

Characteristics of Venomous Snakebites in Herzegovina

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Aim. To investigate the degree to which primary and secondary care physicians in the Herzegovina region follow the protocols recommended in the literature for treatment of patients bitten by a venomous snake.

Method. We retrospectively examined hospital records of all patients treated at the Department of Infectious Diseases, Mostar University Hospital, for intoxication following a venomous snakebite in the 1997-2002 period. The data on demographic characteristics, clinical presentation, therapy protocols, and final outcome were collected for each patient.

Results. From 1997 to 2002, 43 men (60.5%) and 28 women (33.4%) were treated at our Department for a venomous snakebite. The greatest number of snakebites occurred in persons older than 60 (chi-square = 12.44, df = 3, p = 0.006) and during the summer months (chi-square = 8.12, df = 1, p = 0.004). More than half of the patients (38, or 53.5%) were bitten on the hand. The commonest symptoms and signs of the local envenomation were pain (97.1%) and swelling (87.3%), whereas general symptoms were tachycardia (39.4%), nausea (33.8%), and vomiting (28.1%). Also, 56 patients (78.8%) experienced anxiety and fear. The primary care protocol recommended in the literature (antibiotics, tetanus antitoxin, snakebite antiserum, and immobilization) was given to only 2 patients (2%). However, there were no lethal outcomes.

Conclusion. Development of a precise evidence-based protocol for prehospital management of venomous snakebite is needed in the Herzegovina region, followed by educational efforts targeted at primary care physicians.

Key words: antivenins; Bosnia-Herzegovina; snakebites; therapy; viper venoms

Poisonous snakes inhabit all continents, especially those with partly tropical and sub-tropical climate (1). Although no precise data are available, estimates are that about 500,000 people worldwide suffer a venomous snakebite each year (2). Deaths caused by venomous snakebites are extremely rare in most European countries, but between 30,000 and 40,000 people die yearly worldwide (3). Among the venomous snakes, which are grouped into five families (*Elapidae*, *Viperidae*, *Crotalidae*, *Hydrophilidae*, and *Colubridae*), the most common on the territory of Bosnia and Herzegovina are the *Viperidae*, the sub-family of the *Viperinae*, particularly the horned viper (*Vipera ammodytes*) and the common adder (*Vipera berus*).

Herzegovina makes for ideal snake habitats because of its land configuration and the Mediterranean climate, and snakebites are a significant part of the pathology of the population of this area (4). However, these snakes are not as poisonous as those inhabiting some tropical countries (5). Horned viper, the most poisonous snake in the Herzegovina region (6,7), injects up to 20 mg of venom in a single bite, whereas the common adder injects up to 14 mg (8). The ven-

oms of these snakes are hemotoxic and cause hemolysis and hemorrhage in seriously affected victims (9). The seriousness of the clinical presentation of snake venom intoxication (ie, ophidism) depends on the characteristics of the snake and the victim (10).

There is no general professional consensus as to what treatment a snakebite victim should receive. However, most authors do not recommend bandaging or incision of the wound as first aid, because it can do more harm than good (11). Although the adequate treatment of choice depends on the type of poison, kind of a snake, and severity of symptoms, the "triple A" therapy (antibiotics, tetanus antitoxin, and snakebite antiserum) should be applied, in addition to the supportive symptomatic therapy (compresses, analgesics, and sedatives) and immobilization of the bitten limb (1,6).

The purpose of this study was to report regional experiences with venomous snakebites in the Herzegovina region, which gravitates to the Mostar University Hospital for secondary health care, by defining the epidemiological characteristics and clinical presentation of snakebites, as well as therapeutic approach to ophidism.

Patients and Method

Method

We retrospectively examined hospital records of all patients who were treated at the Department of Infectious Diseases, Mostar University Hospital for intoxication following a venomous snakebite in the 1997-2002 period. The data were collected on patients' age, season and localization of the bite, time to hospital admission, clinical presentation, therapy protocols applied before and after hospitalization, duration of hospitalization, and final outcome. Since death is a rare outcome seen in venomous snakebite victims in Herzegovina, our main final outcomes were "cured" (complete remission of all symptoms at hospital discharge) or "improved" (improved patient's condition at hospital discharge, although some symptoms still persisted).

