



## Our clinical experience in the treatment of snakebites

### *Yılan sokmalarının tedavisinde klinik deneyimimiz*

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**Amaç:** Bu çalışmada, zehirli yılan sokması nedeniyle başvuran olgularda uygulanan tıbbi ve cerrahi tedavilerin sonuçları değerlendirildi, güncel ilkyardım ve tedavi yöntemleri irdelendi.

**Çalışma planı:** Çalışmaya, zehirli yılan sokması nedeniyle kliniğimize başvuran 14 hasta (8 erkek, 6 kadın; ort. yaş 22; dağılım 7-75) alındı. Altı hastaya sadece tıbbi tedavi uygulandı; sekiz hasta ise tıbbi tedavi yanı sıra cerrahi tedavi gördü. Yılan sokmasına bağlı yaralanma dokuz olguda kolda, beş olguda ise bacadaydı. Ekstremitede gelişen şişlik ve etkilenen bölge adalelerinde pasif germeyle şiddetlenen ağrı saptanan yedi olguda kompartman sendromu nedeniyle fasyotomi yapıldı. Üç olguda fasyotomi alanı primer olarak kapatıldı, dört olguda lezyon yerinin erken debridmanı ve cilt grefti kullanmak gerekti. Bir olguda ise, etkilenen parmağa ilkyardım amacıyla uygulanmış olan sıkı turnikeye bağlı olarak nekroz gelişmesi üzerine, üçüncü parmak orta falankstan amputasyon uygulandı. Ortalama izlem süresi 11.5 ay (dağılım 3-30 ay) idi.

**Sonuçlar:** Fasyotomi uygulanan olguların tümünde uzun kesi izi veya konulan cilt greftiyle ilişkili geniş skar dokusu, iki olguda ise dirsekte fleksiyon kontraktürü (35 ve 105 derece) gelişti. Bir olguda görülen hemoperikard tıbbi tedaviyle iyileşti. Hastanede kalma süresi, yalnız tıbbi tedavi görenlerde ortalama 11.3 gün, tıbbi ve cerrahi tedavi uygulananlarda 18.2 gün bulundu. Hiçbir olguda geç dönemde serum hastalığı veya ölüm görülmedi.

**Çıkarımlar:** Zehirli yılan sokmalarında, bilinçli ilkyardım ve hastanede uygun tedavinin uygulanması; kompartman sendromu geliştiğinde klinik olarak ve ölçümlerle fasyotomi endikasyonunun konması gerekir.

**Anahtar sözcükler:** Antivenin/terapötik kullanım; kompartman sendromu/cerrahi; fasya/cerrahi; yılan sokması/önleme ve kontrol/cerrahi; yılan venomu/zehirlenme.

**Objectives:** We evaluated the results of medical and surgical treatment for venomous snakebites and reviewed current principles of first aid and therapy for affected patients.

**Methods:** Fourteen venomous snakebite victims (8 males, 6 females; mean age 22 years; range 7 to 75 years) were enrolled in the study. Six patients received medical treatment alone, while eight patients required both medical and surgical treatments. Injury was in the upper and lower extremities in nine and five patients, respectively. Fasciotomy was performed in seven patients due to ensuing compartment syndrome, which was manifest with extreme swelling in the affected extremity and severe pain on passive stretching of the muscles at the site of the lesion. Fasciotomy site was primarily closed in three patients, whereas four patients required debridement and skin grafting. One patient, who developed necrosis due to an excessively tight tourniquet at the time of first aid, underwent amputation of the third finger at the level of the middle phalanx. The mean follow-up was 11.5 months (range 3 to 30 months).

**Results:** Following fasciotomy, a long incision line remained in all the patients and a marked scar tissue due to skin grafting, which were associated with flexion contracture deformities in two elbows (35 and 105 degrees). Hemopericardium detected in one patient was dealt with by medical treatment. The mean length of hospital stay was 11.3 days for medically treated patients, and 18.2 days following surgical treatment. No incidence of late serum disease or mortality was encountered.

**Conclusion:** Management of snakebite victims include an appropriate first aid and treatment at the hospital; identification of compartment syndrome through clinical means and measurements should lead to an indication for fasciotomy.

**Key words:** Antivenins/therapeutic use; compartment syndromes/surgery; fascia/surgery; snake bites/prevention & control/surgery; snake venoms/poisoning.

