

Manifestations and Treatment of Alcohol Toxicity in Emergency Department

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Abstract

Introduction: Ingestion of large amounts of Alcohol can cause a clinically harmful condition called Acute Alcohol Toxicity. A person with Acute Alcohol Toxicity presents with a wide-ranging set of clinical symptoms and signs that involve various organ systems. He/She may show cardiac, pulmonary, gastrointestinal, neurological, metabolic and behavioral complications. An intoxicated patient is managed primarily in the Emergency department Alcohol-related where treatment is directed at stabilizing his/her condition, depending on his/her clinical presentation. Metadoxine, a drug that is able to accelerate ethanol excretion, is a useful adjunct in the treatment of such patients. Patients presenting with Alcohol Toxicity should be screened for Alcohol-related disorders and directed to Treatment units if required.

Aim of Work: Considering that Acute Alcohol Toxicity is a common and potentially life-threatening disorder, often associated with other harmful conditions, such as trauma and alcohol abuse, the Paper is aimed to address its clinical aspects and management in the emergency department.

Methodology: The review is comprehensive research of PUBMED from the year 1970 to 2019.

Conclusion: Consumption of undue amounts of alcohol at once can present as a medical emergency. The patient may present with a variety of complications. Immediate management focuses first on patient stabilization, followed by sedation if necessary and lastly the antidotal drug.

Keywords: Acute Alcohol Toxicity; Emergency Care; Management of Alcohol Toxicity; Manifestations of Alcohol Toxicity

Introduction

Alcohol use has now become very common all over the world. It is the oldest and most widely used substance of abuse. When compared to other psychoactive substances, alcohol is among the most fatal in terms of how close the amounts used for psychoactive effects are to the median amount that is lethal [31].

It was observed that 20 - 40% of the subjects admitted to hospital emergencies in the United States had alcohol-related problems and in elderly people, alcohol-related hospitalizations have become as common as hospitalization required for Myocardial Infarctions. Of all the alcohol-related disorders present in subjects referred for emergency management, Acute Alcohol Toxicity appears to be the most common [32].

Ethanol, the type of alcohol used in alcoholic beverages, is a selective central nervous system (CNS) depressant at low doses and acts as a general depressant at higher doses. There is a loss of protective reflexes, coma and increased risk of death from respiratory depression at peak BAC (Blood Alcohol Concentration) levels.

Highly Intoxicated Patients are at high risks of mortality because of the narrow margin between the anesthetic and fatal dose and must be managed accordingly [1].

A "standard drink" (one glass of wine, a shot, or 350 ml beer) increases blood alcohol by 25 - 35 mg/100 ml. For infrequent drinkers, clinically apparent intoxication may be apparent at blood alcohol concentrations of 150 - 250 mg/100 ml; Stupor and Coma may occur at concentrations of 350 mg/100 ml; while concentrations of > 450 mg/100 ml are often fatal. Frequent consumers of Alcohol tend to develop tolerance to its effects. In such individuals, the effects of alcohol are significantly diminished and they are less likely to get intoxicated or develop toxicity [2]. According to reports, Ethanol is lethal at doses of 5 - 6 mL/kg in adults and 3 mL/kg for children [1].

10% of ingested alcohol is metabolized by Gastric alcohol dehydrogenase (ADH) ("first-pass metabolism") and it has been found to have important gender-related differences [3]. The rest of the Ethanol is metabolized with enzymatic pathways in the liver. Liver ADH is responsible for 90%; microsomal ethanol oxidizing system (MEOS) is responsible for 8 - 10% and catalase for 0 - 2% [4].

Methodology

A comprehensive and systematic search was conducted regarding manifestation and treatment of alcohol toxicity using PubMed search engine (<http://www.ncbi.nlm.nih.gov/>) and Google Scholar search engine (<https://scholar.google.com>) were the mainly used database. All relevant available and accessible articles were reviewed and included.

The terms used in search were: Acute Alcohol Toxicity, Emergency Care, Management of Alcohol Toxicity, Manifestations of Alcohol Toxicity.