For the purpose of this study, we classified the severity of ophidism as mild, moderate, and severe, where mild and moderate implied only local symptoms (pain, swelling, and erythema around the fang marks) and the severe presentation included systemic symptoms (tachycardia, nausea, vomiting, perspiration, prostration, paleness, paresthesiae, fever, coma, or shock). The distinction between mild and moderate clinical presentations was based on the severity of local symptoms, as well as the possibility of mild systemic symptoms (but not as prominent to allow classifying as the severe) in patients with moderate clinical picture.

Patients

We identified 71 patients who were treated for a venomous snakebite at the University Hospital Mostar, Department of Infectious Diseases in the 1997-2002 period. Forty-three were men (60.5%) and 28 (39.4%) women (chi-square=3.17, df=1, p=0.075) (Table 1). The youngest patient was a 3-year-old girl, and the oldest a 93-year-old man.

Table 1. Number of snakebites according to age of the patients hospitalized at the Mostar University Hospital, 1997-2002

Age (years)	No. (%) of patients		
	women	men	total
0-20	2 (2.8)	8 (11.2)	10 (14.0)
21-40	3 (4.2)	13 (18.3)	16 (22.5)
41-60	7 (9.8)	8 (11.2)	15 (21.1)
over 60	16 (22.5)	14 (19.7)	30 (42.2)
Total	28 (39.4)	43 (60.5)	71 (100.0)

Statistical Analysis

Chi-square test was used to compare prevalence of different snakebite parameters or clinical therapy. The level of statistical significance was set at $p < 0.05$. SPSS Version 11.5 for Windows (SPSS Inc., Chicago, IL, USA) was used for statistical analysis.

Results

Ten (14.0%) patients lived in an area with the continental climate and 61 (85.9%) in areas with Mediterranean climate. All patients were bitten by a poisonous snake for the first time ever. In 70 (98.5%) patients, the bite went directly into the skin, whereas one (1.4%) patient was bitten through a sock. There were no cases of multiple bites.

A significantly greatest number of our snakebite patients were older than 60 (chi-square=12.44, df=3, p=0.006). However, when analyzed according to sex, this difference was statistically significant only in women (chi-square=17.43, df=3, p<0.001), whereas it was not significant in men (chi-square=2.86, df=3, p=0.414).

The number of bites per year was significantly greater in 1999 than in any other year in the studied period (chi-square=8.12, df=1, p=0.004), whereas

in 2001 the number of venomous snakebites was significantly lower (chi-square=4.91, df=1, p=0.027). The bites were significantly more common during the summer months (chi-square=8.12, df=1, p=0.004), and rarer in the autumn (chi-square=20.31, df=1, p<0.001). There were no bites during the winter months.

Thirty-eight patients (53.5%) were bitten on the hand, 18 (25.3%) on the foot, 13 (18.3%) on the calf, and 2 (2.8%) on the forearm (chi-square=38.35, df=3, p<0.001). In 52 patients (73.2%), the time from the bite to admission to hospital did not exceed five hours, whereas the remaining 19 patients (26.7%) came to the hospital 5-14 hours after the bite. Some of the patients came directly to the hospital, whereas others first consulted their primary care physicians, who then referred them to the hospital. Before arriving to the hospital, two patients (2.8%) were immobilized, the incision of the wound was performed in five patients (7.0%), bandaging was applied in four (5.6%), and sedatives and/or analgesics were given to three patients (4.2%) (Table 2). Some patients were sent to the hospital by general physicians without any therapy, whereas no patient received a complete prehospital therapy (triple A and immobilization). Thirty patients (42.2%) received snakebite antiserum at the hospital emergency room.

