

Snake Envenomation in Bovine

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Snakebite envenomation constitutes an important hazard in human and veterinary medicine, especially in tropical and neotropical regions. In the United States, two families of venomous species are reported: the Elapidae includes the coral snakes and the Viperidae commonly referred to as pit vipers.² In Costa Rica such envenomations occur in both large and small animals (unpublished observations) and, despite the lack of rigorous epidemiological data, represent an important veterinary medical problem. The majority of snakebite envenomations in Central America are inflicted by species of the family Viperidae (subfamily Crotalinae), primarily *Bothrops asper*.³ Pit viper venoms induce prominent local effects (myonecrosis, hemorrhage and edema) and systemic alterations (hemorrhage, coagulopathies, cardiovascular shock and renal failure).^{3,4} In this communication we report on the anatomopathological and histopathological findings of a severe case of bovine envenomation by a crotaline snake.

Case Report

In Orotina (province of Alajuela, Costa Rica) a female Brahman, 3.6 years old, 440 Kg was found in recumbency early one morning. On physical examination, a swollen area was observed in the left hind limb, compatible with snakebite. Polyvalent antivenom (Suero antifidico veterinario, Instituto Clodomiro Picado, Costa Rica) was administered (80 ml IM) and a slight improvement in the general condition of the animal was observed. Two hours later, an additional dose of 40 ml antivenom was injected (30 ml IM and 10 ml IV). Twenty minutes later the animal died. A complete necropsy was carried out at the School of Veterinary Medicine, National University. In addition, tissue samples from various organs were routinely fixed in 10% buffered formalin, dehydrated, embedded in paraffin, sectioned at 4 µm

and stained with hematoxylin-eosin (HE).

Gross Pathology

The left distal part of tarsal and all the metatarsal and phalangeal region was swollen and, upon opening, severe hemorrhage and edema were observed (Fig. 1). In the respiratory tract there was epiglottal edema and all the airways showed abundant froth. In the pulmonary parenchyma generalized emphysema was present. In the heart, the entire epicardium had extensive hemorrhages, having a "mulberry" appearance; hemorrhages were also present in myocardium and endocardium.

Examination of the abdominal cavity revealed extensive ecchymotic hemorrhages in the omentum of the forestomach and the ruminal wall. There was hepatomegaly and the gallbladder was dilated and filled with dark contents; its entire wall was edematous. The large bowel had prominent sanguineous contents. Both kidneys had hematomas involving perirenal fat and the parenchyma was friable with diffusely dark-red areas and white areas. (Fig. 2).

Histopathology

In the heart; diffuse hemorrhage and edema were noticed in epi-, myo- and endocardium, with separation of myocytes. The Purkinje fibers were also affected. Moreover, a few small arteries exhibited edema in their walls. In the lungs; marked alveolar edema, hemorrhage and hyperemia were observed (Fig. 3). The walls of several arteries had fibrinoid degeneration and edema (Fig. 4). Subcapsular hemorrhages of the kidneys were observed along with severe necrosis of cortical tubules and glomerular hemorrhage (Fig. 5). In some proximal tubules the epithelial cells had disappeared and only the basal lamina remained; tubular protein casts were also present. Other organs: the gallbladder had severe

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Figure 1. (Left) Distal left tarsus and metatarsus of the bitten extremity. After removal of the skin (arrows), the entire subcutis showed prominent hemorrhage and edema.

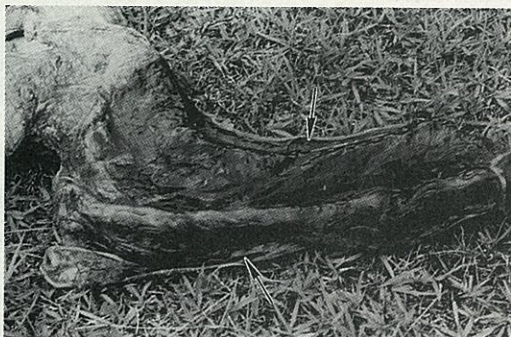


Figure 2. (Right) Kidney. Notice the presence of diffusely located dark-red areas with tiny white spots in the parenchyma.



necrosis and hemorrhage, as well as fibrinoid vasculitis. The muscular layer of the rumen was hemorrhagic. The spleen and lymph nodes showed hemorrhage and depletion of white pulp.

