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Role of first aid in the management of acute alcohol intoxication: a narrative review

A. PICCIONI[1], C. TARLI[2], S. CARDONE[1], M. BRIGIDA[1], S. D'ADDIO[2], M. COVINO[1], C. ZANZA[1], G. MERRA[3], V. OJETTI[1], A. GASBARRINI[2], G. ADDOLORATO[2-4], F. FRANCESCHI[1]

[1]Emergency Medicine, Fondazione Policlinico Universitario A. Gemelli IRCCS, Università Cattolica del Sacro Cuore, Rome, Italy
[2]Institute of Internal Medicine and Gastroenterology, Università Cattolica del Sacro Cuore, Rome, Italy
[3]Nutritional Sciences Department, University of Tor Vergata, Rome, Italy
[4]Department of Internal Medicine and Gastroenterology, Internal Medicine and Alcohol Related Disease Unit, Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy

Abstract. – OBJECTIVE: Acute alcohol intoxication is actually a common admission cause in the Emergency Department and represents an increasing public health burden, in particular among adolescents. It involves possible and significant illness and injury, which can quickly get worse and may need to be managed in the emergency room.

MATERIALS AND METHODS: We conducted a narrative review of the literature regarding the effectiveness of first aid role of the Emergency Department setting.

RESULTS: This review included eighteen studies about alcohol intoxication management in the Emergency Department; most of all highlights the emerging phenomenon in Europe and around the world of acute alcohol intoxication management in first aid.

The treatment of acute alcohol intoxication depends on general clinical conditions of the patient, vital signs, hemodynamic stability, cognitive state, alcohol-related complications, which are closely related to the blood alcohol concentration. At the same time, symptoms could be extremely variable due to individual differences in alcohol metabolism. In case of mild-moderate intoxication (blood alcohol concentration < 1 g/L), no drugs are necessary. In case of severe intoxication (blood alcohol concentration > 1 g/L), it is necessary to support with intravenous fluids, treat hypoglycemia, hypotension, hypothermia and electrolyte imbalance, administer complex B and C vitamins and accelerate alcohol elimination from blood with metadoxine. Unlike adults, adolescents are more exposed to the toxic effect of alcohol (because of their immature hepatic alcohol dehydrogenase activity), and then, acute alcohol-related complications are more frequent and dangerous in young people than in adult population. In many cases, patients affected by acute alcohol intoxication referring to an Emergency Department have mild-moderate transitory symptoms that do not require the use of drugs; they can benefit from a clinical observation, with a clinical course often completed within 24 hours with a favorable outcome. Clinical observation with vital signs control is necessary also to evaluate the possible development of the alcohol withdrawal syndrome (that involves a specific treatment) and to evaluate also possible pathological complications of the organism, above all acute liver damage.

CONCLUSIONS: Patients affected by acute alcohol intoxication are the best candidates to apply the rules of the Temporary Observation Unit in the Emergency Department, because of a clinical course often completed within 24 hours, a favorable outcome and without the need for hospitalization. In many cases, hospitalization could be not necessary, but the patient affected by Alcohol Use Disorder must be referred to an Alcohol Addiction Unit for the follow-up, to reduce the risk of alcohol relapse and complications related to alcohol abuse, and financial costs of hospitalization.

Key Words:
Acute alcohol intoxication, Temporary Observation Unit, Emergency Department.

Introduction

Acute alcohol intoxication is a common and increasing public health burden that causes significant illness and injury in the Emergency Department (ED)[1,2].

According to the fifth edition of the Diagnostic and Statistical Manual (DSM-5) alcohol abuse and alcohol dependence (repeated use) are integrated into a single disorder called Alcohol Use Disorder (AUD).

Corresponding Author: Andrea Piccioni, MD; e-mail: andrea.piccioni@policlinicogemelli.it

Frequently, patients affected by AUD who refer to ED are not known to the territorial services and are not followed up for the specific disease; in this context, ED plays a first aid role[3].

Excessive alcohol consumption represents one of the principal causes of preventable death around the world.

The most frequent clinical presentation of alcohol intoxication is a cognitive impairment, but it hides complex pathological states of the organism caused by the action of a substance that depends on type of substance, dosage, time of elimination, comorbidity.

It is a dynamic process that can quickly get worse and lead to life-threatening complications; it includes acute illness such as hepatitis, liver cirrhosis, cancer, respiratory disease and can rapidly develop to hepatic insufficiency or respiratory arrest even death. In addition to this, acute alcohol intoxication induces behavioral alterations such as euphoria, dysphoria, social disinhibition, sleepiness, belligerence and aggressiveness (until lethargy, stupor and coma) that could provoke accidents and violence, reducing the quality of life or resulting potentially fatal[4,5].