Although some pose danger, most of the snakes are harmless.<sup>[1]</sup> Vast majority of envenomations are associated with vipers in our country. Such envenomation results in hematological disorders (nose-bleed, hematemesis, retroperitoneal or intracranial hemorrhage, severe failure in the coagulation process), neurotoxic (ptosis, weakness, paresthesia, dysphagia, sweating, respiratory depression or paralysis) and myotoxic effects.<sup>[2-4]</sup> Accidental snakebites usually result from unexpected exposure to snakes when they have no time and place to slip away. That is why camping or picnic people, and people working or living in snake-inhabitant areas are mostly exposed to danger.<sup>[5]</sup>

The present study evaluated the medical and surgical treatment methods used in patients, who presented to our emergency department for snakebites.

### Patients and method

Study included 14 patients (8 male, 6 female; mean age 22 years; range 7 to 75 years) who presented to our emergency department for snakebites between June 2001 and August 2003. Seven cases were pre-intervened with anti-snake venom by another health center. Lesion was located in the lower in five cases, and in the upper limbs in nine cases. One of the cases presented within one hour after the snakebite without any previous medical intervention. Six patients received only medical treatment in the internal disease and pediatric clinics. The venom was suctioned before their arrival to the hospital as first aid, and tourniquet was applied for immobilization.

Patients were followed up for following parameters associated with snakebites throughout the medical treatment: impaired consciousness, symptoms of neurotoxicity, abnormal ECG findings, hypotension and shock findings, homeostatic abnormalities like spontaneous bleeding and coagulopathy, and renal failures like uremia, oliguria or anuria (Table 1).

In addition to the symptomatic treatment, patients received equine-derived serum (Equinum, Institute of Immunology, Croatia) according to the grade of the envenomation shown at Table 2. Eight patients (4 male, 4 female; mean age 40.5 years; range 7 to 75 years) received medical and surgical treatment. In seven patients who underwent fasciotomy for compartment syndrome, there was no complaint of trauma or functional restriction related with the affected extremities. Mean period between the exposure to snakebite and the administration of first antiserum was 1.8 hrs (range 1 to 5 hours).

Patients who had swelling in the extremity and severe pain on passive stretching of the muscles at the affected site were diagnosed with compartment syndrome during the clinical follow-up. Based on this diagnosis, three cases underwent fasciotomy of the femur-leg-foot, and four patients fasciotomy of the hand-forearm-arm.<sup>[6,7]</sup> In one case, the third finger was amputated from the middle phalanx due to necrosis, most probably resulting from tight tourniquet applied on the envenomed finger as a first aid.

No abnormality was seen in the vital signs of the patients during the first examination. One patient, who later developed remarkable coagulopathy, was treated by blood and blood products. Eight patients who were transferred to the intensive care unit were followed up together with experts from internal diseases department. All cases received routine tetanus prophylaxis, and a wide-spectrum antibiotic treatment was initiated. Mean hospital stay was 11.3 days (range 7 to 18 days) in patients who received medical treatment, and 18.2 days (range 8 to 37 days) in those who received surgical treatment. Fasciotomy was primarily closed in three cases whereas early debridement and split thickness skin grafting procedures were performed in four cases. Mean follow-up period was 11.5 months (range 3 to 30 months) (Figure 1a-d).

**Table 1.** Laboratory evaluation for snakebites

Complete blood count*	Platelet count
Prothrombin time*	Liver function tests
Partial thromboplastin time*	Bilirubin
Fibrinogen*	Creatinine kinase
Fibrin degradation products*	Creatinine
Blood type and cross match	Urinalysis**
Serum electrolytes	Stool hemocult
Glucose	ECG***
Blood urea nitrogen	Arterial blood gas****

\*should be performed as soon as possible and repeated within 12 hours

\*\*including hemoglobin and myoglobin

\*\*\*for patients older than 50 years, and those with a history of heart disease

\*\*\*\*if there is any sign of respiratory disorder

**Table 2.** Grading for envenomation

Grade	Envenomation	Sign and symptoms	Dose of antivenin
0	N/A	N/A	None
1	Mild	Mild or moderate pain; edema 10-13 cm at lesion within first 12 hours after the incident; no systemic signs of envenomation	4 to 5 vials
2	Moderate to severe	No laboratory abnormalities; severe pain; edema 15-30 cm at lesion within first 12 hours after the incident; nausea, vomiting, diplopia; perioral paresthesia and other symptoms	10 to 15 vials
3	Severe to very severe	Laboratory abnormalities; very severe pain; edema rapidly extending to trunk; severe systemic signs; severe laboratory abnormalities	15 to 20 vials

