DOI: 10.7860/JCDR/2023/62534.18279

Review Article

Internal Medicine Section

A Narrative Review on Emergency Management of Poisoning

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ABSTRACT

Poisoning cases are coming to the Emergency Department (ED) and cases are increasing day by day due to their easy and vast availability. Clinicians are frequently dealt with to manage critically ill poisoning patients. With the swing of prominence in managing poisoning from in-patient care to early decontamination and early stabilisation, ED physicians are playing a more dynamic role in the care of poisoned patients. The clinical effects encountered by them are dependent on numerous variables, such as the dose, the duration of exposure, the health history of the patient, to provide thorough supportive care, recognition of patients requiring treatment with a specific antidote, and to use the appropriate methods to restrict poison absorption or to increase its elimination, which is the foundation of management. If poisoning in the patient is documented early and appropriate compassionate care is commenced hastily, maximum of patients recover soon. This article is aimed to focus on the more specific issues of emergency management of the poisoned patient.

Keywords: Antidotes, Blood poisoning, Emergency medicine, Gastric lavage, Medico-legal aspects, Patient care

INTRODUCTION

The management of addiction, drug overdoses, and unfavourable drug responses are some of the most crucial and dynamic issues that practitioners in the field of medical toxicology deal with daily. In India, abuse of both legal and illegal substances is still prevalent [1]. Because of how quickly drugs are approved, their full toxicity is frequently not understood until they have been used, or in the post-marketing era. The frequency of poisoning in humans is difficult to estimate. Information on drug abuse and overdose is available from a variety of sites [2]. The American Association of Poison Control Centers (AAPCC) operates the National Poison Data System (NPDS), which includes the Toxin Exposure Surveillance System (TESS). TESS is a surveillance system that tracks and analyses cases of potentially harmful exposures to toxins, including medications, chemicals, and other substances [3]. The information gathered by TESS can be used to identify trends and patterns in toxic exposures and to develop interventions and educational programmes to prevent future poisonings. The data is also used to inform the public about health policy decisions and to respond to public health emergencies related to toxic exposures [4].

Acute poisoning is a common emergency that requires early management decisions to ensure optimal outcomes while avoiding lengthy investigations, interventions, or observations. A systematic and individualised approach to patient evaluation and treatment is ideal for providing the best emergency care for acute poisoning. The purpose of this paper is to address the main aspects to consider, in developing an individualised treatment plan for each patient [4].

A rational treatment plan for poisoning involves identifying the poison, assessing the severity of poisoning, initiating supportive care, administering specific antidotes, considering gastrointestinal decontamination, monitoring the patient, and providing appropriate follow-up care [5]. The term “poisoning” refers to the process of being exposed to a substance, called a poison or a toxicant that can cause harm or death. Poisoning can occur through ingestion, inhalation, or absorption of the poison into the body through the skin or mucous membranes [6]. Poisons can be found in a variety of sources, including household products, pesticides, industrial chemicals, drugs, and certain plants and animals. Symptoms of poisoning can range from mild to severe and can include nausea, vomiting, headache, dizziness, difficulty breathing, seizures, and even coma or death, depending on the type and amount of poison involved. Prompt and appropriate treatment is crucial in cases of poisoning and may involve administering antidotes, providing supportive care, or seeking emergency medical attention [7]. Intentional toxic exposure or overdose of drugs can have serious and potentially life-threatening consequences. It is important to seek immediate medical attention if you suspect that someone has intentionally ingested toxic substances or taken an overdose of drugs. The symptoms of drug overdose or toxic exposure can vary depending on the substance involved and the amount taken, but common signs can include confusion, dizziness, difficulty breathing, seizures, and loss of consciousness. In severe cases, overdose can lead to cardiac arrest, coma, and death [8]. Snake bites in India are a significant public health issue, with an estimated annual incidence of around 50,000 deaths and 200,000 cases of disability. The incidence of snake bites in India varies by region and season. In general, the incidence of snake bites is higher in rural areas than in urban areas and higher in the monsoon season (June to September) than in other seasons [9]. Snake bites are a common occurrence during the monsoon season. There are four main types of venomous snakes found in India [10]. The Indian cobra and common krait are known for having neuroparalytic characteristics. Viper bites are responsible for the haematotoxin symptoms [10,11]. The common krait has venom that affects the nervous system and can cause muscle weakness, paralysis, and respiratory failure. The Russell’s viper has a venom that affects the blood-clotting system and can cause bleeding, shock, and kidney failure [11,12]. In addition to these four main types of venomous snakes, there are many non venomous snakes found in India that can still cause harm through bites or other means. It is important to seek immediate medical attention if you are bitten by a snake in India, as prompt treatment with anti- venom can save lives and prevent disability [10-12].

