Ulus Travma Acil Cerrahi Derg 2010;16 (3):210-214
Klinik Çalışma

Snakebites in adults from the Diyarbakır region in southeast Turkey

Türkiye'nin güneydoğusunda Diyarbakır ve çevresinde erişkinlerde yılan ısırıkları

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BACKGROUND

Snake venom poisoning is a medical emergency requiring immediate attention. Bites from poisonous Turkish snakes can lead to local tissue damage and systemic symptoms. The *Vipera ammodytes* species accounts for the majority of envenomation in southeast Turkey.

METHODS

The demographic and epidemiological characteristics, clinical symptoms and signs, laboratory findings, treatment, and outcome of 79 consecutive victims of *V. ammodytes* poisoning admitted to our hospital from 2003 to 2005 were reviewed and analyzed prospectively.

RESULTS

The most common symptoms and signs included fang marks (100%), pain (100%), swelling (83.5%), ecchymosis (92.4%), tachycardia (24.1%), fainting or dizziness (14.5%), fever (19.0%), enlargement of regional lymph nodes (43.0%), nausea (70.9%), hypotension (21.5%), vomiting (36.7%), and dyspnea (3.2%). The main complications were thrombophlebitis, reduced range of motion, local hemorrhagic blister formation, bleeding from skin, rhabdomyolysis, reduced sensation, acute renal failure, necrosis with tissue loss, digit amputation, carpal tunnel syndrome, and compartment syndrome.

CONCLUSION

A *V. ammodytes* bite is a potentially serious event that requires immediate hospital care. Nevertheless, the majority of victims can be treated successfully with conservative methods. No deaths occurred in our series.

Key Words: Compartment syndrome; rhabdomyolysis; snake venom; thrombophlebitis; Turkish snakes; Vipera ammodytes poisoning.

AMAÇ

Yılan zehiri ile zehirlenme hızlı tedavi gerektiren bir tıbbi acil durumdur. Türkiye'deki zehirli yılan sokmaları kısmi doku hasarı ve sistemik semptomlara neden olabilmektedir. *Vipera ammodytes* türü Türkiye'nin güneydoğusunda en zehirli olanıdır.

GEREÇ VE YÖNTEM

2003 ve 2005 yılları arasında acil servisimize başvuran 79 *V. ammodytes* yılan sokması olgularının demografik, epidemiyolojik karakterleri, klinik belirti ve bulguları, laboratuvar bulguları, tedavileri ve sonuçları prospektif olarak incelendi, analiz edildi.

BULGULAR

En yaygın belirti ve bulgular diş izleri (%100), ağrı (%100), şişkinlik (%83,54), ekimoz (%92,40), taşikardi (%24,05), baş dönmesi ve bayılma (%14,52), ateş (%18,98), bölgesel lenf nodu büyümesi (%43,03), bulantı (%70,89), hipotansiyon (%21,52), kusma (%36,71) ve dispne (%3,22) idi. Ana komplikasyonlar tromboflebit, hareket kısıtlığı, lokal hemorajik bül oluşumu, cilt kanaması, rabdomiyoliz, duyu azalması, akut böbrek yetersizliği, doku kaybı ile beraber nekrozis, parmak amputasyonu, karpal tunel sendromu ve kompartman sendromu idi.

SONUÇ

Bir *V. ammodytes* ısırığı acil hastane bakımı gerektiren ciddi bir durumdur. Olguların çoğu konservatif yöntemlerle başarılı bir şekilde tedavi edilebilir. Serimizde ölüm meydana gelmemiştir.

Anahtar Sözcükler: Kompartman sendromu; rabdomiyoliz; yılan zehiri; tromboflebit; Türk yılanları; Vipera ammodytes zehirlenmesi.

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Snakebite is a neglected problem of the rural tropics; its incidence is underestimated because of the lack of reliable epidemiological data.[1] The southeast region of Turkey is home to poisonous snakes of the Viperidae family, which belongs to the subgroup Viperinae (adders) that includes *Vipera ammodytes*, *V. xanthine, V. labetina, V. berus,* and *V. ursinii*. *V. ammodytes* is the most common snake found in all parts of the country and is responsible for the vast majority of envenomation. Other snakes are located in specific geographic regions of the country. Snakes in southeast Turkey start their activity at the beginning of spring and remain active until the end of autumn.