Table 2. Therapy given to patients bitten by the snake by a primary care physician, before admission to the Mostar University Hospital, 1997-2002

Therapy	No. (%) of patients		
	women	men	total
None	3 (4.2)	9 (12.6)	12 (16.9)
Complete triple A* therapy with immobilization	0 (0.0)	0 (0.0)	0 (0.0)
Complete triple A without immobilization	0 (0.0)	2 (2.8)	2 (2.8)
Antibiotics and snakebite antiserum	3 (4.2)	6 (8.4)	9 (12.6)
Only snakebite antiserum	9 (12.6)	14 (19.7)	23 (32.3)
Only antibiotics	2 (2.8)	1 (1.4)	3 (4.2)
Only tetanus antitoxin	1 (1.4)	1 (1.4)	2 (2.8)
Corticosteroids/antihistamines and/or sedative/analgesics	5 (7.0)	3 (4.2)	8 (11.2)
Total	28 (39.4)	43 (60.5)	71 (100.0)

*Antibiotics, tetanus antitoxin, and snakebite antiserum (6).

The commonest general symptoms and signs of snake venom intoxication in our patients were the prostration, tachycardia, vomiting, and high temperature. Considering the clinical presentation, there were 4 patients (5.6%) with mild clinical signs and symptoms, 64 (90.1%) with moderate, and 3 (4.2%) with severe.

Laboratory tests showed no abnormalities in 54 (76.1%) patients, and were changed in 17 (23.9%). The most frequent findings were leukocytosis and increased bilirubin plasma concentration (in 8 patients, or 11.2%). Increased urea and creatinine serum concentrations were found in 7 patients (9.8%). Shortened thrombin and prothrombin time were recorded in 6 patients (8.4%), and anemia and low platelet count in 2 (2.8%). Statistical analysis showed no significant differences among sexes in the symptomatology, except for the prostration, which was significantly more frequent among women (Table 3).

Table 3. Symptoms and signs of patients bitten by the snake on admission at the Mostar University Hospital, 1997-2002

Symptoms and signs	No. (%) of patients		
	women n=28	men n=43	total n=71
Local envenomation:			
pain	27 (96.4)	42 (97.6)	69 (97.1)
swelling	24 (85.7)	38 (88.3)	62 (87.3)
erythema	19 (67.8)	29 (67.4)	48 (67.6)
Systemic envenomation:			
tachycardia	15 (53.5)	13 (30.2)	28 (39.4)
nausea	10 (35.7)	14 (32.5)	24 (33.8)
vomiting	7 (25.0)	13 (30.2)	20 (28.1)
perspiration	10 (35.7)	8 (18.6)	18 (25.3)
prostration	7 (25.0)	9 (20.9)	16 (22.5)
paleness	5 (17.8)	8 (18.6)	13 (18.3)
paresthesiae	1 (3.5)	7 (16.2)	8 (11.2)
fever	1 (3.5)	5 (11.6)	6 (8.4)
Psychological symptoms:			
fear	25 (89.2)	31 (72.0)	56 (78.8)

All patients who arrived to the hospital were admitted to the Department of Infectious Diseases. Sixty-eight of them (95.7%) stayed at the hospital for 10 days or less. Only 3 (4.2%) patients stayed longer, up to 12 days.

At the hospital, patients were treated symptomatically and specifically. The local symptomatic treatment (3% boric acid, immobilization, and elevation of limb) was applied to all patients. Snake bite antivenom was given to 67 (94.3%) patients, whereas the four patients with mild clinical picture received no antivenom (Table 4). No cases of anaphylactic shock or serum disease were recorded as a reaction to the serum. We also did not record a single case of death. Nineteen patients (26.7%) left the hospital as cured and 52 (73.2%) as improved.

Table 4. Treatment of the patients bitten by the snake admitted at the Mostar University Hospital, 1997-2002

Therapy	No. (%) of patients		
	women	men	total
Triple A* and immobilization	12 (16.9)	16 (22.5)	28 (39.4)
Snakebite antiserum and antibiotics	5 (7.0)	6 (8.4)	11 (15.4)
Snakebite antiserum and tetanus antitoxin	0 (0.0)	1 (1.4)	1 (1.4)
Antibiotics and tetanus antitoxin	7 (9.8)	13 (18.3)	20 (28.1)
Antibiotics	3 (4.2)	6 (8.4)	9 (12.6)
Tetanus antitoxin	1 (1.4)	1 (1.4)	2 (2.8)
Total	28 (39.4)	43 (60.5)	71 (100.0)

*Antibiotics, tetanus antitoxin, and snakebite antiserum (6).