Nowadays, acute alcohol intoxication prevalence is increased, in particular among adolescents with the pattern of binge drinking[6]. Binge drinking is defined as the consumption of five or more drinks (12 grams of ethanol each one) in a single occasion, reaching so quickly cognitive impairment[6]. Acute alcohol intoxication represents the most frequent cause of hospitalization for children under 16 years of age[5]; 17% of all ED visits for acute alcohol intoxication are adolescents < 14 years old[7].

This scenario emerges in a period in which World Health Organization has long recommended total alcohol and drugs abstinence for adolescents up to 16 years old: who starts drinking before 16 years old has a four-fold increased risk to develop addiction in adulthood, compared with people who begin no earlier than 21 years old[8].

This high burden of alcohol-related injury and disease indicates a need to increase awareness of AUD and its effective treatment options[9]. It is necessary to underline the importance of an appropriate and timely management and treatment of the alcohol disease referring to territorial services and Alcohol Addiction Unit also to reduce the ED access and the financial costs of hospitalization.

Patients affected by acute alcohol intoxication are the best candidates to apply the rules of Temporary Observation Unit (TOU) in ED, because the clinical course is often resolved within 24 hours with a favorable outcome and the hospitalization might not be necessary.

We undertook a narrative review about the effective role of TOU in ED to improve management of acute alcohol and drugs intoxication.

Materials and Methods

We conducted a narrative review of the literature regarding the effectiveness of first aid role of the ED setting, using the following key terms: alcohol, alcohol dependence, alcohol abuse, Alcohol Use Disorder, acute alcohol intoxication, and emergency department.

Electronic database searches of Medline-PubMed, Web of Science, Scopus, Cochrane Central Register of Controlled Trial (CENTRAL) were conducted for English-language articles published between 2002 and 2019. The studies selected were preferentially randomized placebo-controlled studies, case-control studies, retrospective and prospective observational studies, systematic reviews.

Results

Eighteen studies[3,4,6,9-23] about alcohol intoxication management in ED were included.

Table I describes the type of study, year of publication, number of patients evaluated and principal findings. Studies were generally limited to individuals older than 18 years, with the exception of four studies[5,6,18,20] that surveyed adolescents and young adults.

Most studies highlight the emerging phenomenon in Europe and around the world of acute alcohol intoxication management in first aid.

All studies agree on the need to urgently treat patients affected by acute alcohol intoxication in ED, to stabilize the patient's vital signs, and to prevent mid- and long-term alcohol-related complications.

The first goal is to monitor and support vital functions and keep the patient under observation also for the onset of alcohol withdrawal symptoms, mainly for people affected by severe Alcohol Use Disorder.

Symptoms are usually related to blood alcohol concentration (BAC) and are extremely variable due to individual differences in its metabolism[11]

Table I. Studies analyzed for this narrative review.

Authors	Type	Year of publication	No. of patients	Findings
Bouchery et al [1]	Research support	2011	/	US National databases from 2006 were analyzed in order to assess the economic costs of excessive drinking: the impact was about 750$ per person, most of it related to binge drinking. The overall burden in 2006 was $223.5 billion
Mullins et al [2]	Retrospective study	2017	/	A national retrospective review conducted in Washington concerning ED visits for alcohol intoxication in adults from 2001 to 2011 showing that these are increasing at a greater rate with respect to all-cause admission trends, thus representing a burden on hospital resources
Barata et al [3]	Review	2017	/	Moderate-quality evidence of targeted utilization of brief intervention and brief motivational intervention in the ED showed a little reduction in alcohol use in low or moderate drinkers, a minimization in the negative consequences of use (e.g., injury), and a decline in ED readmission for adults and children ≥ 12 years of age
Vonghia et al [4]	Review	2008	/	Acute alcohol intoxication management primarily involves stabilizing the patient's clinical condition, hastening the elimination of alcohol, and defining and treating all of the clinical alterations. Metadoxine can be regarded as an effective and useful drug.
Grüne et al [5]	Retrospective cohort study	2017	1441	Male and female in-patients with acute alcohol intoxication differ concerning the drinking context (admission time, drinking situation, drinking occasion and admission context)
Addolorato et al [6]	Prospective study	2018	2704	Alcohol use with a binge drinking pattern is strongly correlated with the development of Alcohol Use Disorder
Grant et al [9]	Prospective study	2015	36309	Face-to-face interviews for the 2012-2013 National Epidemiologic Survey on Alcohol and Related Conditions III, to estimate twelve-month and lifetime prevalence of alcohol use disorder (AUD). The study highlights the urgent need to improve public and policy makers' awareness of AUD and its treatment alternatives
Fillmore et al [10]	Prospective study	2011	251	Female binge drinkers achieved significantly higher estimated blood alcohol concentrations (BACs) per episode than their male binge drinking counterparts. It is also important to consider frequency of consumption in determining risky drinking *vs.* basing solely on quantity measures.
Caputo et al [11]	Position paper	2019	/	Although mild alcohol withdrawal syndrome (AWS) may not need treatment, moderate to severe AWS should be treated pharmacologically; patients with serious AWS should be admitted to hospital. Benzodiazepines (BDZs) are the gold standard for AWS care, while alpha2-agonists, beta-blockers and neuroleptics can be used in conjunction when BZDs do not fully relieve specific chronic symptoms.
Hinfray et al [12]	Prospective study	2019	411	In order to classify patients who may benefit from brief intervention or advanced brief intervention in an addictology unit, a comprehensive screening is essential