Risk of injury

Intoxicated Individuals also present with an increased risk of injury [16]. In a study, it was observed that conditions that result from Acute Alcohol Intoxication, like trauma and violence, were twice as responsible for potential life years lost as chronic alcohol abuse-related conditions [17].

All groups of drinkers are at risk for alcohol-related injuries, but Individuals who drink infrequently and in little quantities but at times may drink heavily are at the highest risk for alcohol-related injuries, probably because of their low alcohol tolerance [18]. Moreover, alcohol can worsen the clinical course of the injury, increasing the frequency of intubation, the duration of hospitalization and the risk of mortality [16].

Clinical manifestations

The extent of individual acute alcohol intoxication varies and can depend on a number of factors. These include the amount of alcohol ingested, tolerance to alcohol, body weight, the percentage of alcohol in the beverage consumed and the period over which the alcohol was consumed seem to be particularly important [6].

| Blood Alcohol Concentration (BAC) | Symptoms |
|-----------------------------------|---|
| < 50 mg/100 ml | Impairment in some tasks requiring skill Increased talkativeness State of Relaxation |
| > 100 mg/100 ml | Altered perception of the environment Ataxia Hyperreflexia Impaired judgment. Lack of coordination Mood, personality, and behavioral changes, Prolonged reaction time, Slurred speech |
| > 200 mg/100 ml | Amnesia Diplopia Dysarthria Hypothermia Nausea Vomiting |
| > 400 mg/100 ml | Respiratory depression Coma Death |

Table 1: Manifestations are mostly related to the blood alcohol concentration [7].

Effect on various organ systems and their manifestations

Acute ingestion of Alcohol has varying effects on the different organ systems of the body. These effects, in turn, are responsible for the clinical findings that are observed in these patients.

Metabolic Alterations: Acute alcohol Toxicity may cause lactic acidosis, hypoglycemia, hypokalemia, hypoalbuminemia, hypocalcemia, hypomagnesemia and hypophosphatemia [7].

Cardiovascular effects of acute alcohol: Toxicity may include tachycardia, peripheral vasodilation and volume depletion. These may, in turn, result in the development of hypothermia and hypotension [7].

Respiratory effects of acute alcohol toxicity: Respiratory Depression caused by Alcohol toxicity can be life-threatening. There is also a decreased sensitivity of the airway to foreign bodies, increasing chances of aspiration, which is very dangerous. Patients also show decreased ciliary clearance and tend to be at an increased risk of bacterial infection leading to bronchitis and pneumonia [8].

Gastrointestinal effects: Common symptoms may include nausea, vomiting and diarrhea. At times abdominal pain secondary to peptic ulcer, gastritis and pancreatitis may be observed in some patients [9,10]. Hyponatremia may occur in cases with prolonged vomiting [11]. Dysfunction in the motility of esophagus, stomach and duodenum may be observed [12]. There may also be an increase in Type III duodenal (propulsive) waves in the ileum [13], causing faster transit of intestinal contents, which may, in turn, contribute to diarrhea [10].

Hepatic effects: Some patients, usually subject with a history of Chronic Alcohol abuse or patients with existing Alcoholic Cirrhosis, may present with Acute Alcoholic Hepatitis. Patients with features of Hepatic Decompensation with a history of excessive alcohol abuse most often warrant this diagnosis [14]. Such patients may present with nausea, vomiting and abdominal pain commonly and fever, shivering and jaundice less frequently. Zieve syndrome, which consists of hemolytic anemia, jaundice and hypertriglyceridemia, has also been reported in such subjects [15].