PREHOSPITAL MANAGEMENT

The prehospital management of poisoning in a patient begins from the sight of the incident. Early initiation of vomiting can eliminate a major part of the ingested poison. It is still unclear, however, whether early initiation of vomiting influences the outcome [13]. In countries where information centres for poison are easily attainable to the general public, people are recommended to keep *Carapichea ipecacuanha* (Ipecac Syrup USP or Pediatrics Ipecacuanha Emetic Mixture BP) with them

[14]. When the poison ingested is not identified, the physician does not advise inducing vomiting by the gag reflex or with any chemical agents. If the toxic agent ingested is corrosive, vomiting will impose a second insult on the gastrointestinal tract (upper). Furthermore, if vomiting is induced in patients with lessening consciousness, it can be lethal [15]. For the on-site treatment of poisoning the most useful and easy recommendations are as follows:

I. To wet external chemical burns with an abundance of water.

II. If the toxic agent ingested is corrosive then drink some water or milk, it helps in the dilution of the corrosive thus reducing tissue damage.

III. Submerge stings from stonefish or any other deep-sea fish in some hot water (at 45°C) for about 30 to 60 minutes which helps in the inactivation of the toxin which in turn decreases the severity of the symptom [16].

MANAGEMENT OF POISONING IN THE EMERGENCY DEPARTMENT

All severely poisoned patients are triaged on arrival at the Emergency Department (ED), as being in a serious or emergency condition [17]. A detailed and reliable description of the drug or drugs taken should be sought; which must comprise the drug name, the dose taken, time of intake, and the ingestion of other substances such as alcohol or recreational drugs (if any), which might help in the management of patient's critical state and drug clearance [18]. The patient may be unable to give these details due to unconsciousness or trauma hence incenting history should be obtained from available sources such as witnesses, a packet of the drug consumed, any suicidal notes from the ambulance team, and the patient's health history [19].

Immediate Care/Initial Management

The preliminary approach to evaluate the critically poisoned patient is based on methodical assessment, proper stabilisation, and compassionate care [20]. It is important to reflect on an extensive differential diagnosis to evade impulsively excluding potentially serious conditions which include both toxicological and non toxicological emergencies. The critically poisoned patient may present with central nervous system depression or coma where intubation is essential to effectively protect their airway and reduce the aspiration risk [21]. The preliminary precedence in treating critically ill poisoned patients is standard resuscitation that includes airway, breathing, and circulation. An oropharyngeal or nasopharyngeal airway and bag-mask ventilation with the provision of supplemental oxygen may be required in patients with insufficient ventilation caused by reduced respiratory effort or airway compromise until a definitive airway can be obtained in them either through toxin reversal (for example: naloxone for opioids), or rapid succession induction, intubation, and mechanical ventilation [22]. A low respiratory rate with reduced oxygen saturation may signify hypoventilation, but note that a normal saturation does not exclude hypoxia in carbon monoxide poisoning. Arterial blood gases should be measured in doubtful conditions, convulsion, and arrhythmia, their onset can be quite sudden hence these toxic symptoms should be observed thoroughly. Gut decontamination should be considered if the physical examination and patient's history support toxic ingestion [23].

Many drugs demonstrate cardiovascular toxicity in overdose e.g., β-blockers, digoxin, tricyclics, and lithium. This may appear as hypotension and or cardiac arrhythmias. In these cases, pulse, blood pressure, and Electrocardiogram (ECG) should be recorded. Initial fluid resuscitation should be given as appropriate and intravenous access established [24].

Further Management

Additional investigations: Additional laboratory investigations such as urea, electrolytes, and blood glucose as a minimum should be done. Creatinine Kinase (CK) should be measured if there is a suspected probability of rhabdomyolysis or serotonin syndrome [25]. Providing a rapid evaluation of acid-base disturbance as well as reviews are the way of ventilation in patients with reduced reconciliation. Even blood gases are helpful. Properly timed drug levels (e.g., paracetamol, lithium, salicylate) should be taken when indicated. If there is any possibility of paracetamol poisoning, paracetamol levels should be sent. Many emergency departments measure paracetamol levels in all patients where poisoning is suspected, as paracetamol poisoning is related to lack of early clinical signs. In conscious overdose patients, who have no indication signifying salicylate and lithium toxicity, and refuse staking salicylate/lithium-containing preparations, there is no need to measure salicylate or lithium concentrations. Salicylate levels should be measured in patients where poisoning is suspected in all unconscious patients. Most poisonings are treated based on observed clinical toxicity rather than drug concentration [26]. Temperature, blood glucose (low in β-blocker, ethanol poisoning), and weight should also be recorded. Weight is very important in calculating the dose of the drug whether the patient is likely to have received a toxic dose and may direct treatment, e.g., in paracetamol overdose.

