

# Snakebites in domestic animals

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**Abstract:** In Portugal, there are three venomous species: the horned viper (*Vipera latastei*), seoane (*Vipera seoanei*), rat snake (*Malpolon monspessulanus*) and the hooded snake (*Macroprotodon brevis ibericus*), and in the UK the common European adder (*Vipera berus*). Snake venom is a complex mixture of toxins whose composition varies depending on the families, genera, species and even subspecies. In Europe, particularly Portugal, there are no published data on the frequency of these types of incidents, but it is estimated to be a high incidence, mainly in dogs. Thus, to characterise the injuries caused by the bite of venom snacks in domestic animals, the authors describe cases in dogs, cats and goats with a suspected snack bite. Animals present wounds compatible with snakebites two points 1 to 1.8 cm apart that could be noted at the head or limbs. The main clinical signs observed included pain, oedema and necrosis. From the animals that died, the *post-mortem* examination revealed subcutaneous and muscular necrosis and haemorrhages of surrounding tissues, including muscles and organic haemorrhage. The severity of envenomation will depend on the quantity of inoculated venom, the species, age, size and previous state of health of the bitten animal, bite location and post-bite excitability. With this study, the authors hope to help improve the knowledge regarding snakebites in Europe.

**Keywords:** toxins, venom, snakes, domestic animals

## 1. Introduction

There are 3,000 snake species worldwide, but only 15% are considered venomous [1]. Venomous snake species can be broadly grouped into three families: Colubridae, Elapidae, and Viperidae. In Europe 11 species are venomous [2]. In Portugal, there are four venomous species: the horned viper (*Vipera latastei*), seoane (*Vipera seoanei*), rat snake (*Malpolon monspessulanus*) and the hooded snake (*Macroprotodon brevis ibericus*), and in the UK the common European adder (*Vipera berus*) [3,4].

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**Figure 1.** A - *Vipera latastei*; B - *Vipera seoanei*; C - *Malpolon monspessulanus*; D - *Macroprotodon brevis ibericus*; E - *Vipera berus* (Creative commons Licence Wikipedia).

They possess canaliculated venom devices, that is, hollow fangs located anteriorly in the maxilla, associated with a venom gland, whose content is inoculated at high pressure by gland compression by skeletal muscle fibres [5]. Snake venom is a complex mixture of toxins, the composition of which varies depending on the families, genera, and species [6]. In this mixture is possible to find such as enzymes [serine proteases, zinc metalloproteases, phospholipase A2 (PLA2), fibrinogenases, factor X, and prothrombin, among others) L-amino acid oxidases] and proteins without activity enzymatic (natriuretic peptides, disintegrins, Kunitz-type protease inhibitor, cysteine, type C lecithin, neuronal, vascular and endothelial growth factors and protein secretions rich in cysteine (CRISP). The different types of PLA2 isoenzymes are responsible for hemolysis, myotoxicity, presynaptic and postsynaptic neurotoxicity, cardiotoxicity, oedema and pro- or anticoagulant effects [7]. The factors responsible for the severity of envenomation are the amount and dangerousness of the inoculated venom, the species, age, size, previous state of health of the bitten animal, bite location and post-bite excitability [8].

The main manifestations caused by the venom of ophidians are the pain of varying intensity, oedema, hemorrhages, changes in the gastrointestinal tract (vomiting, abdominal pain, diarrhea), neurological signs (ptosis, ophthalmoplegia, ptialism, dysphagia, lethargy), respiratory changes, leukocytosis, anaemia, and thrombocytopenia [7,8].

Snakebite envenoming is an acute and potentially life-threatening disease affecting Humans and domestic animals. It is a major issue in rural communities [9]. It is estimated that 150,000 animals (dogs and cats mainly) are bitten by snakes in the United States annually, with reported canine mortality frequencies ranging from 1%-30% [1]. The annual incidence of poisoning of humans in Europe varies between 4000 and 20 000 cases; the incidence in animals is believed to be 30 times higher and with a higher mortality rate of 3.5-14% [10]. The data on snakebites in domestic animals are dispersed and still scarce in various regions. Therefore, the real number of animals affected every year in Europe is unknown at the moment [11]. With the cases presented, the authors hope to help improve the knowledge regarding snakebites in Europe.

## 2. Material and Methods

We retrospectively reviewed the medical records of domestic animals admitted with snakebites to the Veterinary Hospital of Trás-os-Montes and Alto Douro (Vila Real, Portugal), Santa Marinha Veterinary Clinic (Avanca, Portugal) and Calweton Veterinary Group (United Kingdom) from 2020 to 2023. This study included animals where two fang marks were observed at the wound site, or the tutors were witnesses of the attack.

## 3. Results

This study involved 8 animals from Portugal and the United Kingdom, including 1 feline, two goats and six canids. The dogs were from 4 breeds, including Labrador Retriever (1), Whippet (1), Springer Spaniel English (2), and Collie (1). The cat was of a mixed breed. Overall, 20% (1) of dogs were males, and 80% (4) were females. The cat was a male (1). Both goats were females (2). The age of the animals was between 3 and 12 years.

The bite wounds were localized on the face (62.5%, 5/8), neck (12.5%, 1/8), and limbs (12.5%, 1/8). The clinical signs observed on presentation in all cases were oedema and erythema. All the dogs survive. The cat and the goats did not survive. Antivenom was administrated only in two animals; the remaining animals were treated with a support treatment.

Next, we present three cases in detail, one from a dog and the other from a cat.

### 3.1. Feline, neutered male, three years old

According to the tutors, the animal disappeared for one day and when it returned, it staggered again, with anorexia and very prostrate. Regarding the region where this animal lived, the most probable responsible for the bite were *Malpolon monspessulanus* or *Vipera latastei*.