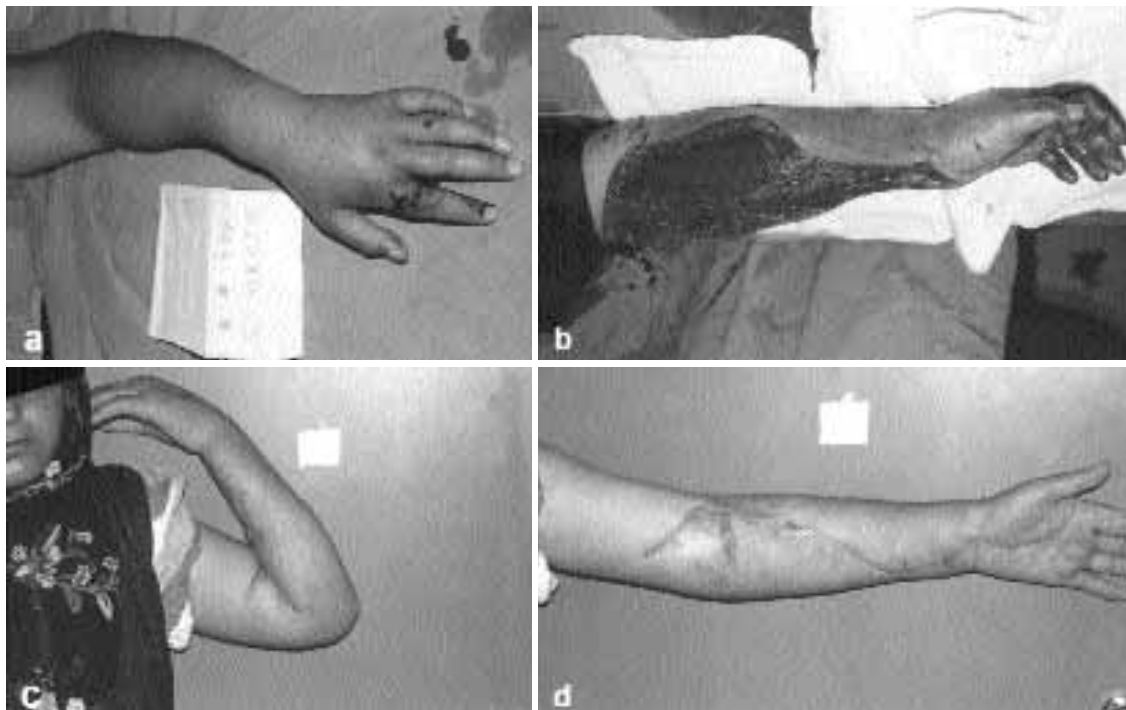
## Results

Out of two patients who underwent fasciotomy, one developed flexion contracture of 35°, and the other, of 105°. Soft tissue release surgery was performed in the latter in order to open the contracture. [8] A large evidence of incision or a thick scar tissue associated with the skin graft used was developed at the lesion in all patients, who underwent fasciotomy. Mild hemopericardia developing against the anti-serum as a reaction in one case was managed by supportive treatment. Excessive coagulopathy experienced in another case was treated by blood and

blood products. Amputation was performed in one patient, who developed finger necrosis because of the prevention of arterial flow by tourniquet applied after the snakebite. None of the cases developed a late serum sickness, and none of them died.

## Discussion

It has been reported that only ten out of 40 indigenous species in Turkey are venomous.<sup>[1-2]</sup> In case of snakebites, first thing to do should be preventing the patient's panic for fear of death. Excessive actions of the patient in panic will cause faster expansion of the venom into the systemic cir-



**Figure 1.** (a) Lesion and edema associated with snakebite in the forefinger of the left hand of a twenty year old female patient. (b) Appearance of the arm after fasciotomy (c, d) Functional views of the patient at postoperative month 3.

