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Systemic Review on Clinical Management of Poisoning

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Abstract:

Poisoning remains a significant global health concern, necessitating a structured and timely clinical approach. This systemic review synthesizes current practices in the clinical management of poisoning, encompassing diagnosis, general supportive care, and specific interventions. Diagnosis relies on a comprehensive clinical examination, including vital signs, characteristic odors, urine color, and specific clinical manifestations, alongside a thorough patient history. The initial management prioritizes the "ABCD" (Airway, Breathing, Circulation, Disability) assessment for unconscious patients, while conscious patients require detailed historical accounts. This review emphasizes the importance of meticulous supportive care, judicious application of decontamination and elimination strategies, and the critical role of specific antidotes when available, highlighting the ongoing need for evidence-based approaches in poisoning management.

Keywords: Management of Poisoning, Gastric Lavage, Activated Charcoal, Antidote

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INTRODUCTION:

Poisoning, whether accidental, suicidal, or homicidal, presents a complex and dynamic challenge in emergency medicine. The myriads of potential toxic substances, coupled with varying routes of exposure and individual patient responses, necessitates a systematic and adaptable approach to management. Effective clinical management of poisoning aims to minimize absorption, enhance elimination, counteract toxic effects, and provide comprehensive supportive care to prevent organ damage and mortality. Despite advancements in toxicology and critical care, accurate diagnosis and timely intervention remain paramount. This systemic review aims to consolidate current best practices in the clinical management of poisoning, drawing upon established diagnostic principles, general supportive measures, and specific therapeutic interventions. By examining the utility of various techniques, from initial patient assessment to advanced detoxification methods and antidote administration, this review seeks to provide a comprehensive overview for clinicians managing poisoned patients.[1]

General measures include immediate stabilization and assessment of consciousness using tools like the Glasgow Coma Scale. Specific interventions are categorized into decontamination (gastric lavage, activated charcoal), enhanced elimination techniques (urinary alkalinization, multiple-dose activated charcoal, extracorporeal techniques), and antidote administration. While decontamination and enhanced elimination are crucial in selected cases, the role of antidotes is limited to a small number of specific poisons.[2]

Materials and Methods

The clinical management of poisoning cases is structured around a sequential approach, beginning with prompt diagnosis, followed by general supportive measures and specific interventions tailored to the type and extent of poisoning.

Diagnosis of Poisoning:[3,4]

A standard clinical examination is foundational for every poisoned patient. This includes:

- **Recording Vitals:** Meticulous assessment of pulse, respiratory rate, blood pressure, body temperature, and pupillary manifestations.
- **Noting Odor:** Identification of characteristic odors (e.g., bitter almond for cyanide) can offer crucial clues, though sensitivity varies.
- **Observing Urine Color:** Changes in urine color may indicate specific toxins.
- **Clinical Features:** Recognition of specific clinical manifestations indicative of certain poisons (e.g., neurological deficits, cardiovascular instability).
- **Physical Signs:** Examination for needle marks, self-harm scars, or other evidence of exposure.[5]
- **Conditions Arousing Suspicion:** Sudden onset of symptoms in healthy individuals, unexplained worsening of a sick person's condition, symptoms appearing after food/medicine ingestion, or characteristic symptom progression (e.g., steady downhill course) warrant suspicion. Detection of

poison in remnants of food or vomitus is a strong indicator. It is crucial to note that absence of poison on analysis does not definitively rule out poisoning, as the substance may have been eliminated or the analysis faulty, or it may be a disease case.

Duties of a Doctor in a Poisoning Case: [5]These encompass medicolegal responsibilities (as detailed in Medicolegal Aspects of Poisoning, not explicitly provided here but implied), alongside immediate patient care.

General Measures:[6]

These measures differ based on the patient's consciousness level.

- **Unconscious Patient:**

a) **ABCD Assessment:** Prioritize ensuring a clear Airway, adequate Breathing, stable Circulation, and absence of CNS depression.

b) **Assessment of Unconsciousness:** While the Reeds Classification/Edinburgh Method can be used, the Glasgow Coma Scale (GCS) is most frequently employed, despite not being formally validated for poisoned patients.

c) **Exclusion of Other Causes:** In the absence of a clear history, diagnosis relies on excluding other causes of coma (e.g., meningitis, trauma, metabolic disorders) and considering circumstantial evidence.

- **Conscious Patient:**[7]

a) **Brief History:** Obtain a detailed history of the ingested substance (type, quantity, timing), route of exposure, and reason for overdose (if applicable). Clinicians must be aware that patients may not always provide accurate information due to impairment or deliberate misleading.

b) **Past Medical History:** Record details of pre-existing conditions (e.g., asthma, cardiac issues, psychiatric illness), allergies, alcohol use, and social history. Psychiatric evaluation is recommended for all overdose patients.

