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Popular Article

Treatment of Poisoning in Veterinary Medicine

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Introduction

Poisoning is a distinct disease from other diseases, as it is treated as an emergency. The primary focus is to maintain vital functions. While specific antidotes like receptor antagonists or chelating agents are available for some poisons and drugs, for most drugs and chemicals, there is no specific treatment. Symptomatic therapy is the only approach to support vital functions in poisoning cases.

In vivo toxicity cases' intensity and outcome depend on factors like toxicant dose and concentration at the target site, with delivery mainly influenced by absorption into general circulation and distribution via blood to body tissues. The concentration and duration of exposure to a toxicant are influenced by its rate of elimination from the body.

The major goals in the treatment of poisoned animal

- ✓ Prevention of further absorption of toxicant
- ✓ Removal of unabsorbed toxicant
- ✓ Reduction in distribution of toxicant
- ✓ Use of specific antidote
- ✓ Elimination of absorbed toxicant
- ✓ Support of vital body functions and symptomatic treatment

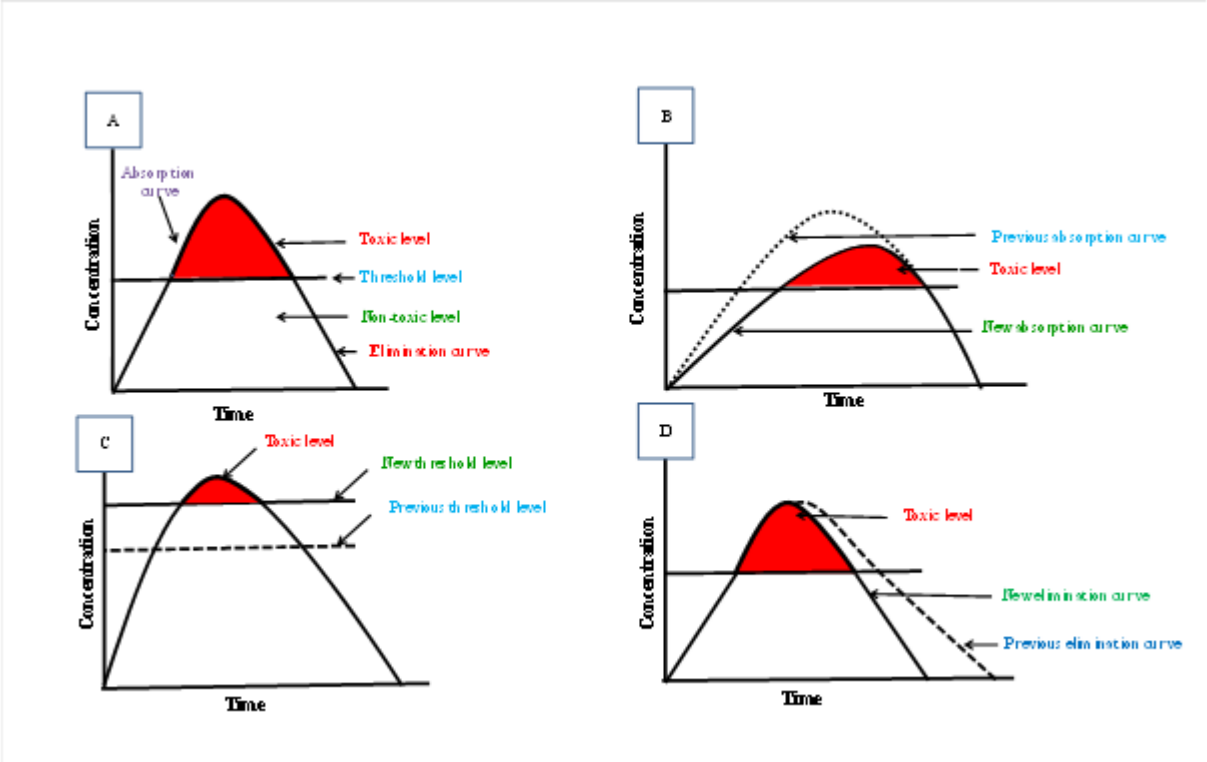
The time – drug concentration curve is obtained by measuring the concentration of toxicant in plasma (Y- axis) versus the corresponding time at which the plasma samples were collected (X-

axis). The treatment of poisoning can be better explained on the basis of time – drug concentration curve aimed at following points.

I. To decrease the slope of ascending portion of curve

II. To increase the threshold level of toxicity

III. To increase the slope of descending portion of curve



Normal time-concentration curve of a toxicity case

A) Time-concentration curve of a toxicity case depicting decreased absorption of a toxicant

B) Time-concentration curve of a toxicity case depicting enhanced threshold level of toxicity

C) Time-concentration curve of a toxicity case depicting enhanced elimination of a toxicant

I. Agents decrease the slope of ascending portion of curve:

Achieved by preventing the continued absorption of toxicant from its exposure site and decreasing the distribution of toxicant to its target site.

