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Case Report

Treatment of a 41-year old female patient bitten by a viper conducted at the emergency department – A case report

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ABSTRACT

Introduction: *Vipera berus* is the only species of venomous viper found in Poland, especially in Bieszczady. Cases of such bites in this country are rare and mortality does not exceed 1%. Most viper bites are dry bites with hardly any symptoms and do not require any hospital treatment; however, viper venom contains a complex mixture of proteolytic enzymes such as hyaluronidase, phospholipase A₂, cardiotoxins and presynaptic neurotoxins, which can be very dangerous for the victim. Thus, if symptoms exacerbate in the victim, observation and hospital treatment become a necessity.

Aim: The aim of this paper was to present the importance and validity of multi-diagnostic procedure and treatment at the Hospital Emergency Department (ED) in the case of viper bite and to describe the effect of viper venom on the human body. The diagnosis, management and care leading to the fast recovery of the patient are discussed.

Materials and methods: This study presents a case report involving a patient admitted to the ED in the Provincial Specialist Hospital in Olsztyn, following a viper bite.

Results and discussion: *V. berus* bites are rare in Poland, occasionally causing severe complications. Most bites are asymptomatic. Much less likely to develop are wide ranges of symptoms caused by toxins contained in the viper venom, including serious hypotension, cardiac arrhythmias, irritation of the central nervous system, heart rhythm disturbances, multiple organ dysfunction, pulmonary edema, disseminated intravascular coagulation syndrome, and anaphylactic shock. A typical viper bite involving extremities results in edema and ischemia of the distal parts of extremities with peripheral nerve damage. Due to a variety of possible complications, for patients with emerging symptoms, hospitalization becomes necessary in order to implement multidisciplinary treatment. The units predisposed to provide adequate care are EDs which ensure proper medical staff as well as diagnostic and monitoring facilities and access to appropriate treatment. Particular importance is given to controlling blood pressure, coagulation function, swelling of the bite area and the peripheral circulation. Specific treatment consists of administering specific

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antitoxin against viper venom. In symptomatic treatment, besides the use of anticoagulants, corticosteroids, antibiotics and antitetanic anatoxin, surgical procedures are also considered.

Conclusions: Rapid and well-coordinated medical assistance at the ED helps to avoid complications and facilitates faster recoveries in patients bitten by vipers.

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1. Introduction

Vipera berus of a viper species is the only venomous reptile found in Poland in the natural environment. Adults grow to a length of 70 cm (in exceptional cases to 90 cm). The color pattern visible on its back varies, ranging from brown, yellowish, olive green, bluish gray, orange, or reddish brown, with a characteristic zigzag pattern, the so-called "Cain band".⁴ *V. berus* is mainly found in wetlands and forest clearings.

This viper species generally avoids and evades people, but when in danger, it can attack a human. *V. berus* venom is usually not highly toxic and in the majority of cases complications do not occur after the bite; however, the venom can be dangerous, especially to children and the elderly. Mortality following the bite is approximately 1%. The volume of venom injected into the victim's body depends on the length of time elapsing since the previous bite and the viper's size (in *V. berus* up to 60 cm, a single volume of venom in both venom glands amounts to 30 mg – i.e., 10 mg of dry mass).^{7,10}

V. berus venom contains proteolytic enzymes: hyaluronidase which facilitates the invasion of toxins from the bite site further into the skin and subcutaneous connective tissue, thus its name: "spreading factor," phospholipase A₂ (PLA₂), as well as cardiotoxins, presynaptic neurotoxins, amino acids and polypeptides with toxic properties. In total, it contains approximately 25 various proteins and peptides. Venom is absorbed via the lymphatic circulation and via veins. Presynaptic neurotoxins are contained in the venom of the *Viperidae* family of venomous snakes (also *Crotalidae*, *Elapidae*, and *Hydrophiidae* families). These neurotoxins are divided into PLA₂ toxins as well as dendrotoxins and fasciculins. Their neurotoxic activity is associated with the ability to hydrolyze phospholipids anchored at a cell membrane. Presynaptic toxins' activity follows three phases. Initially, there appears a short-term interference with the release of neurotransmitters from nerve terminals (this phase depends on the phospholipase activity). During the second phase, due to the phospholipase activity, the release of neurotoxins increases; in the last phase, neurotransmission is completely blocked.

V. berus venom is characterized by proteolytic, fibrinolytic and anticoagulative properties.^{2,4,5} Venom can cause myonecrosis, hemorrhages, severe local pain and edemas, nausea, vomiting, abdominal pain, diarrhea, sleepiness, fever, angioneurotic edema of the lips and tongue, acidosis, and leukocytosis. Local symptoms and pain at the bite site are associated with damage to the surrounding tissues and blood vessels by proteolytic enzymes and the release of inflammatory mediators. Venom at higher concentrations can lead to blood pressure disturbances (hypotonia), tachyarrhythmia, confusion, convulsions, proteinuria,

erythrocyturia, and, in extreme cases, renal failure, multiple organ dysfunction, pulmonary edema, disseminated intravascular coagulation (DIC), and anaphylaxis (results from cross reaction in individuals allergic to bee sting venom and venom of other hymenopterous insects). At the bite site, there appears an oozing wound with visible traces of two fangs.^{1,2,3,5}

2. Aim

This paper presents the importance and validity of multi-diagnostic procedure and treatment at the Hospital Emergency Department on the basis of a female patient bitten by *V. berus*. Its aims are to describe the effect of viper venom on the human organism; to present specific and symptomatic treatments; and, finally, to discuss the diagnosis, management and care leading to the fast recovery of the patient, while avoiding complications.