Management of alcohol toxicity

Diagnosis

The Diagnostic and Statistical Manual of Mental Disorders-IV edition criteria for acute alcohol intoxication include: [5]

- a) Recent alcohol ingestion;
- b) Clinically significant maladaptive behavioral or psychological transformations occurring while drinking alcohol or shortly after it including improper sexual or violent behavior; unstable mood, impaired judgment and impaired social or occupational functioning; and
- c) One or more of the following signs that develop during or shortly after alcohol use:
 - (i) Slurred speech;
 - (ii) Lack of coordination;
 - (iii) Unsteady gait;
 - (iv) Nystagmus;
 - (v) Impairment of attention or memory;
 - (vi) Stupor or coma; and
 - (vii) Symptoms that are not due to a general medical condition and that cannot be accounted for by another mental disorder.

History taking may be challenging in intoxicated patients, but it is of the utmost importance. Information such as quantity of alcohol ingested, type of beverage consumed, time period and circumstances of consumption, onset and extent of symptoms, any resultant injuries, should be collected. Vital signs and Nutritional status of the patient should be checked [27]. Attention should also be paid to the hydration level of the patient and signs of chronic alcohol abuse like capillary prominence, palmar erythema, spider naevi, telangiectasias and muscular atrophy [15].

Determination of the patients' Blood Alcohol Concentration is very important [28]. BAC, however, has its own limitations as it may not necessarily correlate with the clinical presentation of the patient as individuals have different alcohol tolerance levels. Therefore, it cannot be relied upon to accurately predict the clinical severity or extent of the toxicity [1]. Breath Analysis or Saliva dipstick can also be used to determine the alcohol levels, but these two are less reliable [29].

The diagnostic picture and choice of therapy may be influenced by several factors. A diagnosis of Alcohol toxicity should not lead the clinician to not thoroughly examine the patient for additional diseases. Therefore, it is essential to get other investigations done for a patient depending on his/her clinical features to check for potentially dangerous additional non-alcohol or alcohol-related diseases, even after Blood Alcohol Level Determination.

Special attention should be paid to mental status changes of the patient. Patients with alcohol intoxication may show psychopathologic features ranging from lethargic depression to violent delirium. Mental status changes tend to be similar in a patient with each bout of binge drinking. In a patient with previous episodes of Alcohol-related intoxication, if the mental signs seem uncharacteristic of the patients' usual pattern, it may be a warning sign. In such cases more aggressive assessment should be done to check for head injuries, cerebral hemorrhage, electrolyte abnormalities and consumption of illicit drugs [20].

Patients that report with Acute Intoxication should be undressed and the attending physician should view all body surface areas thoroughly to check for injuries because of increased risk of injuries in these patients [16].

Treatment

Although intoxicated patients may be uncooperative and challenging for the physician to handle, they require rapid and thorough evaluation and aggressive treatment if indicated.

An intoxicated patient is managed primarily in the Emergency Department, where treatment is directed at stabilizing his/her condition, depending on his/her clinical presentation (Table 2).

| | |
|-------------------------------------|---|
| Patient Stabilization | Airway assessment Observation of respiratory function Prevention of aspiration Mechanical ventilation, if necessary Intravenous access. Intravenous solution administration correction of hypoglycemia and electrolyte imbalances (dextrose + magnesium + folate + thiamine + multivitamins) Anti-emetic drugs |
| Patient sedation (if necessary) | Droperidol Haloperidol Physical restraints (not advised) |
| Acceleration of ethanol elimination | Metadoxine (300 - 900 mg i.v.) |

Table 2: Management of alcohol intoxication.

The first priority in patients with alcohol toxicity is attention to the ABCs (i.e. airway, breathing and circulation). Airway assessment and observation of the development of respiratory function should be done. Prevention of aspiration is necessary for these patients; Placement of the patient in a lateral decubitus position after clearance of the C-spine, if indicated may be helpful in this aspect. Getting an IV access and administration of Intravenous fluid solution may be required to hydrate the patient and reverse the electrolyte imbalance and hypoglycemia [19]. According to current clinical protocols, the Intravenous solution used contains dextrose, magnesium, folate, thiamine and multivitamins (e.g. a premixed intravenous solution of 1l of 5% dextrose and 0.45% sodium chloride, 2g of magnesium sulfate, 1 mg of folate and 100 mg of thiamine) [7].

