

Snake envenomation in two cattle: clinical/laboratory aspects and treatment using equine-derived antivenin of Viperidae

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Received: 03.04.2019 • Accepted/Published Online: 05.07.2019 • Final Version: 07.08.2019

Abstract: In this case report, specific antivenin treatment for Viperidae snake envenomation in two cattle was defined for the first time. The diagnosis of snake envenomation was made according to the history and clinical findings. Clinical examination revealed systemic (tachycardia, dyspnea, cyanosis, hypersalivation, ruminal hypotony) and local (swelling of the leg and head) findings depending on the location of snake bites. Laboratory analysis determined granulocytic leukocytosis, monocytosis, decreased iron binding capacity, and increased CK and LDH enzyme activities. In the specific treatment of cases, equine-derived polyvalent antivenin containing antitoxic immunoglobulins against Viperidae species was administered. Additionally, 5% dextrose, antibiotics, dexamethasone, antihistamines, diuretics, and a vitamin B complex were applied. All clinical and laboratory abnormalities improved after treatment. Complete clinical improvement was observed within 1 week in both cases. The results indicate that equine-derived specific antivenin treatment in snake bites of the family Viperidae can be successfully used in cattle.

Key words: Snake envenomation, cattle, antivenin, treatment, Viperidae

1. Introduction

Snake bites are included in clinical emergencies in cattle, but they are rare [1]. Snake bites usually occur during grazing [2,3] and the summer months when snakes are active [1]. In Turkey, snake bites are usually committed by the family Viperidae. *Vipera ursinii* and *Vipera aspis balcanica* are the most common snake species in the Aegean and Mediterranean regions of Turkey [4]. Viperidae snake venom includes a mixture of toxins with hemotoxic, necrotic, and myotoxic effects [5].

Clinically, local and systemic (pulmonary, cardiovascular, gastrointestinal, hematologic, neurologic) disorders are observed in cases of snake bites [6]. These findings vary depending on the species and size of the snake, the fullness of the venom glands, the size of the bitten animal, the location of the bite, the number of bites, the thickness of the hair coat, and the quantity of subcutaneous adipose tissue [1,7]. Clinical severity is scored at 3 levels, as minimum, moderate, or severe [6]. Similarly, changes in hematological and biochemical parameters reflecting clinical pathology are observed according to degree of exposure and/or etiological variables [2,7,8].

Specific treatment is the use of antivenin according to the venom of the snake species [1,5], but this is usually not possible due to the lack of antivenins produced for

veterinary use. However, it is reported that snakes affect all humans and animal species in the same region; therefore, equine-derived antivenins produced for humans can also be used in the treatment of animals [1,6]. It is recommended that the antivenin be given within 6 h after snake bites. It has been reported that antivenin prevents systemic effects but does not contribute to the reduced size of local swelling in the bite area [9]. Treatment also includes symptomatic and supportive treatment modalities whether or not antivenin treatment is initiated [1–3,6,7].

Despite the large number of snake bite cases reported in human medicine both in Turkey [10] and in the Hatay region [11,12], there is only one case report in dog in animals [13]. Moreover, there are no case reports in cattle. In this case report, successful treatment with specific antivenin against Viperidae snakes in two cattle was first defined by clinical and laboratory findings.

2. Case History

Case 1 was a 4-year-old lactating Holstein cow in the fifth month of pregnancy. The cow was brought to our clinic at the 4th hour after snake bite. Case 2 was a 2.5-year-old Holstein bull. The bull was admitted to our clinic at the 3rd hour after suspicion of snake bites. Physical and clinical examinations were performed in both cases. On clinical

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examination of Case 1, there were two teeth marks above the nail in the right anterior foot and a blood clot in the region of the teeth marks, and a progressive edematous swelling from the right anterior carpal joints to scapular and sternal regions was observed (Figure 1a). Milk color was found to be dark yellow. Conjunctival mucosae were mildly cyanotic, body temperature was 38.1 °C, heart rate was 82 beats/min, and respiratory rate was 20 breaths/min. The clinical examination of Case 2 revealed that the bull was bitten around the jaw (snake teeth mark) and an edematous swelling was observed in the head (Figure 1b). Dyspnea, cyanosis, hypersalivation, and ruminal hypotony were detected. Body temperature was 38.6 °C, heart rate

was 130 beats/min, and respiratory rate was 22 breaths/min.