3. Materials and methods

The research method involves a case report concerning a female patient treated at the Provincial Specialist Hospital in Olsztyn, complemented by data from the literature.

The patient, 41 years old, arrived at 15:00 at the Emergency Department (ED) of the Provincial Specialist Hospital in Olsztyn, reporting a viper bite. While in the forest, she had spotted a snake. On her attempt to avoid it, she had been attacked and bitten at the dorsal metatarsus of the right foot. This incident occurred at 14:00. The patient experienced severe pain at the bite site, which exacerbated within the following minutes. Based on the description provided by the patient during the interview (brownish and copper-colored snake, approximately 50 cm long and 7 cm in diameter), the reptile was identified as *V. berus*. The patient had no history of chronic diseases. On physical examination her condition was good, she was aware with respect to place, time and her identity. Abnormalities involved pain experienced on palpation in the projection of the right inguinal canal and tachycardia of 122 beats/min. Upper extremities were symmetrical with normal mobility. The left lower extremity was not painful, with normal range of motion, and free from swelling. On the right lower extremity, at the level of the 2nd and 3rd toes, 1 cm from the anterior edge of the foot (Fig. 1) a bite wound was detected. The wound comprised two puncture-like openings, 1 cm from each other, parallel to the toes, approximately 5 mm deep, and slightly bleeding. The extremity presented excessive skin warmth, pain on palpation, clearly visible swelling from the toes of the right foot (ascending towards the shank and knee) to the right inguen, and oval erythema, uniform in color (red),



Fig. 1 – Viper bite site (indicated by the arrow).



Fig. 2 – Lower right extremity edema 60 min following the bite.

10.0 cm × 5.0 cm and 8.0 cm × 3.5 cm in size, merging with each other and elevated approximately 2 cm above the skin level (Figs. 2 and 3).

The patient was monitored with a cardiac monitor. Vital signs were controlled by means of noninvasive blood pressure (NIBP) recording measured every 10 min, continuous measuring of oxygen saturation, pulse and three-channel electrocardiographic (ECG) recording. The circumferences of both lower extremities at several levels: bite site, shank and knee were recorded. The level of skin warmth of both lower extremities and superficial sensibility were also determined. The measurements were taken every 10 min.

On admission the patient was administered with antitoxic anatoxin (0.5 mL subcutaneously, Biomed), antibiotic (Augmentin 1.2 g every 12 h), low molecular weight heparin (Clexane 40 mg subcutaneously).

Additional tests revealed neutrophil leukocytosis (leukocytes – $14.79 \times 10^3 \mu\text{L}^{-1}$, including 76.7% of neurocytes; control leukocytes – $16.55 \times 10^3 \mu\text{L}^{-1}$, including 92.3% of neurocytes), a slightly reduced platelet count – $146 \times 10^3 \mu\text{L}^{-1}$ and the activated partial thromboplastin time – 22.7 s, and increased D-dimer – 2.13 $\mu\text{g/mL}$ (control D-dimer 3.87 $\mu\text{g/mL}$).

During her stay at the ED, the patient complained of dizziness; decrease in blood pressure was observed to the level of 61/41 mmHg (Table 1). Following the administration of 200 mg of hydrocortisone and 500 mL of 0.9% NaCl, blood



Fig. 3 – Lower right extremity edema 90 min following the bite.

Table 1 – Circumference of both lower extremities at the largest swelling (cm).

Measuring site	Foot 10 cm from the 1st toe	Shank 15 cm below the knee joint	Knee joint	Thigh 10 cm above the knee joint
Right	28.0	42.0	43.5	48.5
Left	22.5	38.5	39.0	46.0

pressure increased to 80/60 mmHg. Transfusion of 0.9% NaCl was continued and it was decided to administer viper antivenin (500 IU, viper venom antiserum Institute of Immunology Zagreb) – administration was complication-free.

When hypotension and increased tachycardia occurred, the patient was consulted by an anesthesiologist, who recommended continuing treatment introduced already at the ED. The patient was consulted by a neurologist twice, who did not detect local and general symptoms of venom toxicity in the central nervous system. Following the treatment, after 12 h of hospitalization, no further swelling of the bitten extremity was noted. However, due to the complaints concerning numbness in the right lower extremity below the bite site, the patient, having been consulted by a vascular surgeon, was transferred to the Department of General and Vascular Surgery. At this Department Doppler USG of the veins of the right lower extremity was performed. The examination revealed a significant edema of subcutaneous tissue of the right thigh and shank, without thrombotic changes in the examined veins (femoral veins, popliteal vein, posterior tibial veins and fibular veins). Conservative treatment was continued with good result. After three days of hospitalization at the Department of Surgery, while continuing treatment introduced at the ED, the patient was discharged in a generally good condition.

