired LQTS have a less severe genetic mutation than patients with congenital LQTS, and this abnormality can be unmasked by exogenous stressors.[9] The mechanism of this prolongation is inhibition of the KCNH2-encoded HERG (human ether-a-go-go related gene) potassium channel.[10] This channel is an integral mediator for phase 3 of cardiac potential repolarization, resulting in lengthening of the action potential interval and thus a prolonged QT. Mutations of this KCNH2-encoded potassium channel are responsible for some forms of congenital LQTS.[11] A variety of medications can result in prolongation of the QT interval. The medications most commonly associated with acquired LQTS are antiarrhythmic agents, such as amiodarone, but a variety of noncardiac medications are also implicated, including antipsychotics (haloperidol), antiemetics (ondansetron), antibiotics (macrolides and quinolones), and antidepressants (TCAs and SSRIs)[11]. Medications are rarely the lone causative agent in acquired TdP and are usually one of many risk factors that lead to the malignant arrhythmia.[12] Acquired LQTS and resulting TdP may also be caused by hypomagnesemia. Magnesium plays a critical role in myocardial ion exchange and the effects of magnesium depletion are visualized on ECG by derangements in cardiac repolarization as well as development of ventricular arrhythmias.[13]

Alcoholism and end stage hepatic disease have also been associated with QT prolongation. Studies of chronic alcohol drinkers have shown an association between increasing amounts of daily alcohol consumption and QT prolongation.[14-16] This association has been incompletely studied, but is believed to be from cardiac remodeling leading to alcoholic cardiomyopathy. Patients with end stage liver disease commonly develop QT interval prolongation independent of other known causes of long QT (i.e., electrolyte abnormalities, renal insufficiency, treatment with QT prolonging medications) and are at elevated risk for malignant ventricular dysrhythmias. Studies have shown that QT prolongation in liver cirrhosis is associated with impaired synthetic liver function. This is evidenced by the fact that improvement in liver function as well as liver transplantation result in significant shortening of the QT.[17,18] It is important to consider obtaining a baseline ECG on any patient with history of liver disease, alcoholism, or presenting with alcohol withdrawal.

Conclusion

The providers in the case anchored prematurely on a diagnosis and focused only on the symptomatic treatment of AWS and thus missed underlying severe disease. The patient in this case was screened for many but not all of the conditions on the aforementioned list. Upon evaluation of his electrolytes, only a basic metabolic panel was ordered which revealed a mildly low potassium. The Providers did not evaluate the patient's calcium, magnesium, or phosphorus levels. The cause of this patient's QT prolongation was likely due to the catecholamine state of acute alcohol withdrawal, chronic alcoholism, undiagnosed liver cirrhosis, administration of QT prolonging medications, and severe electrolyte derangements. This case highlights the importance of maintaining a methodical approach to patients presenting with alcohol intoxication. Providers must resist premature anchoring and ensure that life-threatening conditions are ruled out prior to finalizing disposition decisions. It is not necessary to obtain the same workup on all patients, but it is important to maintain a high index of suspicion for the following: risk for AWS, co-ingestion, toxic alcohol ingestion, occult trauma, pancreatitis, bleeding and electrolyte derangements.[4] Additionally, providers should consider obtaining a screening ECG on these patients to evaluate the baseline QT interval and take care to avoid QT prolonging medications prior to obtaining ECG.

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