**Table 3.** Indications for treatment by antivenin

- 
- Impaired consciousness
  - Neurotoxicity
  - Abnormal ECG; hypotension and shock
  - Hematological abnormalities (spontaneous systemic hemorrhage and coagulopathy)
  - Generalized rhabdomyolysis
  - Evidence of severe intravascular hemolysis
  - Evidence of renal failure like uremia, oliguria or anuria
- 

culatation and clinical presentation to get worse. At present, incision of the lesion and use of local ice packs are not encouraged as a firstline intervention in snakebites; furthermore, alcohol, sedatives, aspirin or non-steroid anti-inflammatory drugs are not recommended since they can mask the signs of envenomation.<sup>[5,9-11]</sup>

Snakebites frequently occur in the extremities. It was found that snake toxins often disperse through lymphatic circulation. Therefore, in order to prevent dispersion of the toxin, compression should be applied by 50 to 10 cm elastic bandages instead of using tight bandages blocking the arterial circulation, and the extremity should be immobilized.<sup>[5,11-15]</sup> One of our patients developed necrosis at the distal of the tourniquet since the arterial flow of the finger was retarded.

Routine laboratory evaluations that must be carried out upon admittance to the hospital following the snakebites are summarized in Table 1.<sup>[11]</sup> Treatment should be planned depending on the grade of envenomation determined by laboratory evaluation and degree of edema developed in the affected extremity (Table 2).<sup>[10]</sup> Gold et al.<sup>[16]</sup> defined the indications for treatment by antivenin in snakebites (Table 3). It has been suggested that in case of snakebites, first intervention carried out for circulatory and respiratory problems should be followed by routine tetanus prophylaxy while equine-derived serum should be administered in case of systemic envenomation.<sup>[10,14,16,17]</sup> It also has been suggested that wide spectrum antibiotics should be routinely used in snakebites<sup>[9,10]</sup> However, numerous clinical studies suggested that hygienic wound care is sufficient, and routine antibiotic use is not required.<sup>[18-20]</sup>

At present, surgical treatment is occasionally used since antivenin is much more frequently

**Table 4.** Precautions in avoiding snakebites

- 
- Keep hands and feet out of areas you can't see.
  - Don't pick up rocks or firewood. First move it by a stick or by foot if your leg and ankle has well protection against any snake strike.
  - Leave the snakes alone.
  - Do not set up your sleeping bag near rocks or entrance of caves.
  - Sit down after you look carefully on the ground.
  - Do not set fire after dark.
  - While overstepping a log, firstly step on the log instead of passing thru the other side.
  - Do not enter snake-inhabitant areas without well protection.
  - Do not try to touch a recently killed venomous snake.
  - Do not crawl among tall grasses.
  - Do not run over it when you see a snake.
  - Do not panic when you see a snake.
- 

administered both due to developments in the first aid and emergency services and lesser adverse effects. However, we had to perform fasciotomy in eight of 14 cases hospitalized in the services of internal diseases and pediatrics for snakebites due to the compartment syndrome.

Rashes progressing from the lesion in the skin toward the proximal decreased after the fasciotomy, and clinical parameters improved in all cases. As surgical complications, two patients had limited motion range of the elbow; and all cases had scar tissue associated with incision. Indication for fasciotomy was based only on the clinical observations and

**Table 5.** Common mistakes in the treatment for snakebits

- 
- Insufficient antivenin administration, particularly in children.
  - Exclusion of envenomation in cases presenting with dusky, and swollen extremities in the absence of an exact etiology (e.g. in children).
  - Improper administration of antivenin, i.e. intramuscular or direct administration on the lesion.
  - Unnecessary skin test, i.e. when there is no intention to administer antivenin.
  - Improper use of tourniquet and cryotherapy.
  - Failure to provide thorough irrigation of fang puncture wounds.
  - Surgical intervention (fasciotomy) without demonstrating elevated intracompartmental pressure.
-

examinations (increased swelling and pain in the affected extremity; severe pain in the passive muscle stretching tests). Some studies suggested that fasciotomy should be indicated when the intracompartmental pressure rises up to 30-45 mm Hg.<sup>[10,12,17,21]</sup>

Furthermore, recent clinic and experimental studies reported better outcomes with aggressive treatment by antivenin when the results of envenomation after the snakebites were compared; and fasciotomy and debridement were indicated for those who are irresponsive to this treatment and developing compartment syndrome and myonecrosis.<sup>[22-24]</sup>

Treatment of cases bitten by snakes should be locally initiated, and maintained at the hospital by a multidisciplinary approach including experts from internal diseases, pediatrics, orthopedics an traumatology, and infection services. People should be acquainted with precautions to avoid snakebites (Table 4).<sup>[25]</sup> Also, it has been emphasized that health professionals who are not experienced enough in treating the patients exposed to snakebites may lead to complications, resulting in morbidity (Table 5).<sup>[10]</sup>

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