CASE REPORT

PATHOMORPHOLOGY OF PRESUMPTIVE POISONOUS SNAKE ENVENOMATION IN TWO FEMALE ADULT GERMAN SHEPHERDS IN ZARIA, NIGERIA

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ABSTRACT. Snakebite is an important medical and veterinary problem but often overlooked in Nigeria with many health institutions have yet to become aware of the magnitude of this problem. Despite its clinical significance, there is little published information on the pathomorphology of snake envenomation in Zaria, Nigeria. We report the gross and microscopic lesions associated with presumptive snakebite envenomation in two German Shepherds. The prominent gross lesions in both cases included puncture wounds, multicavitary serosanguineous effusions, and localized oedema in the regions of the presumed bite wounds. Histopathology revealed coagulative hepatocellular necrosis and acute renal tubular necrosis in both cases. The case was diagnosed as snake bite based on the history, gross, and microscopic changes. This report provides valuable veterinary pathological diagnostic information on snakebites in Zaria, Nigeria.

Keywords: German Shepherds, gross lesions, histopathology, snakebite

INTRODUCTION

Snake envenomation is one of the common accidental emergency cases encountered in companion animals including dogs, in many countries (Padula *et al.,* 2018; Boller *et al.,* 2020). There are 2,500 – 3,000 snake species distributed worldwide, of which about 500 are venomous (Mathew & Gera, 2005). Of the 500 identified venomous snakes, 25 are known to cause mortality in Africa. In Nigeria, the most common venomous snakes of medical and veterinary importance are the elapids and the vipers including the *Naja melanolema* (black cobra), *Naja nigricolis* (spitting cobra), *Viperid echis carinatus* (carpet viper), and *Bilis asietaurs* (puff adder) (Habib *et al.,* 2001; Eric *et al.,* 2002; Omogbai *et al.,* 2002). However, studies in Zaria, Nigeria have shown that snake envenomation are mainly caused by spitting cobra and carpet viper (Aguiyi *et al.,* 1999). A higher prevalence of snakebites is reported in dogs and horses than other animals (Garg, 2000). Snake venoms contain complex mixtures of enzymes, glycoprotein, lipids, histamine, serotonin, acetylcholine, and catecholamine, that appear to have more lethal effects in snakebite victims (Alder & Kraig, 2002; Joshua *et al.,* 2010). Garg (2000) and Klaassen (2008) described typical clinical signs in animals which include vomiting, frothy/foamy salivation, tingling of limbs and head, swelling and pain at the affected parts, puncture wounds or fang marks on the bitten area. Immediate constant attention is required for relief from the condition. Otherwise, delayed and improper treatment may culminate in a grave prognosis. There is little or no reports regarding pathomorphological changes following presumptive snake bites in dogs in Zaria, Nigeria.

CASE REPORT

The carcasses of 1½ (Case 1) and 2½ (Case 2) -year-old female German Shepherds were presented

for necropsy at the Department of Veterinary Pathology, Veterinary Teaching Hospital (VTH), Ahmadu Bello University (ABU), Zaria on the 5th February and 8th April 2021, respectively. History revealed that the two dogs were suddenly found recumbent, weak with dilated pupils, having bloody/dark urine, and irregular bleeding from the nose and anus, coupled with respiratory distress. Case 1 died on arrival to the VTH, ABU while Case 2 died a few hours upon supportive therapy including ventilatory support, IV fluid therapy, anticonvulsants, and glycopyrrolate. History revealed that the dogs were alert and apparently healthy prior to their presentations, were always caged especially in the daytime, and had complete vaccination and deworming history.

Postmortem examination in both dogs revealed good body conditions (body condition score 3/5), pale ocular and buccal mucous membranes, inflamed submandibular lymph nodes, bite sites on the left lateral abdominal region of the skin which penetrate down to the subcutis with diameters 0.8 to 3 cm (Figure 1), diffuse subcutaneous muscular hemorrhagic, gelatinous and oedematous areas (Figure 2), left ventricular hypertrophy (Figure 3), severe frothy exudate in the trachea and lungs, severe congested, haemorrhagic and oedematous lungs (Figure 4), and haemorrhagic gastrointestinal tract with ulcerative mucosa of the pyloric and the cranial parts of the stomach and duodenum (Figure 5), respectively. In addition, Case 1 had sloughing and ballooning gastric mucosa, while there were no remarkable findings in the stomach of Case 2 except for findings of wooden pegs in the empty stomach. The liver was severely enlarged, congested and firm with a gritty sound on cut (Figure 6). The spleen exhibited multi-focal haemorrhagic areas and congestion (Figure 7), while the kidneys were bilaterally and uniformly enlarged with severe pigmenturia indicated by the dark red to black colouration (Figure 8).