V. ammodytes has, in its upper jaw, two movable poisonous teeth, and one single bite can release about 20 mg of poison. The snake poison is rich in proteins, of which neurotoxin, cytotoxin and hematoxin are the most important. It also has large amounts of enzymes that are proteolytic or hydrolytic and contain hyaluronidase. In addition, the poison stimulates the release of histamine or similar substances that can cause gas gangrene and infection from *Clostridium* species.[2-4]

Bites from poisonous snakes of the *Vipera* order found in southeast Turkey can lead to local tissue damage and systemic symptoms, such as generalized edema, hypotension, gastrointestinal symptoms, hemolysis, and renal dysfunction. Allergic symptoms, such as urticaria, localized angioedema asthma, and compartment syndrome have been observed.[5-9] Anaphylactic reactions following snakebites may be IgE-mediated.[10]

The purpose of this prospective study was to review the demographic, epidemiological, and clinical and laboratory findings, as well as the treatment and outcome of 79 consecutive cases of snakebite envenomation treated in our hospital.

MATERIALS AND METHODS

Seventy-nine individuals treated at Department of Emergency Medicine, Dicle University Faculty of Medicine, from April 2003 to April 2005, for *V. ammodytes* bites were included in this study. Data were collected prospectively.

All patients exhibited evidence of envenomation. The severity of the reaction to snakebite depends on the degree of envenomation. The classification of our cases was based on a system described by Downey et al.[11] According to this system, grade 0 indicates no envenomation but swelling and erythema around the fang marks <2.5 cm; grade 1 indicates swelling and erythema of 2.5-15 cm but no systemic signs; grade 2 indicates swelling and erythema of 15-40 cm with mild systemic signs; grade 3 indicates swelling and erythema >40 cm with systemic signs; and grade 4 indicates severe systemic signs including coma and shock. The demographic and epidemiological characteristics, clinical symptoms and signs, laboratory findings, treatment, and outcome were analyzed.

Statistical analysis was performed using the χ^2 test and with Spearman's Rho correlation coefficient and stepwise regression analysis. A p-value <0.05 was considered to represent a statistically significant difference.

RESULTS

Demographic and Epidemiological Characteristics of the Victims

As expected, the snakebites showed a well-defined seasonal pattern, with all cases occurring from April through October. Most of the cases (79.0%) were noted during the summer and autumn months of June, July, August, and September. The offending snake was seen in the majority of cases (98.7%). Forty-two patients killed the snakes; 19 patients brought the dead snake to the hospitals where they first had recourse for identification.

The temperature varies from 39°C to 47°C during the summer in southeast Turkey. The largest incidence was during the warmest midday hours. The anatomical locations of the bites were the upper extremities (46.8%) (fingers and hand) and the feet (53.2%) (ankle, heel and tibia). Table 1 shows the demographic characteristics, while Table 2 shows the severity of the snakebite according to Downey et al.'s system.

Table 1. Demographic characteristics of the snakebite victims (n=79)

Gender	Male	n (%)	42 (53.16)
	Female	n (%)	37 (46.84)
Employment			
Farmers or shepherds	Male	n (%)	34 (43.04)
	Female	n (%)	35 (44.31)
Other professions	Male	n (%)	8 (10.12)
	Female	n (%)	2 (2.53)
Age	Male	Years	6-48 (24.13±11.23)*
	Female		13-51(27.11±18.12)*

*Minimum-Maximum (Mean±Standard Deviation).

Table 2. Severity of the snakebite according to Downey et al.'s system

Grade	n	%
0	7	8.86
1	37	46.83
2	27	34.18
3	6	7.59
4	2	2.60
Total	79	100

Table 3. Clinical symptoms and signs

Symptoms and signs	n	%
Local		
Fang marks	79	100.00
Pain	79	100.00
Ecchymosis	73	92.40
Swelling	66	83.54
Swelling of regional lymph nodes	34	43.03
Paresthesia	10	12.66
Swollen reactions	5	6.33
Allergic reactions	1	1.26
Systemic		
Nausea	56	70.89
Vomiting	29	36.71
Tachycardia	19	24.05
Fever	15	18.98
Hypotension	17	21.52
Fainting or dizziness	9	14.52
Blurred vision	3	3.80
Convulsions	2	2.53