Discussion

The epidemiology of venomous snakebites in Herzegovina was similar to the data reported in the literature. Victims who suffered a venomous snakebite were mostly active working people. Men were more common victims of snakebites most probably because of their outdoor lifestyle. The fact that most bites happened directly on the skin stresses the importance of preventive measures, ie, wearing the right clothes and footwear during outdoor activities.

Snakes in Herzegovina become active by the beginning of spring and remain such until the mid-autumn. The least venomous bites occur during the years when summers are cool and rainy (4). Unfortunately, we were not able to obtain the weather re-

cords for 1999, the year with the highest prevalence of bites.

A venomous bite is usually followed by great anxiety and fear, so that most of the patients ask for doctor's help very shortly after the bite (12). It is important to consider this because the psychological trauma could have long-term consequences to the bitten person.

The majority of our patients had clinical presentation which we classified as moderate, ie, pronounced local presentation with possibly mild systemic symptoms. In three patients, the clinical presentation was severe, with impaired consciousness, pathological laboratory findings, and significant local symptoms. Four patients had mild local symptoms due to small concentrations of the injected venom.

There was no significant difference in the clinical presentation between patients living in continental areas and those living in Mediterranean areas.

We became aware of the fact that our general practitioners either did not have enough knowledge or were afraid to treat these patients, so they send them urgently to hospital without providing a proper therapy. Only 30 patients (42.2%) received snakebite antiserum prior to the hospitalization, probably as the result of general physicians' fear of allergic manifestations. The reason for antiserum application at primary health care level should be justified by the fact that it is the best to receive it as soon as possible after the bite. This does not mean that the serum should be given to every patient with the snake venom intoxication. To apply the antiserum properly, we need to be certain that the wound was caused by the bite of a snake, that the snake was poisonous (this should be concluded by the looks of the fang marks), and that the venom was actually injected, ie, that the signs and symptoms of snakebite envenomation are present (13). At our hospital, antivenin is applied in moderate and severe cases of poisoning. Tetanus antitoxin recommended within the triple A therapy (antibiotics, tetanus antitoxin, and snakebite antiserum) was not applied in all the patients, probably because majority had only mild clinical symptoms. According to some authors, application of tetanus antitoxin has no justification, since no case of tetanus caused by venomous bite has been recorded in the relevant literature (14). However, it might be a good idea to conduct active immunization in all patients who do not have the proper evidence that they have been vaccinated against tetanus. The number of patients protected from this disease would considerably grow.

Antibiotics were administered to all hospitalized patients, because the snakebite wound is contaminated with bacteria. Such routine use of antibiotics is recommended by many authors (15), although it encourages the occurrence of bacterial resistance (16). Some authors consider that the routine application of antibiotics should be reserved for snakebite patients with necrosis, tissue gangrene, or abscess (17). In addition to specific therapy, application of symptomatic therapy is also important, primarily to soothe the local symptoms. Symptomatic therapy was applied in all our patients admitted to the Department of Infectious

Diseases, Mostar University Hospital. Many authors suggest adding antihistamines to the triple A therapy, because it can alleviate allergic manifestations after applying the snakebite antiserum and neutralize the effect of histamines and hyaluronidase (1).

The main disadvantage of our study was the lack of data on snake identification, which was made in only a few cases based on the patient's report.

We conclude that poisonous snakebites in Herzegovina, although not as dangerous as in some tropical countries, still require adequate prehospital and hospital treatment. Although it is completely justified for all snakebite victims to eventually reach hospitals and receive hospital treatment, development of precise evidence-based protocols for prehospital management of venomous snakebites is needed in the Herzegovina region, followed by educational efforts targeted at primary care physicians.

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