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Table I (Continued). Studies analyzed for this narrative review.

Authors	Type	Year of publication	No. of patients	Findings
Oliver et al [13]	Prospective study	2019	173	Patients with acute behavioral disorders often have a mental illness history and are commonly intoxicated. These patients have impacts on healthcare resources and pose risks to staff safety, but these patients do not frequently show significant complications
Nepal et al [14]	Review	2018	/	There is no clear evidence that lockouts prevent alcohol-related damage, as opposed to what is known about halting alcohol sales, for which there is proof of effectiveness.
Maniaci et al [15]	Retrospective study	2020	251	Involuntary hold patients reported increased ED LOS associated with alcohol use, use of barbiturates and screening for urine drug testing. Developing a protocol to help the streamline assessment of alcohol and drug use in this patients' population may improve the ED LOS.
Calle et al [16]	Prospective study	2017	487	Ethanol remains the most commonly consumed legal substance, but modern illegal recreational substances are also often co-used. The most alarming observation, in particular among MDMA user, was the high-risk poly-drug use.
Galicia et al [17]	Retrospective study	2019	609	Co-ingestion of ethanol increases the adverse events of GHB/GBL-intoxicated patients, resulting in greater consciousness impairment, need for care, ICU admission and longer LOS.
Rodrigues et al [18]	Retrospective study	2018	180	This study confirms a high rate of adolescent alcohol use, in particular "heavy episodic drinking", which shows an easy access to alcohol at this age. Each adolescent consultation will promote and incorporate the introduction of drug-use reduction services into community and education systems.
Homma et al [19]	Retrospective study	2018	106	For the treatment of Acute Alcohol Intoxication (AAI), intravenous crystalloid fluids (IVF) extended ED LOS even after correction for possible confounders. Patients being administered IVF for AAI should be carefully chosen.
Adam et al [20]	Prospective study	2016	631	Interviews conducted to assess the prevalence of AUD, social status and mental health 7 years after ED admission for alcohol intoxication in a tertiary center in Switzerland. Mental health disorders and social problems are likely, and secondary preventive measures should be offered to these patients during ED management.
Marshall et al [21]	Prospective study	2019	74	This study indicates that the awareness and confidence of clinicians can be significantly influenced by targeted training/education, but this must incorporate knowledge translation skills.
Vallersnes et al [22]	Prospective study	2018	1952	Nine percent (169/1952) of cases of acute poisoning due to abuse substances, another episode of intoxication rep-presented within a week. Patients more likely to re-present were self-discharging patients, homeless patients and those using opioids as toxic agents.

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such as gender, age, body weight, consumption during meal or not, chronic alcohol abuse (because of alcohol tolerance due to the reduction in number and sensitivity of GABA receptors to GABA and due to the increase in number and sensitivity of NMDA receptors to glutamate)[24].

Table I (Continued). Studies analyzed for this narrative review.

Authors	Type	Year of publication	No. of patients	Findings
Kim et al [23]	Review	2015	/	Naloxone is an intrinsically safe drug, and may be administered in large doses with minimal clinical effect in non-opioid-dependent patients. However, when administered to opioid-dependent patients, naloxone can result in acute opioid withdrawal. Therefore, it is prudent to use low-dose naloxone (0.04 mg) with appropriate titration to reverse ventilatory depression in opioid-dependent patients
Tabakoff et al [24]	Review	2013	/	A review on the history of development in the study of neurobiology of ethanol's effects (GABA and glutamate neurotransmission)
Shpilenya et al [26]	Prospective study	2002	58	Double-blind, randomized, placebo-controlled trial conducted on acute alcohol intoxication to evaluate clinical and biochemical parameters after metadoxine 900mg administration. This drug accelerated ethanol elimination from blood and led to faster recovery
Addolorato et al [27]	Review	2003	/	This review reports preclinical and clinical results obtained using metadoxine in acute and chronic alcohol intoxication
Pianca et al [28]	Review	2017	/	Screening, diagnosis, evaluation, and treatment of ethanol intoxication in children and adolescents in the emergency setting