Table 4. Complications and laboratory aspects of snakebite victims

	n	%
Complication		
Wound infection	31	39.24
Reduced range of motion	19	24.05
Thrombophlebitis	18	22.78
Bleeding from skin	17	21.52
Local hemorrhagic blister formation	26	32.91
Rhabdomyolysis	4	5.06
Reduced sensation	6	9.68
Acute renal failure	2	2.53
Local necrosis with tissue loss	7	8.86
Carpal tunnel syndrome	1	1.26
Compartment syndrome	6	7.60
Digit amputation	4	5.06
Laboratory findings		
Leukocytosis	72	91.14
Neutrophilia	69	87.34
Urea	26	32.91
Elevated CPK	35	44.30
Elevated PT/PTT	25	31.64
Elevated SGOT/SGPT	24	30.38
Elevated LDH	16	20.25
Hematuria/proteinuria	15	18.98
Elevated creatinine	10	12.65
Thrombocytopenia	18	22.78
Elevated bilirubin	8	10.12
Myoglobinemia	4	5.06
Myoglobinuria	3	3.80

CPK: Creatine phosphokinase; PT/PTT: Prothrombin time/partial thromboplastin time; SGOT/SGPT: Aspartate aminotransferase/alanine aminotransferase; LDH: Lactate dehydrogenase.

Clinical Symptoms, Signs and Laboratory Aspects

All patients were seen within 12 hours of the bite, either in the regional medical center or in the hospital. Table 3 shows the clinical symptoms and signs, and Table 4 shows the main complications and laboratory findings of the snakebite victims. The duration of hospitalization ranged from 1 to 18 days, with a mean duration of 3.7±2.46 days. Thirty-one patients (39.2%) were in the hospital for fewer than four days and 48 (60.8%) for more than four days.

Treatment and Outcome

On admission to the hospital, the wound was cleansed thoroughly and covered with a sterile dressing. The injured extremity was immobilized in a position at heart level. Gypsum plaster was carried out for the wounds rated class 2 and higher. The patients were confined to bed rest, not allowed to walk, and kept warm. Vital functions, size of local swelling, ecchymosis, development of systemic symptoms and signs or of delayed toxicity including coagulopathy, and estimation of urine output were noted for all patients.

Prophylaxis with tetanus toxoid and/or tetanus immune globulin at a dosage of 250 IU intramuscularly was administered at separate sites in separate syringes. All patients received supportive and symptomatic treatment, with special care in the maintenance of fluid and electrolyte balance and urine output. Analgesics, antiemetics, antiallergics, and mild sedatives were given when necessary. All patients received antibiotics (a combination of penicillin and metronidazole) in order to prevent microbial contamination because the majority of victims had made the incisions themselves in the bite area using non-sterilized knives.

Renal dialysis was not required in cases of mild acute renal failure. There were no serious coagulation disorders. No platelet transfusion or replacement with specific clotting factors or fresh whole plasma was required.

Intravenous administration of antivenin (one dose) was given to all (100%) cases before they arrived at our hospital. Thirty-two (40.5%) patients needed a second dose of administration of antivenin, while only eight (10.1%) patients needed a third. The antivenom available in Turkey does not contain antibodies for all Turkish snakes. We were unable to perform the skin testing with horse serum in all patients before administration of the antivenin in an effort to prevent the complications of antivenom (as anaphylactic reaction). Nevertheless, all patients were successfully treated and recovered completely. There were no deaths.

DISCUSSION

Snakes do not bite unless they are provoked, frightened, tightened, and bothered. Snakes have many

enemies and have several means of protecting themselves, the most effective of which is to avoid detection by camouflage. If this fails, they may resort to other methods of defense like biting, hissing and buffing in order to appear larger and fiercer than they actually are.[1]

This study shows that snakebites are, in large proportion, an occupational risk in middle-aged persons. Lack of concentration, overconfidence, lack of protective measures (e.g. not wearing gloves, boots, or long pants during outdoor activities) and working in places where snakes may be hidden are some of the causes of snakebites. In our series, 37 patients were subjected to snakebite after stepping on the snakes in rural areas. In five patients, exposure occurred while drinking from spring water.

