SDRL Laboratory

TOXICOLOGY TIMES

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Ethanol (Part 3)

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The effects of alcohol on the electrolyte balance is complex and related, not only to whether or not the ingestion is acute or chronic, but also to whether or not the blood level of alcohol is in an early increasing phase or at steady state. On top of these considerations the clinical conditions of withdrawal, malnutrition, vomiting or diarrhea need to be factored in, if present.

Both acute and chronic ingestion of alcohol most commonly cause the following imbalances. Some of these are secondary to the increased urination seen in acute ingestion due to suppression of anti-diuretic hormone (ADH) and its effect on the kidneys. Potomania is hyponatremia secondary to the massive consumption of beer.

Alcohol has profound effects on carbohydrate and lipid metabolism. Alcohol causes the liver to produce more fatty acids and hypertriglyceridemia (elevated triglycerides) is commonly seen as chronic alcohol dependence. Hypoglycemia (low blood sugar) is often seen with alcohol ingestion because of the direct effects of alcohol on glucose metabolism and malnutrition. Heavy drinkers deplete their glycogen stores within a few hours when their diet does not provide a sufficient amount of carbohydrates. Over time, excessive alcohol consumption can decrease the effectiveness of insulin, resulting in high blood sugar levels. One study showed that 45% to 70% of people with alcoholic liver disease had either glucose intolerance or diabetes. Alcohol consumption can damage the pancreas, causing inflammation which can lead to the release of both the enzymes lipase and amylase.

As is well known, alcohol and especially chronic alcohol abuse causes liver damage and may result in cirrhosis. Albumin is the main carrier protein in the blood and is exclusively synthesized in the liver. With increasing damage to the liver, less albumin is made and can ultimately cause ascites and the hepatorenal syndrome in end-stage liver disease. Coagulation factors (fibrinogen, prothrombin, factors V, VII, VIII and IX) are other important proteins are synthesized in the liver. When they are diminished, a bleeding disorder develops which is reflected in an increased PT and PTT.

Bilirubin is a breakdown product of the hemoglobin from red blood cells (RBC). As RBCs are destroyed, hemoglobin is converted to bilirubin in the blood stream and transported to the liver. It is there that bilirubin has sugars added to it (conjugated) by the liver so that it can be made water soluble and excreted in the GI tract. If the liver is damaged, then the bilirubin builds up in the body and creates jaundice. Bilirubin is determined by testing as total bilirubin and direct bilirubin (conjugated bilirubin). Indirect, or unconjugated form, is determined by subtraction of total bilirubin from direct bilirubin. In liver damage by alcohol or other liver disorders causing inflammation, one can see an increase in total, direct and/or indirect bilirubin depending on the severity. However, it usually is caused by an elevation of conjugated bilirubin due to intrahepatic impediment of its transport into the biliary system (cholestasis).

Alcohol is a potent acute and chronic toxin affecting the majority of the body's organ systems and metabolic pathways in all concentrations and duration of use. The above tests only touch on the range of its effects and are in no way meant to be an exhaustive discussion.

??? Did You Know ???

According to SAMHSA's National Survey on Drug Use and Health (NSDUH), more than half of all adults drink alcohol, with 6.6% meeting criteria for an alcohol use disorder. Among Americans aged 12 or older, the use of illicit drugs has increased over the last decade from 8.3% of the population using illicit drugs in the past month in 2002 to 9.4% (24.6 million people) in 2013. Of those, 8.2 million people met criteria for a substance use disorder in the past year. The misuse of prescription drugs is second only to marijuana as the nation's most common drug problem after alcohol and tobacco, leading to troubling increases in opioid overdoses in the past decade. Source: SAMHSA

Question of the Month

Question: Can serum values help in determining if a patient should be receiving a split dose?

Answer: If there is a large discrepancy between the peak and trough values, the methadone is not holding steady in the blood over the course of 24-hours and withdrawal symptoms may appear. Based on the size of variation in these values, one assumption might be that the patient simply needs a dose increase. Instead, splitting the patient's dose at 12-hour intervals rather than issuing a single dose every 24-hours may better serve the patient. A once-per-day dose increase would simply increase the peak, causing greater sedation for part of the day while the patient continues to experience withdrawal symptoms later on. Follow-up serum testing can confirm if the split-dose methadone is holding steady in the patient's system.