

COMPARTMENT SYNDROME IN A CHILD FOLLOWING SNAKEBITE

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ABSTRACT

Compartment syndrome is a rare complication of snakebite. In this article, we report a seven-year-old girl with compartment syndrome resulting from a viper envenomation. Only ten vials of antivenin were used due to inavailability. Despite aggressive medical treatment except for insufficient dose of antivenom administration, her clinical situation

continued to worsen, and she required a fasciotomy. In conclusion, prompt institution of adequate antivenin treatment is imperative in snakebite cases. However, fasciotomy should be kept in mind in compartment syndrome related with snakebite, which does not respond to medical therapy.

• **Key Words:** Snakebite, compartment syndrome, antivenom, fasciotomy *Nobel Med 2010; 6(3): 108-111*

BİR ÇOCUK OLGUDA YILAN ISIRMASI SONRASI GELİŞEN KOMPARTİMAN SENDROMU

ÖZET

Kompartıman sendromu, yılan ısırmasının nadir bir komplikasyonudur. Bu yazıda, engerek yılanı ısırığı sonrası kompartıman sendromu gelişen yedi yaşındaki kız olguyu sunmak istedik. Yılan antiserumu yeterli miktarda temin edilemediğinden, olguya yalnızca 10 flakon verilebilmiştir. Yetersiz antiserum dışındaki diğer tüm destek

tedavilerinin uygulanmasına karşın hastanın klinik durumu kötüleşmiş olup fasiyotomi yapılmak zorunda kalmıştır. Sonuç olarak, yılan ısırıklarında uygun dozda antiserumun öncelikli olarak uygulanması zorunludur. Bununla birlikte tıbbi tedaviye yanıt vermeyen yılan ısırığına bağlı kompartıman sendromunda, fasiyotomi seçeneği de akılda tutulmalıdır.

• **Anahtar Kelimeler:** Yılan ısırığı, kompartıman sendromu, yılan antiserumu, fasiyotomi. *Nobel Med 2010; 6(3): 108-111*

INTRODUCTION

Most of the venomous snakes in Turkey are members of *Viperidae* family.¹ The venom of the *Viperidae* family mainly causes local and hematotoxic effects. Envenomation by a viper usually results in marked pain, limb swelling, and local tissue necrosis. In the majority of cases, vipers inject their venom into subcutaneous tissues. However, in rare cases, the fangs penetrate into the fascia, resulting in development of compartment syndrome. Although the mainstay of treatment for viperidae envenomations is antivenom, the surgical treatment of envenomations complicated by compartment syndrome is very rarely indicated.²⁻⁴

In this paper, we report a severe viper envenomation in a child who required fasciotomy due to inadequate antivenin treatment.

CASE REPORT

A seven-year-old female patient was admitted to the emergency department (ED) three hours after she had been bitten on the distal part of her right forearm by a snake. Her relatives had produced a laceration with a knife near the fang marks while giving her “traditional” first aid. Initial evaluation at the ED revealed two punctures and a laceration over the middle of the anterior surface of the right forearm. There was a marked edema with tenderness, pallor and partial bruising from her fingers through her elbow (Figure 1). The distal pulses were not palpable and sensation on bitten extremity was decreased. Active and passive motion of the fingers exacerbated the pain. At the time of presentation, Glasgow coma score was 13/15. She had a body temperature of 36°C, a heart rate of 160 beats per minute, a systolic blood pressure of 45 mmHg, and her diastolic blood pressure could not be determined. Capillary refill was delayed. The severity of envenomation was graded as three.² We recognized the killed snake as *Vipera xanthina* (Figure 2). On admission, after venous access was established, 20 mL per kg of 0.9% normal saline was infused as rapidly as possible. Tetanus prophylaxis was administered, and the wound was treated with local cleansing. Laboratory values were as follows: hemoglobin: 14.2 g/dL, white blood cells: 24 000 / μ L, platelets: 91 000 / μ L, glucose: 200 mg/dL, blood urea: 31 mg/dL, creatinine: 0.4 mg/dL, sodium: 142 mEq/L, potassium: 3.5 mEq/L, chloride: 106 mEq/L, alanine aminotransferase: 12 U/L, and creatinine kinase: 1027 U/L (N: 5-130 U/L). Coagulation studies disclosed prothrombin time 26.4 sec (N: 10.8-13.9 sec), international normalized ratio 2.44 (N: 0.64-1.17), activated partial thromboplastin time 44 sec (N: 26.6-40.3 sec), fibrinogen 100 mg/dL (N: 200-400 mg/dL), and D-dimer 582 μ g/L (N: 68-494 μ g/L). Her urinalysis was unremarkable and