Hematological (Table) and biochemical (total protein, albumin, glucose, total bilirubin, conjugated bilirubin, creatinine, iron, iron binding capacity, AST, ALT, ALP, GGT, LDH, CK) parameters were analyzed. Hematological analysis showed that total leukocyte and granulocyte levels were increased in both cases (Table). Biochemical analysis showed a decrease in iron binding capacity (87 µg/dL; reference range 110–350 µg/dL) in Case 1. An apparent increase in CK (1097 IU/L; reference range 35–280 IU/L) and a slight increase in LDH (1482 IU/L; reference range 692–1445 IU/L) were detected in Case 2.



Figure 1. Clinical appearance of cattle exposed to snake bites: edematous swelling in the foot area (a, Case 2) and head region (b, Case 2) prior to treatment; loss of swelling in the foot area (c, Case 1) and head area (d, Case 2) after treatment.

Table. Hematological findings of cases.

Parameters	Case 1		Case 2		Reference values ¹
	BT	AT	BT	AT	
Total leukocytes ($\times 10^9/L$)	16.84	8.16	14.67	11.02	4.0–12.0
Lymphocytes ($\times 10^9/L$)	7.31	5.15	4.42	5.72	2.0–7.5
Monocytes ($\times 10^9/L$)	0.95	0.42	0.73	0.39	0–0.8
Granulocytes ($\times 10^9/L$)	8.58	2.60	9.52	4.90	0.6–6.5
Red blood cells ($\times 10^{12}/L$)	5.95	5.50	7.80	7.11	5.0–10.0
Hemoglobin (g/dL)	9.5	8.3	12.0	10.7	8.0–15.0
Hematocrit (%)	25.99	23.58	33.13	30.38	24–46
MCH (pg)	15.9	15.1	15.4	15.1	11.0–17.0
MCHC (g/dL)	36.4	35.2	36.2	35.3	30–36
MCV (fL)	44	43	42	43	40–60
RDWc (%)	19.3	18.5	20.3	20.6	16.7–23.3
PLT ($\times 10^9/L$)	367	358	205	455	100–800

BT: Before treatment, AT: after treatment.

Equine-derived polyvalent antivenin (Institute of Immunology, Inc., Croatia), effective against different species of Viperidae (*V. ammodytes*, *V. aspis*, *V. berus*, *V. lebetina*, *V. xanthina*, *V. ursinii*), was used in the specific treatment of these cases. The administration of antivenin was performed as a slow intravenous infusion after dilution of 20 mL of antivenin (each antivenin package contains 10 mL of antivenin) in 1000 mL of saline. Additionally, 5% dextrose (1000 mL, IV), antibiotics for the control of local infection at the site of the bite based on the reports of Radostits et al. [1] (Case 1: 10,000 IU benzyl penicillin procaine and 10 mg dihydrostreptomycin/kg BW, IM, q 24 h, 3 days; Case 2: enrofloxacin; 2.5 mg/kg BW, IM, 3 days), dexamethasone (0.04 mg/kg BW, q 24 h, IM), antihistamines (mepyramine maleate: 1 mg/kg BW, slowly IV), diuretics (furosemide; 1 mg/kg body weight, slowly IV), and a vitamin B complex (20 mL/cattle, q 24 h, IM, 5 days) were applied.

Physical and clinical examinations of the cases performed on the 7th day of the treatment revealed that the clinical abnormalities observed before the treatment had disappeared and complete clinical improvement was observed (Figures 1c and 1d). After the treatment in Case 1, the milk color gradually improved after the third day and returned to normal on the 6th day of treatment. The swelling in the legs of Case 1 disappeared on the 6th day after the treatment (Figure 1c). The swelling at the head of Case 2 decreased gradually on the fourth day and completely disappeared on the seventh day (Figure 1d). Laboratory abnormalities detected before treatment disappeared after treatment and reached the reference value ranges (Table).