Clinical Management[8,9]

The core of clinical management of poisoning involves specific measures aimed at removing the poison from the body or counteracting its effects. These include decontamination, enhanced elimination techniques, and the administration of antidotes.

Decontamination:[10]

The majority of poisoned patients require meticulous supportive care. Decontamination is reserved for patients who have ingested potentially life-threatening amounts of poison.

- **Skin/Eye Decontamination:** Relevant for contact poisons.
- **Gut Decontamination:** Focuses on removing ingested poisons from the gastrointestinal tract. These procedures carry risks and should only be employed when the untreated patient faces serious poisoning.

a) **Gastric Lavage (Stomach Washout):** Indicated only for potentially life-threatening ingestions within 1 hour. Beyond this timeframe, its efficacy is minimal and it can worsen the situation. Airway protection is paramount before performing gastric lavage. Equipment includes a stomach tube (e.g., Boa's tube), oxygen, suction, lubricants, and a team of at least two staff members.

b) **Activated Charcoal:** Administration can adsorb many poisons, reducing systemic absorption.
c) **Catharsis:** Used in conjunction with activated charcoal to promote bowel emptying.
d) **Whole Bowel Irrigation:** May be considered for certain sustained-release or enteric-coated medications, or for substances not adsorbed by charcoal.

Methods for Enhancing Elimination of Toxins:[11]

Beyond gut decontamination, further measures may be necessary for a limited number of poisonings to increase the elimination of toxins.

- **Urinary Alkalinization (Alkaline Diuresis):**[12] Indicated for serious poisoning with substances like salicylates, phenobarbitone, and chlorpropamide. Involves intravenous bicarbonate administration to achieve a urinary pH of 7.5-8.5. Plasma potassium and renal function must be monitored, and potassium supplementation may be required. Forced diuresis should be avoided due to the risk of pulmonary edema. Acetazolamide is contraindicated as it causes systemic acidosis, which can exacerbate certain toxicities.

- **Multiple-Dose Activated Charcoal:**[13] Repeated doses (e.g., 50 gm every 4 hours in adults) can interrupt enteroenteric and enterohepatic circulation, enhancing the elimination of drugs like carbamazepine, dapsone, phenobarbitone, quinine, and theophylline.[12] While clinical benefit seems logical, controlled studies definitively proving patient outcome improvement are limited.

- **Extracorporeal Techniques:** Hemodialysis, charcoal hemoperfusion, and hemofiltration are advanced methods indicated for specific severe poisonings. Consultation with a clinical toxicologist is crucial before undertaking these procedures. Charcoal hemoperfusion and hemofiltration have limited data and availability, making their widespread recommendation difficult.

- **Diaphoresis (Inducing Excessive Perspiration):** While methods like applying heat, administering hot beverages, or giving pilocarpine nitrate can induce sweating, their efficacy in significantly speeding up the excretion of toxic agents is doubtful.

Administration of Antidotes:[14]

Antidotes are available for a small subset of poisons and act by counteracting or neutralizing the poison's effect.

- **Classification by Action:**[15]

a) **Physical/Mechanical Antidotes:** Act mechanically (e.g., egg albumin as a demulcent, activated charcoal as an adsorbent).
b) **Chemical Antidotes:** Form new, less toxic, or insoluble compounds with the poison (e.g., dilute alkalies for acid poisoning, acetic acid for alkali poisoning).
c) **Universal Antidote:** A historical combination (powdered animal charcoal, magnesium oxide, tannic acid) for unknown poisonings. Its use has been criticized and

condemned due to lack of proven efficacy and potential for dangerous complacency.

d) **Physiological/Pharmacological (Antagonists) Antidotes:** Produce opposite actions to the poison (e.g., atropine for organophosphorus poisoning, naloxone for opioid poisoning). While seemingly beneficial, their perceived effectiveness can sometimes lead to a false sense of security, delaying more crucial supportive care.

- **Chelating Agents:** True physiological agents that form stable, soluble complexes with poison molecules, facilitating their excretion (e.g., British anti-lewisite (BAL), ethylene diamine tetra-acetic acid (EDTA), penicillamine).

Table no. 1 Antidotes and their Indications

Antidote	Indications
4-methylpyrazole	Methanol and ethylene glycol
100% oxygen	Carbon monoxide, cyanide, methemoglobinemia
Ammonium chloride	Phencyclidine, amphetamine and strychnine
Amyl nitrate	Cyanide, hydrogen sulphide
Atropine	Carbamate and organophosphorus poisoning
Calcium disodium edetate (EDTA)	Cadmium, chromium, cobalt, copper, lead, magnesium, nickel, uranium, zinc
Calcium gluconate	Precipitates fluorides, magnesium and oxalates
Chlorpromazine	Amphetamine
Deferoxamine	Iron, aluminium
Diazepam	Amphetamine, barbiturate, chloroquine, alcohol withdrawal
Dicobalt edetate	Cyanide
Dimercaprol (BAL)	Antimony, arsenic, copper, lead, mercury, nickel and gold
Diphenhydramine	Phenothiazines and related drugs
Disodium calcium edetate	Lead
DMPS (Unithiol)	Mercury
DMSA	Lead
D-Penicillamine (Cuprimine)	Arsenic, copper, lead, mercury, chromate, nickel, zinc
Ethanol	Methanol and ethylene glycol
Fab fragment	Digoxin, digitoxin, oleander tea
Glucagon	Propranolol and other beta-blockers toxicity
Hydroxocobalamin	Cyanide
Labetalol hydrochloride	Hypertensive crisis due to cocaine
Methionine	Paracetamol
Methylene blue	Methemoglobinaemia