The relatively high proportion of both male and female young adults among the patient population can be attributed to the fact that, in rural areas in southeast Turkey, both genders are employed equally in the fields, and the possibility of accidentally disturbing a snake is high. Similarly, other reports show that in other parts of the world, the most common victims are children and teenagers[12] or young adults.[13] In our study, only six patients were children (<10 years old), and all were boys.

The degree of protection afforded by responsible behavior and protective clothing is remarkable. Iserson[14] reported on the incidence of snakebites in three groups of experienced outdoor workers. Members of the Southern Arizona Rescue Association worked for 115,000 person-hours in the field without a snakebite. The personnel of the La Selva Biological Station in Costa Rica worked for 350,000 person-hours in the field without a bite. Graduate students in tropical studies, also in Costa Rica, worked for 660,000 person–hours in the fields with only one bite.

The risk of someone being bitten by a snake is small and so is the risk of dying from snakebite. Although there are an estimated 45,000 bites from all snakes in the United States each year, only 6,800 persons are treated for snake poisoning.[15] In a six-year period (1975-1980), the number of deaths from snakebites in the United States ranged from 9 to 14. Most of the deaths occurred in people who were elderly, mistreated, untreated, complicated by other serious diseases, or members of religious sects who handle serpents as part of their worship exercises and refuse medical treatment.[16] Many people bitten by snakes in rural areas in the country do not reach the hospital and may seek traditional treatment.[17]

The severity of the reaction to snakebite depends on the nature, location, depth, and number of bites, the amount of venom injected, the species and size of the snake involved, the age and size of the victim, and the victim's sensitivity to the venom.[18] Larger snakes of the same species tend to have more venom, although the larger snake may have learned to ration its venom while a smaller and younger animal may be more likely to inject the full load. Moreover, the venom is stronger when the snake awakens from hibernation. Our findings suggest that the majority of *V. ammodytes* bites in Turkey produce mild local and systemic manifestations.

In our series, the time interval between snakebite and hospital admission was 148.67±112.15 minutes, which is relatively long in comparison with other series. This time was calculated as 40.95±24.06 in one study.[2] In southeast Turkey, most victims come are from remote rural areas; roads are bad, and the victims can not always find vehicles. Thus, it is difficult for them to reach the doctor in a timely manner. Snakebite is always a hot topic, leading to an unwarranted fear of impending death and necessitating immediate medical care.

It must be pointed out that some of the presenting local signs, such as edema, redness, and ecchymosis, might be produced or deteriorate from improper or unnecessary applications, such as tied tourniquets, pressured dressings, suctions by mouth, local incisions, and the use of ice. The complications of incision and suction, especially in the hands of untrained individuals who do not know the anatomy of the body, include damage to the underlying structures, vascular compromise to the extremity and infection. The blade in a snakebite kit is of sufficient size and quality to damage underlying blood vessels, nerves, tendons, and muscles. Incisions or suctions in the area of the snakebite do not increase mortality but may increase morbidity through improper application.[13] In our study, the upper extremities of three patients were tied excessively tight. When they arrived at our hospital two hours post-bite, compartment syndrome had developed; fasciotomy was performed. Digit amputation had to be performed for four patients. The other three patients in whom compartment syndrome developed arrived to our hospital within 12 hours after snakebites.

Although rhabdomyolysis is a very rare complication in snakebites, in our series, there were four cases of mild rhabdomyolysis with favorable outcome. We attributed this complication to the direct action of the venom on the myocytes. Acute renal failure of short duration was encountered in two cases, probably due to the toxic action of the venom or secondary to dehydration due to fluid loss from vomiting. It was reported in one study that renal failure is the major cause of death after injection of many viper venoms.[1] One of the patients developed acute respiratory distress syndrome three hours following the snakebite. We attributed this complication to an IgE-mediated hypersensi-

tivity reaction to the venom and the action of tryptase or histamine on the respiratory smooth muscles.[5]

This report shows that snake venom poisoning is a medical emergency that may involve multiple organ systems of the human body in addition to the site of the bite. The course of the envenomation syndrome requires careful monitoring and clinical decision-making. Although there were no deaths in our series, we agree with others[2,19] that consultation with a physician experienced in the diagnosis and treatment of snakebites is essential. The most effective treatment is protecting ourselves from snakebites.

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