4. Results and Discussion

V. berus is the only venomous reptile found in Poland in its natural habitat. This makes it easier to identify the animal in case of its bite. However, the importance of collecting detailed

information concerning the place of the incident and the description of the snake cannot be underestimated, because in Poland exotic snakes, including the venomous ones, are bred by amateurs. Consequently, the possibility of being bitten by an escaped animal cannot be excluded.

When bitten by a viper, one must not incise the wound, suck out the venom or take any medication without having consulted its type previously with a physician. The wound should be cleaned with water, disinfected, covered with ice, and the bite site should be immobilized, whilst the victim should be hydrated and monitored. It is very important to call qualified medical staff as soon as possible and transport the victim to a hospital.^{7,9}

Thus far, we have presented diagnostic procedures and therapeutic treatment conducted at the ED concerning a patient bitten by a viper. Most published papers provide guidelines concerning patients treated at the neurology or surgery departments. It should be emphasized, however, that a rapid intervention at the ED results in a higher survival rate and faster recovery.⁹

A 5-grade scale for severity of snake bites has been devised:⁸

- grade 0 (minimal reaction) – bite without venom injection, minimal pain, lack of systemic symptoms within 12 h following the bite and no abnormalities observed in laboratory tests;
- grade I (mild reaction) – bite with a small volume of venom injected, mild pain and edema at the bite site, lack of systemic symptoms within 12 h following the bite and no abnormalities observed in laboratory tests;
- grade II (moderate reaction) – intense pain and edema of the bitten extremity and beyond up to the trunk, extravasations at the bite site; nausea, vomiting and slightly elevated body temperature usually occur;
- grade III (severe reaction) – initially the patient may be qualified as grade I or II; however, within 12 h the victim's condition deteriorates rapidly; swelling of the entire extremity appears, as well as systemic extravasation, tachycardia and hypotension; abnormalities in laboratory tests include neutrophilia, increased prothrombin time and D-dimer, decreased platelet count and fibrinogen level;
- grade IV (life-threatening reaction) – sudden severe pain following the bite, fast progression of the swelling; severe systemic symptoms leading to shock and cardiorespiratory failure.

It is recommended to administer antivenin as the only specific treatment for all victims qualified as having a moderate or severe grade of severity following snake bite. It should be remembered, however, that administering equine antitoxin is associated with the risk of allergic reactions, including anaphylactic shock. At present, it is not recommended to perform a skin test before the antitoxin administration. In patients with a history of allergies, it seems valid to place two peripheral needles and administer preventively 0.3 mg of epinephrine subcutaneously, before administering antitoxin. Pregnancy is not a contraindication for introducing antitoxin.⁸

As viper venom may cause delayed serious complications, such as hypotension, cardiac arrhythmias, irritation of the central nervous system, heart rhythm disturbances, multiple organ dysfunction, pulmonary edema, disseminated intravascular coagulation syndrome, anaphylactic shock, and ischemia of the distal parts of extremities, patients with clearly visible skin symptoms should be closely monitored. Parameters such as blood pressure and oxygen saturation levels should be measured; ECG and biochemical tests should be performed, with particular focus on the coagulation system.

It is underlined that symptomatic treatment should involve administering antitetanic anatoxin and antibiotic therapy. The treatment of complications begins when the signs and symptoms of such complications appear or when the risk for their occurrence is evaluated as high. Treatment consists of the intravenous administration of liquids and steroids in the case of hypovolemic shock, breathing protection and, if necessary, respiratory therapy, fasciotomy in the case of massive edema and a risk for extremity ischemia, anticoagulant therapy and blood replacement therapy in the case of coagulation disorders, invasive treatment of dysrhythmia, dialysis therapy in the case of myoglobinuria and renal failure. A wide range of possible symptoms necessitates the cooperation of physicians of various specializations, for whom the ED is the best place to conduct effective treatment. Devising an optimal treatment by a team of specialists results in implementing therapy at the department best suited for such treatment, or completing the therapeutic process at the ED level.⁹

Both local symptoms – (pain at the bite site and edema) as well as systemic symptoms – (dizziness, hypotonia) developed in the described patient. These symptoms rapidly progressed. Severe reaction (grade III) to viper venom was recognized. Consistent with the guidelines provided in the published literature, antivenin, antitetanic anatoxin, antibiotic, low molecular weight heparin and intravenous liquids filling in the vascular bed were administered, achieving improvement in the clinical condition.¹¹ A risk for vascular complications was the reason for transferring the patient to the Department of Surgery, where treatment implemented at the ED was continued and the symptoms regressed.^{1,2,3,4,5,6,7,8,9,10,11}

5. Conclusions

Rapid and well-coordinated medical assistance at the ED helps to avoid complications and facilitates faster recoveries in patients bitten by vipers.

Conflict of interest

None declared.

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