Figure 1. Marked edema and partial bruising of the bitten limb



Figure 2. The photograph of the killed snake: *Vipera Xanthina*

electrocardiogram revealed sinus tachycardia. The child remained hypotensive after the initial fluid challenge; an additional 40 mL per kg was infused. Administration of fluids and dopamine (increased up to 20 μ g/kg/min) had no effect. The hypotension was reversed by intravenous adrenaline infusion (0.4 μ g/kg/min) 6 hours after the bite. Intravenous fluid support (3000 mL/m²/d, 2 days) and antibiotic treatment (ampicillin/sulbactam 100 mg/kg/d and metronidazole 30 mg/kg/d, 10 days) were initiated. Four hours after the bite, infusion of a ten-vial antivenin was instituted. Although we decided to administer more antivenin, the agent was not available locally. Thus, antivenin treatment was ended one hour later. The swelling extended up to her right shoulder and the pain in her forearm became increasingly severe. The tips of her right fingers were not perfused and the pulses on her right forearm were not palpable. Unfortunately, the intra compartment pressure (ICP) was not measured due to lack of equipment. A diagnosis of compartment syndrome associated with snakebite was made based on the aforementioned clinical findings (pain on passive stretching, pulselessness, pallor and paresthesia). At this point, the consulting orthopedic surgeon recommended urgent fasciotomy. After she received fresh frozen plasma (FFP) and platelet transfusion, fasciotomy was performed. Postoperatively, →

perfusion of fingers and distal pulses recovered. Treatment of FFP (3 x 1 unit per day) was continued for 3 days. We administered a total of 2 units of packed red cells on days 2 and 4 for anemia due to blood loss from the wound site. On the 6th day, all laboratory tests were normal. She was discharged on the 15th day of hospitalization without sequelae.

DISCUSSION

Snake venom shows various effects. It may cause pain and edema at the bitten side, and life-threatening disorders such as bleeding, coagulation disorders, renal failure, and shock.⁵ The mortality rate is kept low by appropriate first aid and an effective treatment.⁶ Therapy is based on the clinician's overall grading of venom toxicity. Local and systemic manifestations, as well as laboratory findings, weight heavily in this judgment. Severity of envenomation is commonly graded on a four-point scale (0 to 3).^{1,7} Severe envenomation is characterized by noteworthy local (entire extremity involvement) and systemic (hypotension, shock, bleeding diathesis, respiratory distress) clinical signs, and laboratory abnormalities (significant anemia, prolonged clotting time, metabolic acidosis).^{1,2,7} In this case, it was graded as severe (grade 3) due to existence of shock, severe and progressive local findings on entire extremity, and prolonged clotting time.

Compartment syndrome rarely develops in an affected limb after a deep muscular injection of venom. Animal studies have shown that intramuscularly deposited venom causes release of tissue fluids into the compartment, resulting in elevated pressures.^{1,4,8,9} Local reaction to envenomation on an extremity may mimic compartment syndrome.^{4,8} In our case there were noteworthy clinical signs of compartment syndrome as pulselessness, paresthesia, pallor, severe pain and pain on passive stretching. In medical practice, simultaneous presence of these findings strongly supports the diagnosis of compartment syndrome.¹⁰ It has been reported that the measurement of ICP is only necessary when the clinical signs of compartment syndrome are unclear, in an unconscious patient, in a young child, or when the clinical symptoms and signs are equivocal. Therefore, it is not recommended if the diagnosis is clinically evident.¹¹⁻¹⁵ Additionally, many hospitals in the world, even in developed countries, do not have equipment for

the measurement of ICP.¹¹ Although the intracompartmental pressure was not measured in our case, the local signs on the limb progressed markedly despite the low dose antivenin therapy.

Generally, fasciotomy is rarely indicated in snakebites but should be considered as soon as clinically significant pressures are suspected despite the use of antivenin, and such supportive therapies as mannitol and hyperbaric oxygen. This strategy may help prevent the development of unwanted complications including loss of an extremity because prevention of muscle necrosis is time-dependent when perfusion is compromised. However, fasciotomy has got some important disadvantages. It may result in disfiguring scars, contractures, and nerve damage, significantly lengthening the course of treatment, and is frequently associated with permanent loss of limb function.^{1,3,4,14,16} Aggressive use of antivenin has safely prevented the need for surgery in envenomated patients.⁸

According to the guidelines, we should have started the antivenin treatment with a minimum of fifteen vials,^{2,7} but, unfortunately, we were able to give only ten vials totally due to inavailability. The antivenins in Turkey are imported from other countries, and sometimes they can not be found in medical centers.¹⁷ This inadequate antivenin treatment might have worsened the local clinical signs on the bitten forearm of our case. We performed urgent fasciotomy, uneventfully. It is likely that the performance of fasciotomy in our patient prevented the loss of her extremity.

