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Honey Bee Poisoning in Animals

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Abstract:

Honey bee stings can be harmful to humans and animals, potentially leading to death. Cattle, buffaloes, equines, and dogs tethered under shaded trees harboring honey bee hives may face lethal attacks from these insects. Honeybee stings can elicit localized reactions, but overwhelming attacks can result in systemic toxic reactions in animals, potentially causing severe symptoms like paralysis, seizures, and even death, depending on the animal's sensitivity. This paper aims to improve veterinarians' ability to handle emergencies caused by honey bee stings.

Key points: Honey bee, String, Animal, Melittin, Poison

Introduction:

Honeybees are herbivores that feed on pollen and nectar. Honeybees found in the family Apoidea, class Insecta, and order Hymenoptera. There are four main species of honeybees: *Apis dorsata*, *Apis cerana*, *Apis florea*, and *Apis mellifera*. When humans or other animals are disturbed, bees will sting them. Of all the animal species, dogs are the most common victims of honey bee poisoning, even though cases involving large animals are also occasionally documented.

Bee venom is a clear acidic liquid that can cause toxic and allergic reactions in affected persons. Apitoxin, or honeybee venom, is essentially a mixture of low molecular weight peptides, biogenic amines, proteins with high allergenic potential, such as melittin, and primarily the enzymes phospholipase A2 and hyaluronidase. Venom produces local injury at the inoculation site as well as a variety of organ consequences such as haemolysis, renal injury, and muscle damage, cardiovascular and respiratory issues. These compounds cause haemolysis, rhabdomyolysis, degeneration, and necrosis of the kidney tubules, which leads to organ failure. Certain factors influence the concentration and toxicity of honeybee venoms, including climatic conditions, age, and the types of flowers used by bees to produce honey. Bee venom is heat-resistant and keeps its toxicity for extended periods.

It is recorded that, Melittin, which makes up half of the dry venom's weight, has haemolytic, cytotoxic, and cardiotoxic properties. It also functions as a detergent and is responsible for the release of histamine and local pain at the sting site. Catecholamine produced by melittin, combined with phospholipase A2, causes intravascular haemolysis. Phospholipase A2 acts as an allergen. Hyaluronidase, often known as "spreading factor," is important for altering the permeability of cell membranes, allowing the other venom components to penetrate into host tissues.

Pathogenesis:

Honeybees can only sting once since their stingers remain connected to the victims' skin. Bumblebee stingers cannot be found at the afflicted place since these bees can withdraw their stinger. The venom of Hymenoptera bees can directly cause neurotoxicity, resulting in ataxia and facial paralysis. It is to note that, Apamin, found in bee venom, causes neurotoxicity by acting on the spinal cord. Delayed hypersensitivity, anaphylactic shock, local and systemic responses, and immune-mediated secondary haemolytic anaemia have all been observed. The majority of bee sting-related deaths are caused by anaphylactic shock, which occurs after a delayed hypersensitivity reaction mediated by IgE antibodies.

The head and neck were the most seriously affected areas of the body, with sting-associated oedema, hyperaemia, and erythema seen all over. Major pathological findings in affected dogs included muscle necrosis, haemorrhage and organ congestion, splenomegaly, dark red urine, kidney, and lungs. The presence of jaundice and various colours such as myoglobin and haemoglobin within the renal tubules and bile ducts suggested that melittin and phospholipase A2 had damaged red blood cells and muscle cells.

Melittin may play a potential role in activating the release of bradykinin (BK) and the haemolytic pathway in the victim's body. Melittin has the ability to adhere to red blood cells and create transitory holes on their surfaces, allowing around 40 haemoglobin molecules to leave freely, resulting in decreased in packed cell volume.