The examination should depict any related injury (accidental or intentional-harm) which may require proper treatment or the presence of other substances such as alcohol. If their clinical condition permit, an assessment of the patient's mental state should be done [27]. In the medicolegal management of poisoned patients or if there is a suspicion of child abuse, toxicology screening may be suitable. Requests for toxicology screens of urgent urine or blood should be discussed with a clinical toxicologist to make them as complete and pertinent as required [28]. Patients who come claiming that they have been the victim of a sexual assault after having some contaminated drink, should have biological samples taken for toxicological analysis only if the contaminated drink was taken very recently. Common drugs used in date rape are midazolam and Gamma Hydroxybutyrate (GHB) and they can only be detected in a urine or blood sample obtained within the first few hours of exposure [29].

DIAGNOSTIC APPROACH

Toxidromes

Toxidromes refer to a group of symptoms and signs that are associated with specific classes of toxins or drugs. Recognising the toxidromes can be helpful in identifying the potential cause of poisoning or overdose, and guiding appropriate management [30]. The diagnostic approach to toxidromes typically involves a systematic evaluation of the patient's history, physical examination, and laboratory tests. Here is a general approach to identify toxidromes: Take a complete history, conduct a thorough physical examination, and check for important clinical characteristics [31]. Toxidromes are divided according to their site of action, and signs and symptoms as shown in [Table/Fig-1] [32-34].

Toxidrome	Mechanism of action	Signs and symptoms
Cholinergic toxidrome	Acetylcholinesterase inhibition	Increased salivation, lacrimation, urinary incontinence, diarrhoea, bronchorrhoea, bradycardia, miosis, muscle fasciculations, weakness, and confusion
Anticholinergic toxidrome	Muscarinic acetylcholine receptor blockade	Dry mouth, dilated pupils, flushed skin, urinary retention, tachycardia, altered mental status, hyperthermia
Sympathomimetic toxidrome	Adrenergic receptor stimulation	Agitation, tachycardia, hypertension, dilated pupils, diaphoresis, hyperthermia
Opioid toxidrome	Opioid receptor agonism	Respiratory depression, pinpoint pupils, decreased level of consciousness
Sedative-Hypnotic toxidrome	Central nervous system (CNS) depression	Sedation, respiratory depression, slurred speech, impaired coordination, altered mental status

Serotonin syndrome	Serotonin receptor overstimulation	Agitation, tremor, hyperreflexia, dilated pupils, diaphoresis, tachycardia, hypertension, hyperthermia, altered mental status
Neuroleptic Malignant Syndrome (NMS)	Dopamine receptor blockade	Rigidity, fever, altered mental status, autonomic instability, elevated Creatine Kinase (CK)

[Table/Fig-1]: Classification of toxidromes.

Hyperthermic Syndrome

Patients with temperatures greater than 39.0°C should be treated insistently with active cooling measures and cool i.v. fluids because prolonged hyperthermia can result in considerable complications such as acute renal failure, rhabdomyolysis, and disseminated i.v. coagulation [35]. In hyperthermic patients with evidence of excessive sympathetic stimulation such as that associated with cocaine and amphetamines, intravenous benzodiazepines are appropriate treatment. Patients with resistant hyperthermia should be discussed with a clinical toxicologist and they may be cured from peripherally acting muscle relaxants (dantrolene), centrally acting serotonin antagonists (cyproheptadine), or general anaesthetic sedation [35].

TREATMENT APPROACH

Decontamination

Inducing emesis is no longer suggested in case of corrosive or volatile substances. Decontamination with ipecac, activated charcoal, gastric lavage, and whole bowel irrigation was once common practice and is in recommendations of the American Academy of Clinical Toxicologists (AACT) and European Association of Poison Centers and Clinical Toxicologists (EAPCCT) [36,37].

Activated charcoal: The dose of activated charcoal used in cases of poisoning can vary depending on several factors, including the age and weight of the patient, the type and amount of toxin ingested, and the time elapsed since ingestion [37,38]. In general, the recommended dose of activated charcoal for acute poisoning is one gram per kilogram of body weight, up to a maximum of 50-100 g, given orally or via a nasogastric tube. The dose may be repeated every 2-4 hours if needed. If you suspect that someone has ingested a poisonous substance, it is important to seek medical attention immediately. Do not attempt to treat the person with activated charcoal or any other home remedies without medical supervision [39]. Doses of activated charcoal should be considered for the adsorption and improved elimination of certain toxins [Table/Fig-2]. Certain other substances (including alcohols, lithium, and ferrous salts) however, are not readily adsorbed to charcoal and hence this treatment is not recommended for poisoning with these substances [40].

