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Snakebite in Animals: Pathophysiology of Envenomation, First-Aid, and Antivenom-Based Treatment in Veterinary Practice

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Abstract:

India is estimated to have the highest snake bite mortality rate in the world. Snake bite incidents are more prevalent in dogs and horses compared to other animals. Of the 300 snake species worldwide, only 15% are considered venomous. In India, venomous snakes belong to two primary families: Elapidae and Viperidae. The most significant snakes from these families include the Common Krait, Indian Cobra, Russell's Viper, and Saw-scaled Viper. Snake venom is primarily a protein mixture, with its composition varying across species. Kraits and cobras produce neurotoxic venom, while vipers produce hemotoxic venom. Identifying the snake species responsible for the bite is crucial for effective clinical management. Most traditional first aid practices should be avoided as they often cause more harm than good. Delayed access to proper veterinary care, a shortage of antivenom serum, and limited supportive therapy are the main reasons for the high morbidity and mortality associated with snakebites in livestock. All photos used in this article were collected from professionals in the field of herpetology.

Keywords: Snake bite, management, anti-venom, envenomation

Introduction:

Snakes are widely distributed across the Indian subcontinent, from the seas to near the snowline in the Himalayas. The severity of snake envenomation depends on several factors, including the quantity and toxicity of the venom injected, the animal's species, age, body size, and overall health status prior to the bite. Additionally, the bite location and the level of excitement or activity following envenomation can significantly influence the outcome. Diagnosing snake envenomation can be challenging, especially when the bite is not directly observed. It is incorrect to assume that bites from venomous snakes are invariably fatal. Snake venom typically produces a wide range of clinical effects in affected animals, including pain of varying severity, swelling, bleeding, and tissue necrosis at the envenomation site. Animals may also exhibit vomiting, diarrhoea, excessive salivation, breathing difficulties, weakness, poor coordination, and behavioural changes. In severe cases, snakebites can lead to shock, heart problems, bleeding disorders, kidney damage, and paralysis. Non-healing ulcers at the bite site have also been reported, sometimes due

to a fang becoming embedded at the site. Discoloration of the skin around the bite occurs in both cobra and viper bites. Snake venom components have both prothrombotic and anticoagulant effects. In both cobra and viper bites, the skin surrounding the wound often changes colour, though this discoloration does not usually result in noticeable swelling. Blisters commonly form near the bite mark and gradually spread upwards across the body. A substantial quantity of venom can sometimes be delivered during the strike. In viper bites, tissue death at the site is almost certain whenever a large volume of venom enters the system. According to data from NCBI, it is estimated that there are over 1,000,000 snakebites in India alone, causing 58,000 deaths annually.

Effects of Venom on Body:

Pit vipers from the Viperidae family, such as Russell's viper and saw-scaled viper, typically produce a combination of blood- and muscle-damaging effects. In contrast, elapid snakes like spectacled cobras and common kraits primarily deliver toxins that affect the nerves and heart. Snake venom is generally categorized into four types: neurotoxic, hemotoxic, cytotoxic, and myotoxic. Neurotoxic venom is the most lethal, as it disrupts brain and nerve function by interfering with chemical signalling at neuronal junctions. Hemotoxic venom, on the other hand, impairs the body's natural clotting ability, preventing wounds from sealing and causing dangerous internal haemorrhaging that can compromise the heart and circulatory system. At the cellular level, cytotoxic venom destroys tissue, leading to painful blistering and localized cell death. Myotoxic venom targets muscle fibres, breaking down myositis and ultimately causing paralysis. Snakes have teeth that are not embedded in sockets, and harmful snakes possess two types of modified teeth or fangs. In cobras, kraits, and vipers, the fangs are located at the front of the mouth, and the groove connecting to the poison gland via a duct becomes a closed canal for venom delivery.

Management and Therapy of Snake Bite:

Snake venom poisoning in animals is an emergency that requires immediate attention, as delayed or inadequate treatment can lead to severe consequences. Animals are primarily affected by snake bites when grazing in fields or sometimes even in housing. The bite site should be gently wiped and covered with a clean handkerchief. No incision should be made, as it often introduces infection. Apply a firm but not tight ligature above the bite using a cloth or handkerchief. The critical aspect of snake bite management is ensuring the animal reaches the nearest medical facility in the best possible condition. Most snake species are nocturnal, so animal owners should be aware of the time of year and weather conditions when snakes are most active. Poultry birds should not be raised near large animal barns, as snakes may hunt them for food. Compared to humans, diagnosing snake bites in animals is challenging. Controlling anxiety is crucial, as an increased heart rate can spread the venom. Do not apply extreme cold to the bite area, and avoid using potentially harmful herbal or folk remedies. Whenever possible, try to identify the snake responsible. All animals bitten by snakes should be closely monitored for the development of clinical signs.

Photographic documentation of snake species commonly responsible for bites in livestock.

Krait

Saw Scaled Viper

Russel's Viper

Spectacled Cobra

Treatment:

Bite sites should be shaved and cleaned. Typically, a potassium permanganate solution is used to cleanse the fang marks before administering anti-snake venom. The efficacy of anti-venom is greater when administered intravenously. Monovalent anti-venoms are effective only against a specific venom; therefore, they have been replaced by polyvalent anti-venoms, which can effectively neutralize a range of snake venoms. Opioid analgesics may be used as needed for residual pain, while NSAIDs not recommended. Most polyvalent anti-venoms are produced using a mixture of elapid and viperid venoms, providing both anti-elapid and anti-viperid activities. The widespread use of polyvalent anti-venoms is expected to eliminate the need to identify the species of snake involved. Rapid administration of an effective polyvalent anti-venom can reduce the severity of envenoming. Alongside anti-venom treatment, fluid therapy, antimicrobial therapy, and the administration of steroids and antihistamines are also practiced.

Conclusion:

Snakebite in animals remains a significant veterinary emergency, particularly in India, where venomous snakes are prevalent. The severity of envenomation varies widely depending on several factors. Early recognition of clinical signs and immediate professional veterinary care play a vital role in reducing morbidity and mortality. Successful treatment depends on correct initial first-aid steps, timely use of specific antivenom, and comprehensive supportive care tailored to the animal's needs. Integrating effective prevention methods, fast and accurate diagnosis, and scientifically proven treatment protocols remains the most reliable approach to minimizing fatalities and supporting full recovery in animals affected by snakebite.

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