Discussion

An antemortem diagnosis of snake envenomation in domestic animals is usually difficult and sometimes impossible. The animals may be found ill without any observed encounter with a snake. Sometimes a snake or a snake attack is observed, but the species is not identified. More often, fang marks in the skin, bleeding or subcutaneous swelling are observed, suggesting a snake bite. In this case, the offending snake was not identified, however, the localization of the swollen lesion, the pathophysiology observed and the severity of the case strongly suggest a snake bite, probably induced by *Bothrops asper* (*terciopelo*). This species is abundant in Orotina and frequently inflicts bites in humans and large animals in that region.

Anatomopathological observations revealed prominent local tissue damage at the site of the suspected bite. Crotaline snake venoms are known to induce marked local necrosis, hemorrhage and edema,^{1,5} as was observed in this animal. Such local effects develop very rapidly after venom injection and are rather difficult to neutralize with antivenom.⁶

Crotaline venoms also induce systemic alterations, particularly hemorrhage and coagulopathy.⁷ Hemorrhage is due to the action of venom metalloproteinases on the basal lamina of capillaries and venules.^{8,9} Our findings clearly demonstrated the presence of hemorrhage in heart, lungs, gastrointestinal tract, gallbladder and kidneys. Such prominent hemorrhage is likely to be responsible for pronounced blood loss which leads to hypovolemic shock. By contrast, kidney alterations were drastic in this case. Acute renal failure has been described in severe cases of *B. asper* bites in humans,¹⁰ and renal alterations are also common in envenomations induced by a variety of poisonous snakes.¹¹ Renal alterations might be due to ischemia, owing to extensive hemorrhage, and to a direct nephrotoxic action of venom components.

The fatal outcome in this case, despite the use of polyvalent antivenom, can be explained on two grounds: first, it is likely that envenomation was well advanced when the first dose of antivenom was applied; and second most of the antivenom was administered by the IM route. It has been repeatedly demonstrated that antivenom is much more effective when given IV.^{3,6} Unfortunately there is a tendency of the practicing veterinarians to use this route, because it is much easier.

In conclusion, this report illustrates a severe case of snakebite in a bovine in Costa Rica with a complete morphological description. It supports the importance of providing adequate and rapid medical treatment with antivenom in these envenomations. ■

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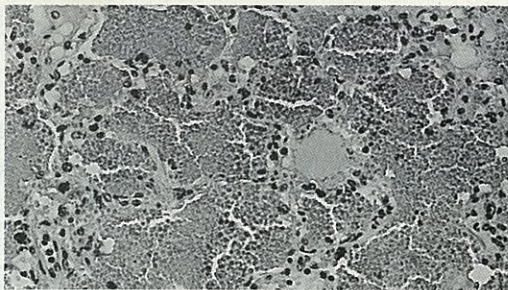


Figure 3. Diffuse alveolar edema, hemorrhage and hyperemia present in lung parenchyma. H.E. 180 X.

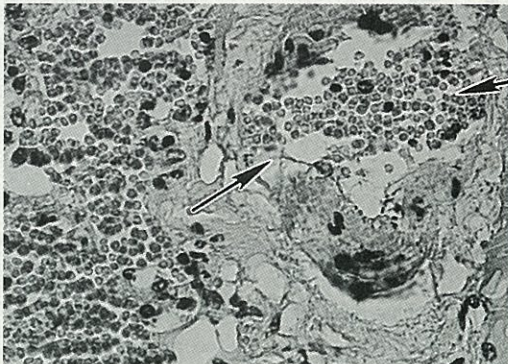


Figure 4. Arterial walls with fibrinoid degeneration. Notice the disruption of the arterial wall (arrow). There is edema and hemorrhage in the surrounding tissue. H.E. 360 X

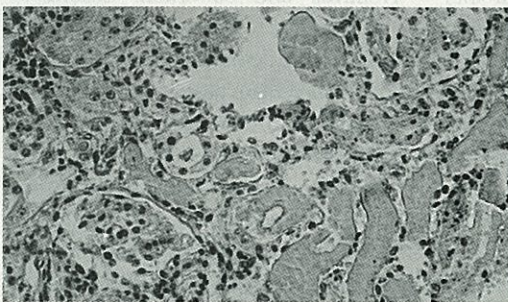


Figure 5. Severe tubular necrosis in the cortical region of kidney. Notice the disappearance of tubular cells and the remnants of basement membrane. H.E. 180 X.

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