A. Preventing continued absorption of toxicant:

Prevented or delayed by using several non-specific and specific agents or measures

1. Non-specific treatments

a) Emesis:

- Emesis is useful only in recently ingested toxicant in monogastric animals like dogs, cats and pigs.

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- It is contraindicated if a corrosive or a petroleum distillate has been ingested. It is also contraindicated in unconscious and comatose animal, severe respiratory distress or severe convulsive seizures or where animal has ingested some foreign bodies or sharp-edged objects.
- Locally acting emetics – Ipecacuanha, H_2O_2 (3%), $CuSo_4$ (1%).
- Centrally acting emetics – 1) Apomorphine HCl (Dogs: 0.04 mg/kg, I.V. or I.M.; 0.3 mg/kg topically in conjunctival sac. 2) Xylazine (Cats: 0.4 – 1 mg/kg, I.M.).

b) Gastric lavage:

- Gastric lavage is performed by inserting a large diameter tube into the stomach and washing it with water or a solution by a suction pump.
- A thicker activated charcoal suspension is generally instilled after the gastric lavage.
- Gastric lavage can be performed in animals by using following agents - Tepid water or saline solution (10 ml/kg b.wt), Tincture iodine (1 : 250 of 5% solution), Tannic acid solution and Sodium bicarbonate solution.

c) Adsorption Therapy:

- Activated charcoal is the most effective adsorbent for a wide variety of toxicants, especially large non-polar molecules, and is generally considered the adsorbent of choice when poisoning is suspected.
- Universal Antidote: Activated charcoal – 10g + Mg oxide – 5g (purgative action) + Kaolin – 5g (acts as adsorption) +Tannic acid – 5g (precipitate alkaloids and metals) in 200 ml of water.
- Used in adsorption of toxins from the GIT and prevents further adsorption of toxins into systemic circulation.

d) Purgation /Cathartics:

- Indicated for removal of unabsorbed toxicants especially those that have passed into intestine.
- Always use cathartics after 30 min. after use of activated charcoal.
- Ex: Na sulphate – 60 g (large animals), 2 g (dogs); Magnesium sulphate – 250 g (Large animals), 15 g (dogs); Sorbitol (70%) – 1 to 3 ml/kg, orally.

e) Enema:

- Enema is also practiced along with cathartics for complete evacuation of lower intestine.
- In enema a solution of warm water or soap solution is gently administered into the rectum.

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f) Cleansing of Skin or hair:

- If a toxicant has been spilled over skin or hair, then animal should be gently washed with using water, mild shampoo or liquid dishwashing detergent.

g) Cleansing of eyes:

- For toxic ocular exposure, the eyes with lids wide open are gently flushed numerous times with body temperature tap water, Lactated Ringers solution or normal saline solution to enhance the decontamination.

h) Gastrotomy or Rumenotomy:

- It could be required in circumstances when emesis, lavage, or activated charcoal don't work.
- The presence of foreign bodies, particularly those that contain hazardous metals like lead or zinc, is a sign that surgery is necessary.

2. **Specific Treatment:** Antidotes can form a stable complex with toxicants in the GI tract or other exposure sites, which is excreted unabsorbed from the body.

S. No	Toxicant	Antidote/Agent	Product/Complex
1	Iron	Deferoxamine Sodium bicarbonate	Iron-deferoxamine complex Ferrous carbonate
2	Silver nitrate	Sodium chloride	Silver chloride
3	Strychnine	Potassium permanganate	Oxidized product
4	Fluoride	Calcium lactate	Calcium fluoride

(Selected antidotes affecting the absorption of toxicants from exposure sites)

B. Preventing Distribution of Toxicant to target site

a. Ion Trapping: The basic principle of ion-trapping is that ionized compounds do not readily traverse cell membranes and are, therefore, not distributed to target site and subsequently not reabsorbed by the renal tubules.

b. Alternate binding site: Distribution can also be affected by providing an alternate binding site to toxicant, Ex: infusion of albumin provides an alternate binding site to some toxicants

S. No	Toxicant	Antidote	M.O.A
1.	Methanol	Ethanol	Competitive inhibition
2.	Fluoroacetate	Acetate/Monoacetin	Competitive inhibition

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3.	Heparin	Protamine	Complex formation
4.	Venoms	Antivenin	Complex formation
5.	Digoxin	Digoxin immune Fab	Complex formation

(List of chosen drugs that impact how toxicants are distributed)

II. To increase the threshold level of toxicity

The threshold level of toxicity can be raised by utilizing a variety of agents, making higher toxicant concentration necessary to achieve intoxication. This can be accomplished by applying the proper emergency supportive and symptomatic therapy or a particular antidote.

a. Treatment of respiratory depression: Maintenance of normal respiration is very important in poisoning cases.

- In order to avoid vomiting from being aspirated by a comatose or anesthetized animal, a patient's airway should be secured with an endotracheal tube that is cuffed.
- If necessary, employ mechanical ventilation or oxygen to treat apnea, anoxia, or severe anemia.
- Respiratory stimulants i.e. Doxapram (1-2 mg/kg, I.V) should be used only if necessary.

b. Monitoring of cardiac disturbances:

- The proper antiarrhythmic medications should be used when a heart arrhythmia occurs. When antiarrhythmic medications are employed, the treatment should be tailored to the exact arrhythmia and species involved.