This report describes the use of fasciotomy for compartment syndrome secondary to *Viperidae* envenomation. Although antivenin treatment is essential in severe envenomations, sufficient dose of antivenin treatment could not be used in this case due to inavailability. The lack of sufficient dose of antivenin limited the appropriate therapy protocol and led us to perform fasciotomy in the clinical compartment syndrome ground. In conclusion, we strongly recommend prompt institution of adequate antivenin treatment in the presence of clinical signs of compartment syndrome due to *Viperidae* envenomation. On the other hand, fasciotomy should be kept in mind for snakebite patients with progressive clinical signs of compartment syndrome in the absence of sufficient antivenin.

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REFERENCES

- 1 Ozay G, Bosnak M, Ece A, et al. Clinical characteristics of children with snakebite poisoning and management of complications in the pediatric intensive care unit. *Pediatr Int* 2005; 47: 669-675.
- 2 Bush SP. Bites and stings. In: Fuhrman BP, Zimmerman JJ (Eds). *Pediatric Critical Care* 3th ed. Philadelphia, Mosby 2006; 1532-1543.
- 3 Warrell DA. Treatment of bites by adders and exotic venomous snakes. *BMJ* 2005; 331: 1244-1247.
- 4 Gold BS, Barish RA, Dart RC, et al. Resolution of compartment

- syndrome after rattlesnake envenomation utilizing non-invasive measures. *J Emerg Med* 2003; 24: 285-288.
- 5 Juckett G, Hancox JG. Venomous snakebites in the United States: management review and update. *Am Fam Physician* 2002; 65: 1367-1374.
 - 6 Açıkalin A, Gökel Y, Kuvandık G, et al. The efficacy of low-dose antivenom therapy on morbidity and mortality in snakebite cases. *Am J Emerg Med* 2008; 26: 402-407.
 - 7 Hodge III D, Tecklenburg FW. Bites and stings. In: Fleisher GR, Ludwig S, Henretig FM (Eds). *Pediatric Emergency Medicine* 5th ed. Philadelphia, Lippincott, 2006; 1045-1065.
 - 8 Shaw BA, Hosalkar HS. Rattlesnake bites in children: antivenin treatment and surgical indications. *J Bone Joint Surg* 2002; 84: 1624-1629.
 - 9 Frangides CY, Koulouras V, Kouni SN, et al. Snake venom poisoning in Greece. experiences with 147 cases. *Eur J Int Med* 2006; 17: 24-27.
 - 10 Ulmer T. The clinical diagnosis of compartment syndrome of the lower leg: are clinical findings predictive of the disorder? *J Orthop Trauma* 2002; 16: 572-577.
 - 11 Tiwari A, Haq AI, Myint F, et al. Acute compartment syndromes. *Br J Surg* 2002; 89: 397-412.
 - 12 Köstler W, Strohm PC, Südkamp NP. Acute compartment syndrome of the limb. *Injury* 2004; 35: 1221-1227.
 - 13 Gourgiotis S, Villias C, Germanos S, et al. Acute limb compartment syndrome: a review. *J Surg Educ* 2007; 64: 178-186.
 - 14 Cawrse NH, Inglefield CJ, Hayes C, et al. A snake in the clinical grass: late compartment syndrome in a child bitten by an adder. *Br J Plast Surg* 2002; 55: 434-435.
 - 15 Satar S, Karcıoğlu O, Sebe A. An unusual localization of snakebite treated without antivenin. *Mt Sinai J Med* 2005; 72: 116-119.
 - 16 Söker M, Haspolat K. Türkiye'nin Güneydoğu Anadolu Bölgesinde çocuklarda yılan ısırması: 52 vaka nedeniyle. *Gülhane Tıp Dergisi* 1999; 41: 331-337.
 - 17 Köse R. The management of snake envenomation: evaluation of twenty-one snakebite cases. *Turk J Trauma Emerg Surg* 2007; 13: 307-312.