In general, the consumption of a standard drink (12 grams of ethanol) induces a BAC of approximately 0.2 g/L and is metabolized in approximately 1 hour[4,25]. At a BAC higher than 300 mg/dl can cause respiratory depression and arrest; death generally occurs at a BAC higher than 500 mg/dl.

In case of mild-moderate intoxication (blood alcohol concentration <1 g/L), no drugs are necessary (only monitor and keep the patient under observation for the onset of alcohol withdrawal symptoms).

In case of severe intoxication (blood alcohol concentration >1 g/L), it is necessary to prevent and to treat the potentially lethal metabolic effects of alcohol libation (in particular in adolescents) and to accelerate alcohol elimination from blood.

It is necessary to support with intravenous fluids, treat hypoglycemia, hypotension, hypothermia and electrolyte imbalance, administer complex B and C vitamins, and support ventilation when necessary[15]. To accelerate the elimination of ethanol from blood (assisting a faster recovery of the patient), two possible strategies can be applied: to perform a gastric lavage within two hours after drinking a considerable amount of alcohol or to administer metadoxine (pyridoxol L-2-pyrrolidone-5-carboxylate) that may be capable of decreasing ethanol blood levels by accelerating the urinary elimination of ethanol and acetaldehyde[26].

Hypoglycemia is fasting-related and develops more frequently in young people (because of a lower reserve of liver glycogen); it is necessary to administer intravenous 5% glucose solution or, if possible, to invite the patient to eat fructose-rich foods and complex carbohydrates.

Other metabolic effects could be electrolyte imbalance such as hypokalemia, hypomagnesaemia, hypocalcemia which must be appropriately and individually treated and replaced.

The administration of vitamin supplements is aimed at preventing the onset of Wernicke's encephalopathy (characterized by ophthalmoplegia, ataxia and mental confusion and more frequent in alcohol withdrawal syndrome) and for this reason thiamine, vitamins B6-B12 and C are used.

In addition to this, alcohol intoxication could lead to cardiovascular effects such as tachycardia, peripheral vasodilatation and volume depletion, inducing hypotension and hypothermia. Like hypoglycemia, hypothermia is also more frequent in young people and if blood alcohol concentration is increasing, the adolescent should be closely monitored for depression of the central nervous system[11]. In case of severe restlessness, haloperidol should be administered, because of a lower chance of alcohol interaction.

Metadoxine is able to accelerate the elimination of alcohol from the blood and tissues, to help restore the functional structure of the liver and to relieve neuro-psychological disorders associated with alcohol intoxication. Due to its safe and manageable pharmacology profile, metadoxine is widely used by physicians especially in the acute setting of the Emergency Unit, where it makes it possible to accelerate clinical and metabolic recovery from intoxication, with a single administration (300 mg i.v.) and without any additional workload for the treatment centre[27].

There are no studies performed on metadoxine use for the improvement of symptoms of alcohol intoxication in the pediatric population[28].

Four of the eighteen analyzed studies[5,6,18,20] focused the attention on adolescents. Unlike adults, adolescents, that have immature hepatic alcohol dehydrogenase activity and did not develop tolerance by repeated alcohol exposure are more exposed to the toxic effect of alcohol. Their fashionable pattern of drinking (*binge drinking* or heavy episodic drinking) affects about 15% of adolescents aged 15 years and older[5] and represents the most frequent cause of hospitalization for children under 16 years of age.

Another reason to the ED referring is the hangover syndrome (characterized by a series of physical and mental symptoms such as headache, sweating, myalgia, red eyes, dizziness, cognitive and mood disorders) that can appear a few hours after stopping drinking, when the blood alcohol level starts to fall, reaching zero. General indications for the treatment of this syndrome are fruit or fruit juice, complex carbohydrates, antacid drugs, caffeine, sleep.

In 2017, the Italian Ministry of Health has shown that 8% of ED visits for alcohol problems are subjects < 17 years and 17% of all ED visits for acute alcohol intoxication are adolescents < 14 years old[7].

The lethal dose of alcohol varies among children and adolescents; alcohol-induced hypoglycemia and hypothermia tend to be more severe in young subjects than in adults.