Control of acid-base disturbance and electrolytes imbalance:

- The most prevalent toxicant-related acid-base imbalance is metabolic acidosis. Initial treatment options include sodium bicarbonate (0.5–2.0 mEq/kg, administered intravenously every four hours) or sodium lactate.

c. Treatment of CNS dysfunctions:

- Diazepam (0.5 mg/kg, I.V.) can be used to treat CNS seizures. It is the medication of choice for severe, idiopathic acute seizures.
- Analeptics have been used to treat CNS depression, particularly when respiratory depression is more severe, such as Doxapram (1-2 mg/kg, I.V)

d. Treatment of hypothermia or hyperthermia:

- Severe hyperthermia frequently coexists with ongoing seizures. Additionally, toxicosis brought on by oxidative phosphorylation uncouplers may result in hyperthermia. Cold baths

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and ice packs are used to cure hyperthermia. Antipyretics typically don't help with toxicant-induced hyperthermia.

- Coma, deep sedation, or anesthesia can all cause hypothermia. When body temperature is below normal, vital physiological processes are typically suppressed. The usage of blankets, warm water bottles, and heating pads can help prevent hypothermia.

III. To increase the slope of Descending portion of curve

The elimination of absorbed toxicant from the body can be made easier, which can raise the slope of the decreasing curve in the time concentration profile. This can be done practically by utilizing therapeutic drugs that enable the excretion of the toxicant through the kidneys, lungs, or other physiological systems.

A. Hastening the elimination of absorbed toxicant

a. Ion-trapping:

- Ion trapping, which is done with the aid of a suitable urinary acidifier or alkalizer, is therapeutically effective for improving the body's ability to expel a variety of weakly acidic or basic chemicals.
- In general, basic agents (such as amphetamine and most alkaloids) are more successfully ionized and more quickly excreted in acidified urine, whereas acidic agents (such as aspirin, paracetamol, barbiturates, and phenoxy herbicides) are more effectively ionized and excreted in alkaline urine. It is best to use ion trapping treatment when there is an acid-base imbalance.
- Urinary acidifiers: Ammonium chloride – 100-200 mg/kg ((dogs), 15 g total (cattle), Ascorbic acid – 40 mg/kg, by I.V route, Sodium acid phosphate – 150-300 mg (total)
- Urinary alkaliniser: Sodium bicarbonate – 10-20 mg/kg, 2 to 3 times daily by oral route

b. Dialysis:

- Dialysis should also be considered if large amount of toxicant is present in the body. It is useful in intoxication by digitoxin, methanol, lithium, phenobarbitone. etc.

c. Diuresis:

- Forced dieresis may considered useful in certain conditions such as in toxicosis with serious clinical signs (e.g. severe hypotension, coma and arrhythmia), when potentially lethal dose of a compound has been ingested, or when there is progressive deterioration of the condition of animal in face of intensive therapy.

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S.No	Toxicant	Antidote	M.O.A
1.	Bromide	Chloride	Enhance renal excretion
2.	Copper	D-Penicillamine	Chelation
3.	Lead	Ca-disodium EDTA	Chelation
4.	Molybdenum	Copper	Enhance renal excretion

(List of selected antidotes affecting excretion of toxicants)

B. Enhancing Metabolic conversion of absorbed toxicant

- Certain substances facilitate the metabolic conversion of a toxicant into a less toxic product. Phenobarbitone, for instance, has been suggested as a means of lowering the amount of persistent toxicant residues in tissues through the stimulation of the mixed function oxidase enzyme.

Management of poisoning: Apart from the poisoned treatment covered above, several management techniques are also beneficial for therapy.

- In the case of cattle, switching feedlots or pastures might stop additional exposure. Pets moving from an exposed place to a different location might also be beneficial. Changing the source of the feed and water stops more toxicant consumption.
- Intoxicated animal should be housed in an area free from loud noises and other disruptions.
- An animal in a recumbent position should have its head kept lower than the rest of its body. This will stop the regurgitated material from aspirating

S.No	Toxicant	Antidote/Drug therapy	M.O.A
1.	Antimony	Dimercaprol, Penicillamine	Chelation
2.	Arsenic	Dimercaprol, Penicillamine	Chelation
3.	Atropine	Physostigmine	Receptor antagonism
4.	Benzodiazepines	Flumazenil	Receptor antagonism
5.	Carbamate insecticides	Atropine	Receptor antagonism
6.	Curare	Neostigmine	Antagonism
7.	Cyanide	Sodium nitrite, Sodium thiosulphate	Alternate pathway
8.	Ethylene glycol	Ethanol	Alternate pathway
9.	5-Flurouracil	Thymidine	Alternate pathway
10.	Iron	Deferoxamine	Chelation

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(List of common poisons and their antidotes)

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