Microscopic examination of the heart revealed Zenker's degeneration as well as congestion (Figure 9). The lungs showed congestion, haemorrhages, and generalized oedema (Figure 10), while the intestines show congestion of the blood vessels within the submucosa and muscularis mucosae, haemorrhages in the intervilli, and Crypts of Liberkuhn (arrowhead), with degeneration of the intestinal villi also observed (Figure 11). Severe hepatic sinusoidal and central vein congestion and coagulative necrosis of the hepatocytes were observed in the liver (Figure 12). The kidney revealed congestion and coagulative necrosis of the glomeruli and renal tubules (Figure 13). This case was diagnosed as a snake bite based on the history, general physical examination, postmortem changes, and microscopic findings.

Figure 1a. Photograph of the skin of the dog (Case 2), note the sites of the bites (arrows)

Figure 1b. Site of bite at the subcutaneous layer (arrow)

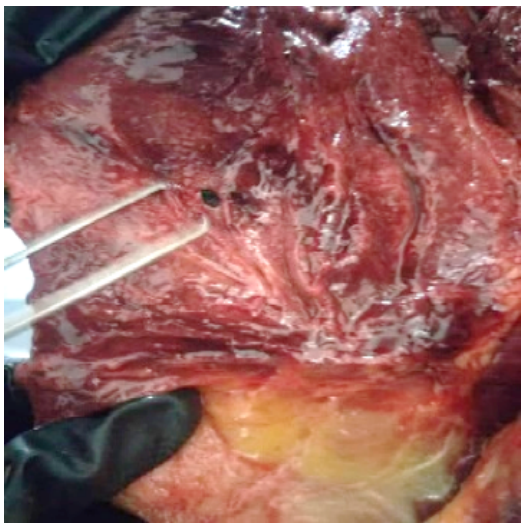

Figure 2. Photograph of the subcutaneous muscle of the dog (Case 1), note the site of the bite (tip of thumb forcep) with diffuse muscular hemorrhagic and gelatinous oedematous areas

Figure 3. Photograph of the heart of the dog (Case 1) showing left ventricular hypertrophy (arrow)

Figure 4. Photograph of the trachea and lungs of the dog (Case 1) with frothy exudate within the trachea (arrow), congested, haemorrhagic, and oedematous lungs (arrowhead)

Figure 5. Photograph of the gastrointestinal tract of the dog (Case 1), note the haemorrhagic gastroenteritis (arrowheads), corrugation, and sloughing of the gastric mucosae (arrow)

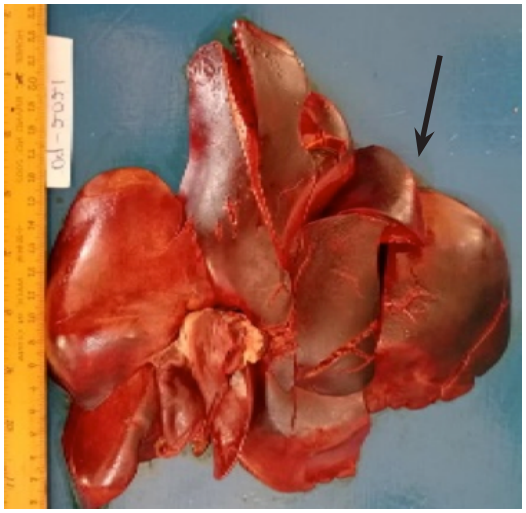

Figure 6. (Case 1): Photograph of the liver of the dog, note the congestion and hepatomegaly (arrow)

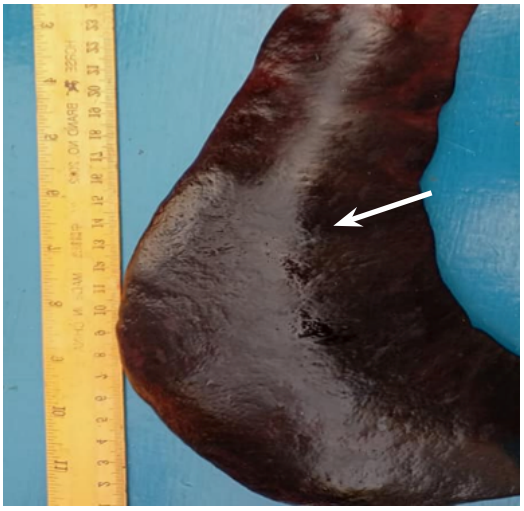

Figure 7. (Case 2): Photograph of the spleen of the dog, note the congested and enlarged spleen (splenomegaly) (arrow)