On physical examination, the temperature was 41.7°C, and the right hind limb was edematous, especially in the tarsal area, painful to the touch and without support. The animal was hospitalized and treated with IV fluids and antibiotic therapy (enrofloxacin and amoxicillin + clavulanic acid) was started. Twelve hours after admission, it presented a generalized tonic-clonic seizure medicated with IV diazepam. Radiography of the limb was performed (Figure 2), and blood was performed for analysis where leukopenia with neutropenia and increased ALT, creatinine and urea were observed (Table 2).



**Figure 2.** Radiography of the right hind limb of a male cat 12h after a snake bite.

After 24h, a hematoma begins to form on the inner thigh, with a small area of skin in the center starting to necrose. In the following days, the limb became more edematous, the area of necrotic skin increased, and the animal remained prostrated. However, the temperature was within normal values. An ultrasound was performed (Figure 3), where a slightly hypoechoic pancreas and a slight generalized peritoneal reaction were observed.



**Figure 3.** Abdominal echography with hypoechoic pancreas and slight generalized peritoneal reaction in cat bitten by a venomous snake.

**Table 1.** Values of the biochemical parameter in snake bite in a cat.

Parameter	Reference values	17/06/2022	23/06/2022
Albumin	2.3-3.5 g/dl	3.0	1.1
Urea	17.6-32.8 mg/dl	40	
Creatinine	0.8-1.8 mg/dl	2.64	1.03
Alkaline phosphatase (FA)	11-67 U/l	19	
Alanine Aminotransferase (ALT)	18-77 U/l	162	
Glucose	71-148 mg/dl	99	
Total Protein (TP)s	5.7-7.8 g/dl	6.7	

On the third day of hospitalization, the animal had a fever, and the antibiotic therapy was changed to enrofloxacin, metronidazole and ceftriaxone. After three days, the temperature returned to normal values, but the necrotic lesion continued progressing, and generalized edema throughout the body was observed. Transfusion of fresh frozen plasma was performed on the 6<sup>th</sup> day of hospitalization, as he had hypoalbuminemia, but he did not show improvement and died after two days. Necropsy was not performed.

### 3.2. Canine, Whippet, neut female, four years

The tutors did not see the viper (*Vipera berus*) but there were plenty in the area around. After the animal had been sniffing the grass, the animal became lethargic, head down, and started swelling around the mouth/face (Figure 4).



**Figure 4.** Oedema of the face and mouth in a female dog bitten by a venomous snake.

On physical exam it was panting, temperature 38.3°C, swelled around the mouth that went towards the ventral head, painful at the touch that not allowed head manipulation. Admitted and placed on IV fluids, with meloxicam, chlorpheniramine and buprenorphine, a fan was also set to help to cool down. The tutors declined antivenom. Blood tests were performed (Table 2)

**Table 1.** Values from the biochemical parameter after 24h snake bite.

Parameter	Reference values	
Amylase (AMY)	200.0-1200.0 U/L	1542
Glucose (GLU)	3.3-6.1 mmol/L	6.4
Total Protein (PT)	54-82 g/L	47
Globulin (GLOB)	23-52 g/L	16
Microhematocrit (PCV)	37-55%	48

During the night, breathing stabilized, although its face became more swelled. Swelling progressed to the axilla region and paracetamol was added to the treatment. The animal was comfortable on the second day of internment, so it was sent home with Synulox, Metacam, Mirtazapine, Prevomax, Omeprazole and Hills A/D. At home, she continues not to eat, and oedema spreads down to the front legs. The animal was readmitted again and treated with IV fluids, Piriton; Dexadreson, Synulox, Prevomax and omeprazole. A small cut was noticed on the left side of the neck with some necrotic skin that was removed (Figure 5). The animal fully recovered.



**Figure 5.** Possible snake bite wound in a dog.

### 3.3. Small ruminant, *Autochthonous Bravia Goats, female, adult*

Two animals presented lethargy, head down, and oedema of the face. In addition, it was observed bit marks on the face and neck. In the region where this animal lived, the most probable responsible for the bit were *Malpolon monspessulanus*, *Macroprotodon brevis* or *Vipera latastei*. Unfortunately, both animals died before initiating treatment due to oedema of the glottis (Figure 6).



**Figure 6.** Oedema of the face and mouth in two goats bitten by a venomous snake.

## 4. Discussion and conclusions

In the present study, snakebites were mostly observed in the head region or on the limbs, findings that are consistent with other studies [1,12]. These results might suggest that dogs are prone to intentional contact with vipers when playing in the fields or are guard animals [13]. Additionally, due to these behavioral characteristics in dogs, most snakebites occur in the distal parts of the limbs or head region [1]. One study reported that young, mature dogs of medium to large breeds are most commonly bitten by snakes [12]. This was also observed in this study.

Most animals had oedema and erythema, and only a small number presented cyanosis and tissue necrosis. These findings may be of non-venomous snakebites or “dry” bites, which induce insufficient envenomation [1].

A standard treatment protocol for snake envenomation needs to be improved for domestic animals; at the moment the only accepted treatment is the administration of antivenom and supportive care (intravenous crystalloid fluid therapy and pain control) [14]. Antivenom limits clinical signs and reverses coagulopathy; unfortunately, due to the high price many tutors cannot afford this treatment.

The present study has several limitations owing to its retrospective design. The medical records were occasionally incomplete because data from three different animal



hospitals were collected for analysis due to the low incidence of snakebites in animals in Portugal. The majority of the cases occurred in the UK. Although snakebites in small animals in some regions of Europe are an uncommon medical problem, they should be considered as they can eventually lead to death, as observed in one case. In the future, more studies are necessary to help a better triage and treatment of animal victims of snake bites.

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