Moreover, in the long term "binge drinking teenagers" have a significantly higher risk to develop alcohol dependence in adulthood: an early exposure to alcohol could sensitize the addiction neurocircuitry and could induce abnormal plasticity in reward-related learning processes, leading to the addiction[18], as observed in a recent cross-sectional study conducted in about 2700 students between 13 and 17 years old[6].

Discussion

Acute alcohol intoxication is a dynamic process that encompasses a variety of clinical states ranging from a slight alteration of the consciousness to life-threatening short, medium and long-term complications.

Fortunately, in many cases, patients affected by acute alcohol intoxication referring to an ED have mild-moderate transitory symptoms that do not require the use of drugs; they can benefit from a clinical observation, with a clinical course often completed within 24 hours with a favorable outcome. In these cases, vital functions should be monitored, and clinical observation is also necessary to evaluate the possible development of alcohol withdrawal syndrome.

The hospitalization could be not necessary; however, at the same time, the medical management in ED must guarantee a consequent follow-up of the patient affected by Alcohol Use Disorder in an Alcohol Addiction Unit to reduce the risk of alcohol relapse, the return to the hospital and complications related to alcohol abuse.

On the other hand, in case of severe acute alcohol intoxication with respiratory insufficiency and coma, it is necessary to: resort to intensive care unit to support ventilation; exclude additional causes of coma; administer drugs to reduce the blood alcohol concentration (e.g., metadoxine); treat hypoglycemia and hypothermia; in the case of simultaneous sedative drugs, use specific antidotes (naloxone for opioids and flumazenil for benzodiazepines).

Treatment of acute alcohol intoxication (that includes an abrupt stop of alcohol intake) with consequent symptoms' regression in patients affected by severe Alcohol Use Disorder (chronic abuse), could determine the development of a new clinical condition requiring emergency treatment: the alcohol withdrawal syndrome.

This is characterized by autonomic hyperactivity, and tremor, insomnia, nausea or vomiting, visual/auditory/tactile hallucinations, psychomotor agitation, anxiety, until generalized tonic-clonic seizures and delirium tremens[29].

The severity of this syndrome is defined by CIWA-Ar score, which is a scale that considers all symptoms and signs of alcohol abstinence. If CIWA-Ar score is less than 8, points no specific treatment is recommended; is CIWA-Ar score is between 8 and 15, an out-patient treatment could be appropriate with the gold standard long-life benzodiazepines (to prefer short half-life benzodi-

azepines in acute alcoholic hepatitis and advanced cirrhosis); if CIWA-Ar score is more than 15, the withdrawal syndrome could be a life-threatening condition (seizures, delirium tremens) requiring the support of the intensive care unit. Benzodiazepines, together with non-pharmacological support (hydration, glucose, correction of electrolyte imbalance, group B vitamins), are the gold standard in the treatment of alcohol withdrawal syndrome. Alfa-2-agonist, beta-blockers, neuroleptics could be useful in association with benzodiazepines, when the latter are not effective in controlling persisting symptoms.

In acute alcohol intoxication, in addition to clinical observation, it is important to evaluate also possible and complex pathological complications of the organism, above all the alcohol-related liver damage.

A very important clinical complication of acute alcohol intoxication is acute alcoholic hepatitis, defined as a syndrome characterized by the rapid onset of jaundice usually in subjects with chronic and heavy alcohol use or in patients affected by alcoholic liver cirrhosis. Laboratory abnormalities include hyperbilirubinemia, serum levels of aminotransferases (AST and ALT greater than upper limit), prolonged prothrombin time and neutrophilia. In severe forms of acute alcoholic hepatitis (defined by a Maddrey discriminant score upper than 32 points), corticosteroid therapy is recommended. Only selected patients that do not respond to medical therapy should be evaluated for liver transplantation.

Conclusions

Patients affected by acute alcohol intoxication are the best candidates to apply the rules of Temporary Observation Unit in ED, because the clinical course is often resolved within 24 hours with a favorable outcome and the hospitalization could not be necessary.

However, the medical management in ED must guarantee a consequent follow-up of the patient affected by Alcohol Use Disorder in an Alcohol Addiction Unit to reduce the risk of alcohol relapse, the return to the hospital and complications related to alcohol abuse. An appropriate and timely management and treatment of the alcohol disease referring to territorial services and Alcohol Addiction Unit is efficacy to reduce the ED access but also the financial costs of hospitalization.

This high burden of alcohol-related injury and disease indicates a need to increase awareness of AUD and its effective treatment options, especially and even more nowadays when the phenomenon of alcohol abuse largely affects teenagers with the binge-drinking pattern.

Conflict of Interests

The Authors declare that they have no conflict of interests.

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