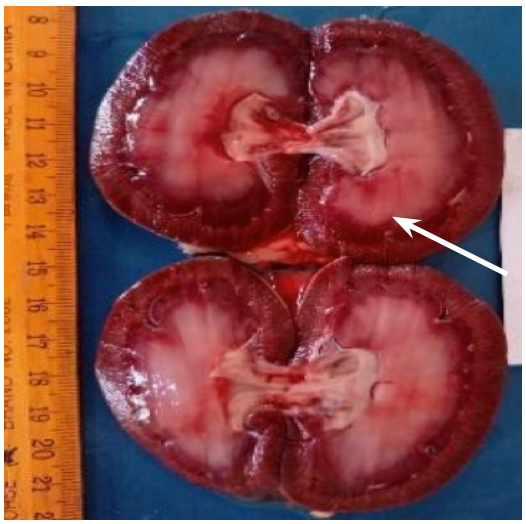

Figure 8a. (Case 1): Photograph of kidneys of the dog, note the enlargement, and congested corticomedullary junction (arrow)

Figure 8b. (Case 2): Photograph of kidneys of the dog, note enlargement and renal congestion

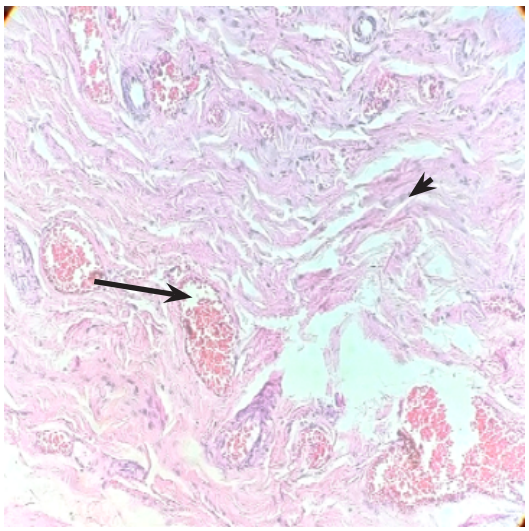

Figure 9. Photomicrograph of the heart of the dog showing myocardial degeneration (arrowhead) and congestion (arrow) (H&E stain x 200)

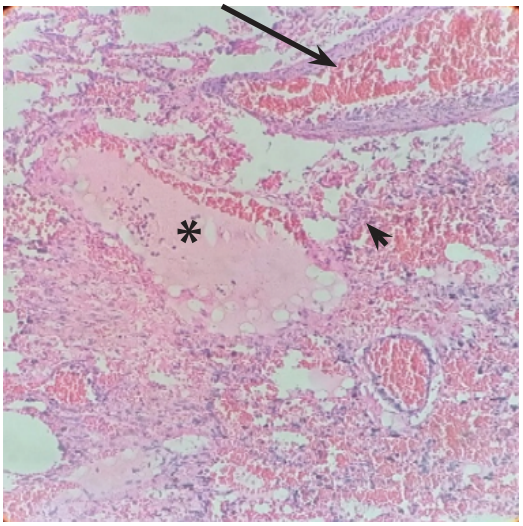

Figure 10. Photomicrograph of the lungs of a dog showing congestion (arrow), haemorrhages (arrowhead), and oedema (*) (H&E stain x200)

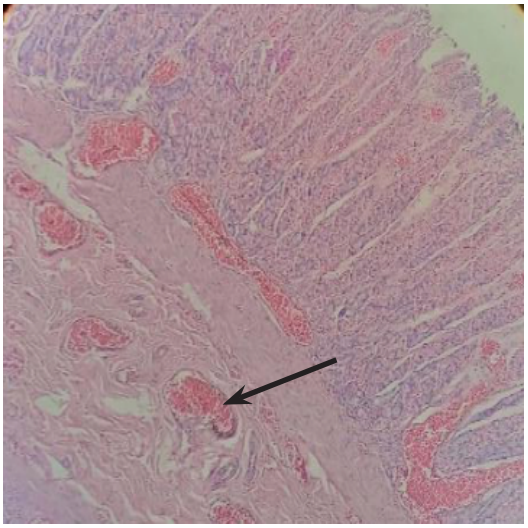

Figure 11. Photomicrograph of the intestine of the dog showing severe congestion of the blood vessels within the submucosa and muscularis mucosa (arrow), haemorrhages (arrowhead) at the intervilli, Crypts of Liberkuhn that involved the intestinal gland, degeneration of the intestinal villi (H&E stain x200)