These patients often present with nausea and vomiting. Therefore, antiemetic drugs may be required. Hyponatremia can result because of prolonged vomiting. This, however, should not be corrected too rapidly lest central pontine myelinolysis is induced [11].

Agitated and violent patients may require the use of sedative drugs such as droperidol and haloperidol. Whenever sedative drugs are used, the clinician must keep in mind the possibility of interaction between the drug and the alcohol, which can cause respiratory depression and hypotension. It's advisable to avoid the use of physical restraints even if it is for the safety of the patient given the ethical concerns governing their use; they should be considered only in extreme conditions. In some cases, mechanical ventilation and intensive care must be provided [20].

In general, based on the biomechanics of alcohol degradation, the patient's clinical condition should begin to improve in a three- to six-hour time frame. Some authors have recommended a longer time frame prior to physician re-evaluation [26].

Metadoxine in alcohol toxicity

One specific drug, Metadoxine (pyridoxal L-2-pyrrolidone-5-carboxylate), has been found to be very useful in the treatment of acute alcohol. Metadoxine has been found to accelerate the elimination of ethanol in adults, which leads to faster recovery from intoxication and a more controlled withdrawal [30].

Chemically, Metadoxine is the ion pair between pyrrolidone carboxylate and pyridoxine. Pyrrolidone carboxylate is involved in amino acid metabolism through the glutathione pathway [20]. It has been found to facilitate de novo ATP synthesis and prevents ATP decrease in both the brain and liver of rats acutely intoxicated with ethanol. Pyridoxine causes an increase in the metabolic degradation rate of ethanol, thereby reducing the damage to cell functions caused by acetaldehyde, the first metabolite in the ethanol elimination process [21].

Metadoxine appears to be able to accelerate ethanol metabolism in both rats and humans due to several mechanisms:

- Increase in acetaldehyde dehydrogenase activity [22].
- Ethanol and acetaldehyde plasma clearance,
- Urinary elimination of ketones [23].
- Prevent glutathione depletion, lipid peroxidation damage, collagen deposition and TNF alpha secretions induced by alcohol and acetaldehyde in hepatocytes and hepatic stellate cells [24].

Recently, the first double-blind, controlled clinical trial was conducted on patients with alcohol toxicity comparing Metadoxine with placebo [25]. A single intravenous injection of metadoxine (900 mg i.v.) was given to the test subjects. Compared to the subjects who were injected with the Placebo, the test subjects with metadoxine injections showed decreased half-life of ethanol in the blood and showed a faster rate of ethanol elimination, leading to a faster onset of recovery (wherein recovery was defined as a decrease of at least one category of intoxication according to alcohol levels). The average time to onset of recovery in the placebo group was 2.34 and 0.95 h in the metadoxine group. In addition, other psychopathological features of intoxication, such as agitation and mental function impairment decreased significantly faster in metadoxine group than in controls placebo group. The proportion of completely symptom-free patients, too, was higher in the metadoxine group as compared to the placebo group [25].

In conclusion, metadoxine appears to be a useful drug in the clinical management of Acute Alcohol Toxicity as it increases ethanol elimination, thereby effectively reducing Blood alcohol concentration levels within a short period of time, resulting in a faster clinical and metabolic recovery in patients. Moreover, it appears to be manageable and safe [25].

Conclusion

Ingestion of large amounts of Alcohol can cause a clinically harmful condition called Acute Alcohol Toxicity. A person with Acute Alcohol Toxicity presents with a wide-ranging set of clinical symptoms and signs that involve various organ systems and apparatuses. He/She may show cardiac, pulmonary, gastrointestinal, neurological, metabolic and behavioral complications. An intoxicated patient is managed primarily in the Emergency Department, where treatment is directed at stabilizing his/her condition, depending on his/her clinical presentation. Metadoxine, a drug that is able to accelerate ethanol excretion, is a useful adjunct in the treatment of such patients. Patients presenting with Alcohol Toxicity should be screened for Alcohol-related disorders and directed to Treatment units if required.

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