Toxins for which multiple doses of activated charcoal are indicated
- Carbamazepine
- Quinine
- Digoxin
- Phenobarbitone
- Paraquat
- Dapsone
- Slow-release preparations such as theophylline
- *Amanita phalloides* fungus
- Multiple doses may also be considered in life-threatening overdoses of other drugs (e.g., tricyclic antidepressants)

[Table/Fig-2]: Toxins for which multiple doses of activated charcoal are indicated [40].

Gastric lavage: The use of gastric lavage is now limited to life-threatening ingestions that present within one hour of ingestion; and even then, clinical benefit has not been confirmed in controlled studies. To reduce the morbidity of the procedure, certain contra-indications should be noted. They include a defenseless airway, an unhelpful patient, and the ingestion of corrosives or volatile products. Additionally, the appropriate method of gastric lavage is important in minimising the risk of pulmonary aspiration and oesophageal rupture [41].

Whole bowel irrigation: This procedure can be considered for potentially toxic intake of sustained-release or enteric-coated drugs. A laxative agent such as polyethylene glycol is administered to fully flush the bowel of stool and unabsorbed xenobiotics [41].

Antidotes

Antidotes are available only for a restricted number of drugs and poisons. While most of the poisoning cases are managed mainly with appropriate supportive care, numerous precise antidote agents may be employed. A few antidotes are commonly utilised in the management of acute poisoning [42]. The table below lists some of the more common antidotes for definite poisonings used in clinical practice. Antidotes commonly used in the management of poisoned patients are in [Table/Fig-3] [42].

Toxin	Antidote
β blockers	Glucagon
Calcium channel blockers	Calcium chloride
Oral anticoagulants	Vitamin K1 (phytomenadione)
Digoxin	Digoxin-specific antibodies (Digibind)
Ethylene glycol/methanol	Ethanol/4-Methylpyrazole
Carbon monoxide	100% oxygen
Cyanide	Thiosulphate/cobaltate/Hydroxycobalamin
Organophosphates	Atropine/oximes
Oxidising agents	Methylene blue
Iron	Desferrioxamine
Heavy metals	EDTA, DMSA, DMPS
Paracetamol	N-acetylcysteine
Opioids	Naloxone
Sulfonylureas	Octreotide
Sympathomimetics	Propranolol hydrochloride; esmolol hydrochloride
Tricyclic antidepressants	Sodium bicarbonate

[Table/Fig-3]: Antidotes commonly used in the management of poisoned patients [42].

Enhancement of Clearance/Dialysis

For agents that can be excreted as weak acids in the urine, Urine alkalinisation can be considered. If metabolic acidosis due to poisoning continues, even with the correction of hypoxia and adequate fluid resuscitation, then correction with intravenous sodium bicarbonate should be considered. Rapid correction is predominantly important if there is a prolongation of the QRS or QT intervals on the ECG [43]. In adults, an initial dose of 50 mmol of sodium bicarbonate may be given and can be repeated if essential (as guided by arterial blood gas monitoring) [44].

Dialysis may be done for poisons that are amenable to filtration across dialysis membranes. These comprise agents that possess a low molecular weight, low volume of distribution as well as low protein binding. Examples of such agents are salicylates, lithium, methylxanthines, and toxic alcohol. Criteria for dialysis are inconsistent across different types of poisonings [44]. In cases of acute poisoning, haemodialysis should be considered for extracorporeal toxin removal as well as for the management of acute kidney injury. Seizures can be controlled primarily with intravenous diazepam (10-20 mg in adults; 0.25 mg.kg-1 body weight in children) or lorazepam (4 mg in adults; 0.1 mg.kg-1 body weight in children) [45].

CONCLUSION(S)

Emergency physicians should take a more active role in the emergency management of severe poisoning, not only in the ED but also in the prehospital setting, where early decontamination by various methods and antidote treatment can be instigated if obligatory. Treatment should provide supportive measures using an Airway, Breathing, and Circulation (ABC) approach. Further

interventions should be added to reduce the absorption and increase elimination, and proper administration of an appropriate antidote.

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PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Dec 29, 2022
- Manual Googling: Mar 16, 2023
- iThenticate Software: Apr 24, 2023 (16%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? No
- For any images presented appropriate consent has been obtained from the subjects. No

Date of Submission: **Dec 28, 2022**
Date of Peer Review: **Mar 22, 2023**
Date of Acceptance: **Apr 27, 2023**
Date of Publishing: **Aug 01, 2023**