N-acetylcysteine	Paracetamol, acetaminophen toxicity
Naloxone (Naltrexone)	Narcotic, opiates, CNS depressants
Nicotinamide	Vacor poisoning, phenylurea pesticide toxicity
Pancuronium bromide	Neuromuscular blocking agents
Penicillamine	Copper
Physostigmine salicylate	Coma, convulsions from anticholinergics
Pralidoxime (2-PAM)	Organophosphorus insecticides, nerve agents
Propranolol	Cocaine intoxication, beta adrenergics
Protamine sulphate	Heparin overdose
Prussian blue	Thallium
Pyridoxine (Vit. B6)	Isoniazid, hydrazine toxicity
Sodium bicarbonate	Urinary alkalinisation for salicylates, phenobarbital
Sodium nitrite	Cyanide
Sodium thiosulphate	Cyanide
Vitamin K	Warfarin

DISCUSSION:

The clinical management of poisoning is a dynamic field, evolving with new toxic exposures and refined understanding of pharmacokinetics and pharmacodynamics. The presented strategies highlight a hierarchy of interventions, beginning with crucial diagnostic steps and supportive care, followed by targeted measures for decontamination and enhanced elimination, and finally, the judicious use of specific antidotes. The emphasis on a thorough clinical examination and history in the diagnostic phase cannot be overstated. Recognizing subtle clues like specific odors or urine color, coupled with a high index of suspicion for certain clinical presentations, is vital for early and accurate diagnosis, especially in cases where the patient is unconscious or uncooperative. The "ABCD" approach for unstable patients forms the bedrock of initial management, ensuring physiological stability before further interventions. While the GCS is widely used, its limitations in poisoned patients underscore the need for careful clinical judgment and consideration of other factors influencing consciousness.

Gut decontamination strategies, particularly gastric lavage and activated charcoal, have undergone significant re-evaluation.[16] The current consensus is that gastric lavage has a very narrow therapeutic window (within 1 hour) and should be used with extreme caution, only in life-threatening ingestions, and with meticulous airway protection. Activated charcoal, while effective for many toxins, also has specific indications and limitations regarding its effectiveness against certain substances and the timing of administration. The concept of the "Universal Antidote" has been largely debunked, reflecting a move towards evidence-based, poison-specific interventions rather than broad, unproven treatments.

Methods for enhancing elimination, such as urinary alkalinization and multiple-

dose activated charcoal, represent more advanced strategies. Their application is dictated by the specific toxicokinetics of the poison and the patient's clinical condition. Extracorporeal techniques are powerful but invasive and resource-intensive, reserved for severe poisonings unresponsive to conventional therapy, and always requiring expert consultation. Diaphoresis, while a traditional method, lacks robust evidence for significant toxicant removal and should not be relied upon as a primary elimination strategy.

Finally, the role of antidotes, though often sensationalized, is in reality quite limited. Antidotes exist for only a small fraction of poisons, and their efficacy is highly dependent on timely and correct administration. The potential for a "false sense of satisfaction" leading to complacency when administering unproven antidotes or in situations where an antidote is not truly indicated is a critical caution for clinicians. Instead, the focus should remain on comprehensive supportive care and targeted interventions based on known toxicological principles. The development and accessibility of new antidotes, along with research into novel detoxification strategies, remain crucial areas for future advancement in poisoning management.

CONCLUSION:

Effective clinical management of poisoning is a multifaceted endeavor that requires a systematic approach encompassing prompt diagnosis, robust general supportive care, and the judicious application of specific interventions. Initial assessment prioritizing airway, breathing, circulation, and neurological status is paramount. Diagnostic clues from history, physical examination, and basic investigations guide subsequent management. While gastric decontamination and enhanced elimination techniques can play a role in selected cases, their application must be carefully considered based on the specific poison, time of ingestion, and potential complications. Antidotes, though invaluable for specific toxins, are available for a limited number of poisons, and their use should be evidence-based. Ultimately, meticulous supportive care, vigilant monitoring for complications, and a deep understanding of toxicology remain the cornerstones of successful clinical management of poisoning. Continuous research into novel diagnostic tools, therapeutic interventions, and the development of new antidotes is essential to improve outcomes for poisoned patients.

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