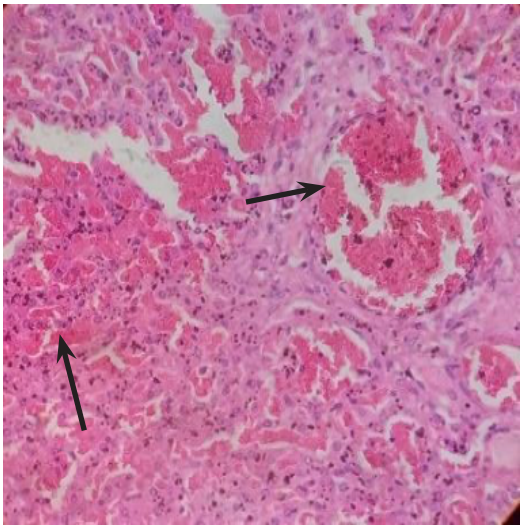

Figure 12. Photomicrograph of the liver of the dog showing severe hepatic sinusoidal and central vein congestion (arrows), and coagulative necrosis of the hepatocytes (arrowhead) (H&E stain x200)

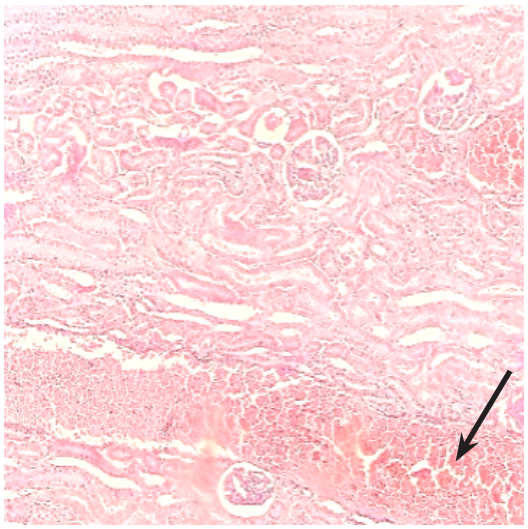

Figure 13. Photomicrograph of the kidney of the dog showing congestion (arrow) and coagulative necrosis of the renal tubules (H&E stain x200)

DISCUSSION

Previous snakebite investigations in dogs and cats highlighted that 78 % of envenomation occurred in rural and 22 % in urban areas (Mirtschin *et al.,* 1998).

There were striking similarities observed in the pathology of the two cases. The observed dilation of the pupils indicates neurological effects of the venom on the nervous system. Snakes' venoms have been reported to have neurotoxic (Hart *et al.,* 2013), haemolytic (Vaughan *et al.,* 1981), anticoagulant and procoagulant effects (Lane *et al.,* 2011), which greatly increasing the risk of bleeding to death. The observed intense, gelatinous, and yellowish serous hemorrhagic eodema with coagulated blood seen at the site of bites were also supported by the findings of Berrocal *et al.* (1998), Bicudo (1999), and Ferreir Junior (2002). The muscular weakness could be due to the presence of hyaluronidase enzyme in the snake venom (Klaassen, 2008; Thangamani *et al.,* 2018). Cardiac lesions may be due to a triggered cardiac arrhythmia as reported by Lervik *et al.* (2010). Manifestations in other organs were generalized pulmonary emphysema, hemorrhagic areas in the epicardium, myocardium, endocardium, lungs, gastrointestinal tract, and kidneys that were similar to previous reports by Chugh *et al.* (1975) and Berrocal *et al.* (1998). Similar renal lesions were reported following bites from vipers, *Echis carinatus* (Sitprija & Boonpucknavig, 1979; Chugh *et al.,* 1984) and puff adder (Warrell *et al.,* 1975). The microscopic changes reported conform to variable lesions reported by Date and Shastry (1988), Fonteque *et al.* (2001), and Ferreir Junior (2002) who observed severe congestion and hemorrhage in most organs, acute tubular necrosis, acute interstitial nephritis, glomerulonephritis, and renal necrosis following snakes' bite. In Nigeria, earlier report had shown incidence of approximately 1 % and 10 % acute renal failure following *Echis carinatus* and puff adder bites, respectively (Warrell *et al.,* 1975).

CONCLUSION

Snake bite is an important medical condition in in Zaria and its environment, but to the best of our knowledge, pathology of snake envenomation in companion animals are rarely reported. This report provides valuable veterinary pathological diagnostic information on snakebites in dogs. Snake envenomation should be considered as a cause of multicavitary effusion, congestion and haemorrhages, respiratory, and neurological disorders in dogs. Suspected snake envenomation should be handled promptly and managed with polyvalent antivenom as a preference to monovalent antivenom. Other symptomatic management should be employed to arrest the undesired manifestations and death of animals, sequel to snake bite envenomation. Bushes should be cleared around residences and close monitoring of dogs in addition to prompt report of any suspicious cases to the nearest veterinary clinics or VTH, ABU.

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