3. Results and discussion

Snake bites are emergency conditions requiring rapid clinical diagnosis and specific treatment in cattle [3]. In this case report, we tried to draw attention to the clinical-laboratory appearance of Viperidae snake bites and treatment with antivenin treatment for Viperidae.

The clinical findings observed in these snake bite cases were similar to those reported by other investigators [1–3,7,8]. Local (Figures 1a and 1b) and systemic findings could be evaluated as mild (Case 1) and/or moderate (Case 2) according to snake bite severity scores as reported in the literature [6]. Farm animals as in Case 2 are usually reported to be bitten in the jaw region [14]. Dyspnea and hypersalivation in Case 2 can be explained as reported by Radostits et al. [1]. Radostits et al. [1] reported that reaching a certain size of swelling due to bite in the head region may cause dyspnea in cattle. Tachycardia was a reflection of cardiovascular effects. In both cases, progressive recovery started after treatment, and clinically complete recovery was observed on day 7 (Figures 1c and 1d). Moreover, an adverse effect due to the use of antivenin was not observed.

Granulocytic leukocytosis in these cases (Table) was a reflection of hematological abnormality as reported in many other cases [8,15,16] and could be attributed to the inflammatory response [2,14]. Similar to the findings of Graça et al. [15], monocytosis was also determined in Case 1 (Table). This can be evaluated in the same way as granulocytic leukocytosis. In a cattle with snake bites by the family Viperidae, for which antivenin treatment was not applied, progressive anemia and progressive neutrophilic leukocytosis developed during the treatment period (3–65

days) [2]. Similar to Jezek et al. [2], RBC, Hb, and Htc levels in these cases due to Viperidae snakes bites (Table) did not differ from the reference values [1], and there was a gradual decrease after treatment when compared to the pretreatment findings. Unlike the report of Jezek et al. [2], however, total leukocyte and neutrophil leukocyte numbers decreased after antivenin administration in this study (Table). This may indicate that the application of antivenin eliminates the inflammatory effect of snake bites, but cannot fully eliminate the hemolytic effect, or that the hemolytic effect can be improved over a longer period of time. Jezek et al. [2] used antibiotics and corticosteroids for treatment, but they did not use antivenin.

Serum total iron binding capacity (TIBC) was reported to be low or decreased in inflammatory disorders [17]. Therefore, the decrease in TIBC in Case 1 is thought to be a reflection of inflammation.

Case 2 showed a marked increase in serum CK and a slight increase in LDH. Increases in CK and LDH levels in snake bites were reported by other researchers [2,15,16] and were attributed to degeneration developed in the skeletal muscles of the surrounding areas of the bite as well as in the myocardium [14]. However, it was also reported that there was no relationship between the degree of local swelling and CK levels in snake bites [18]. Moreover, it was reported that CK levels in cattle could not be attributed to local muscle damage [2]. Although there was severe local

swelling in both cases, only in Case 2 was there a marked increase in CK and a slight increase in LDH. Moreover, although the heart rate was within the reference range in Case 1, it was high in Case 2. This increase in CK in Case 2 could thus be attributed to cardiac affect.

In a study [2] in which antivenin was not used in the treatment of snake bite by the family Viperidae, full clinical recovery was reported in a month. Moreover, laboratory parameters were reported to continue to increase for a long time (WBC until day 29, CK up to day 65). In these cases, where antivenin treatment was used, complete clinical recovery and normalization of laboratory abnormalities occurred within 1 week. In cattle, death usually occurs when bitten in the head (muzzle/lips) and neck regions [14]. Case 2 survived despite exposure to snake bite in the head region.

The use of snake species-specific antivenin is essential in the primary treatment of snake bites. However, the treatment protocol includes not only antivenin treatment but also symptomatic and supportive treatment methods. These methods are widely used both in cases where antivenin treatment cannot be applied and in addition to antivenin treatment. In conclusion, it has been demonstrated by clinical and laboratory findings that equine-derived specific antivenin treatment could be used successfully in snake bites of the family Viperidae in cattle.

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