Clinical Signs:

The clinical indications associated with their sting can range from minor to severe, depending on factors such as the type and quantity of venom, the stinging site, the frequency of stings, and the victim's susceptibility. The majority of lesions affect exposed regions of the body, such as the face and limbs, while dense hair protects the animal's important areas. Signs noticed include anaphylactic shock, anaemia, pale and congested mucous membranes, tense belly, obtundation, generalized seizure, and episodic cardiac arrest. Symptoms such as vomiting, diarrhoea, and signs of anaphylactic shock were observed in dogs. Respiratory distress due to acute respiratory distress syndrome (ARDS), rhabdomyolysis and haemolytic crisis in dogs were reported. The estimated lethal dose for humans and mammals is about 500 stings/adult and 20 stings/kg, respectively. If we check the literature, we can note that a wide range of numbers of bee stings (60-2460) has been associated with the death of dogs, and even a single sting can cause mortality.

Laboratory Findings:

Animals with bee poisoning exhibit polycythaemia, neutrophil leukocytosis with left upper shift, lymphopenia, monocytosis, thrombocytopenia, and azotaemia. Eosinopenia may also be detected in some cases. Hyperfibrinogenaemia occurs in reaction to local or systemic inflammation caused by melittin, the major active component of apitoxin. Increased serum activity of AST and GGT enzymes indicates hepatic damage. An increase in

LDH serum activity may indicate haemolytic anaemia. There is also an increase in serum CK enzyme activity, which indicates a muscle lesion.

Urinalysis revealed turbidity, dark yellow colour, and severe proteinuria, indicating kidney injury. Abdominal ultrasound revealed blood clots in the bladder and liver with decreased echogenicity and echo texture, indicating acute inflammation.

Treatment:

Symptomatic treatment in conjunction with supportive therapy is advised. Complete healing may take 6 weeks. The treatment focuses on lowering oedema and controlling anaphylaxis while also delivering analgesics and antimicrobial medication. A conservative treatment plan that includes the use of antihistaminic drugs and corticosteroids both orally and topically can be followed. Fluid therapy (Ringer's solution), furosemide administration, and the use of warm and cold thermal compresses are further strategies. The most crucial step in therapy is to pull out the stingers as soon as possible to reduce the chance of the venom spreading further into the body

1. **Extraction of stings and their poison sacs:**

   Treatment for honey bee, wasp, and hornet stings begins with this crucial step. The longer a sting lingers in the skin, the more poison enters the bloodstream. When a honey bee stings a person or animal, it attempts to get fly away, but the barb of the sting catches in the skin and tears off the stinging apparatus, which is automatically innervated and contracted outside the bee's body. As a result, venom continues to enter into the victim's body. The sting should be removed from the skin as quickly as possible. To remove a sting fast and gently, use fine tweezers. Scrape out the poison bag with a blade. Remember not to compress the stinger.

2. **Local Treatment:**

   After removing the stingers and poison bags, treat the wound locally. The following recommendations have been made.

- A cream with calendula, surgical spirit, and Vaseline or lanolin. Calendula and spirit effectively reduce pain and burning sensations.
- Potassium permanganate ($KMnO_4$) and other oxidizing chemicals can diminish the effectiveness of bee, wasp, and snake venoms.
- Local application of antihistamine lotion may be beneficial. Local use of mild ammonia and sodium bicarbonate is usually effective.

3. **Antihistamine/corticosteroids:**

- Immediately inject epinephrine (adrenaline) subcutaneously. To prevent venom-induced histamine release, administer both H1 and H2 blockers intravenously (*e.g.*, diphenhydramine at 1-2 mg/kg BID. and cemetidine at 5-10 mg/kg TID). Also, administer corticosteroids at a larger dosage than recommended.
- Fexofenadine @ 2-5 mg/Kg orally every 12 to 24 hours, commonly available as Allegra® or Telfast®, is a second-generation antihistamine that may be used.

4. **Supportive and other measures for treatment:**

- To treat hypovolemic shock, renal or gastrointestinal blood loss, fluid and electrolyte supplementation may be necessary.
- To treat severe rhabdomyolysis, urinary alkalization with sodium bicarbonate is recommended.
- Tracheotomy can help with asphyxia caused by repeated stings to the nose or throat.

Conclusion:

Although stings from honey bees are usually a mild irritation, they can be quite dangerous to animals, particularly if multiple stings happen. Awareness, prompt veterinary intervention, including supportive care and the prescription of antihistamines or corticosteroids, is critical for treating severe instances.

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