**Mediterranean Journal of Emergency Medicine**
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MJEM
Mediterranean Journal of Emergency Medicine

# Snakebite in Lebanon: The painful reality

Citation: Jabbour E. Snakebite in Lebanon: The painful reality. Med Emergency, MJEM 2020; 28:64-8.
DOI: 10.26738/MJEM.2017/MJEM28.2020/CT.CEE.060520
**Key words:** antivenom, emergencies, emergency department, Lebanon, Middle East, snake, species

## ABSTRACT

Unfortunately, snakes remain a nightmare for the villagers in Lebanon. Ninety percent of snakebites are non-venomous, and snakes are not aggressive and do not bite unless provoked. Among the 25 species that were observed in Lebanon, only three were identified as venomous snakes: vipera palaestinae, vipera lebetina and vipera bornmuelleri. The objectives of this article are to present the types of Lebanese snake species, and to provide a guide for management in the emergency department and the indications for antivenom use. Finally, we will present common misconceptions and the Lebanese situation concerning antivenom availability.

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## Article history / info:

Category: Continuous education
Received: Nov. 27, 2019
Revised: Jan. 22, 2020
Accepted: May 06, 2020

## Conflict of interest statement:

There is no conflict of interest to declare

## INTRODUCTION

Snakebites account for at least 421,000 envenoming and 20,000 deaths worldwide [1]. Yet, the Lebanese mortality rate from snakebite remains unknown because of underreporting, not to mention the lack of formal education and preventive measures for the population at risk. In addition, snakebite is a medical emergency that remains a nightmare for the victim but also to the emergency physician due to lack of access to the antivenom.

Ninety percent of snakebites are non-venomous, and snakes are not aggressive and do not bite unless provoked. Among the 25 species that were observed in Lebanon, only three were identified as venomous snakes: vipera palaestinae, vipera lebetina and vipera bornmuelleri [2]. The scarcity of literature is a major problem to the Lebanese physicians and victims. In an effort to circumvent this problem, this review will gather the published data in our region and extrapolate international data to address the conflicts we are facing. The objectives of this article are to provide Lebanese physicians a detailed description of the endemic snakes in our area, the type of the venom they produce and its impact on the human body, in addition to a management guide for application in the emergency department.

## METHODOLOGY

An extensive review of literature was done using various combinations of terms: "Envenoming", "Lebanon", "Middle East", "Snake", "Snakebite", "Venom" and "Vipera". Articles were searched in three languages: Arabic, English and French. Going back to 1946 until September 2018, research also drew on citation tracking of original articles. Twenty-seven articles were retrieved. The review also drew on the Ministry of Health and snakebite experts who were contacted by phone and e-mail for unpublished information on snakebites. Six hospitals were contacted to check on antivenom availability and usage: three in Beirut (Beirut Governmental Hospital Quarantine, Beirut Governmental University Hospital, and Lebanese American University Medical Center-Rizk Hospital), one in Beqaa

(Beqaa Governmental Hospital), one in North Lebanon (Tripoli Governmental Hospital), and one in South Lebanon (Marjayoun). The management guide was retrieved from the international guidelines (Asia [3-5], Australia [6], and Europe [7]) and the few articles done in the Arabic region.

## LEBANESE VENOMOUS SNAKES

**Figure 1:** Vipera palaestinae (known in Arabic as "okdet al jawz") [8]

Vipera palaestina is endemic to the Middle East **(Figure 1)**. It can reach up to 130 cm, has a V-shaped head and a brown zigzag band on the back [9]. The venom contains neurotoxins, procoagulants and haemorrhagins with clinical symptoms ranging from local damage to shock [10].


**Figure 2:** Vipera lebetina (known in Arabic as "barshaa") [11]
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Common names for this viper include: blunt-nosed viper, Lebetine viper, Levant viper, Levantine viper. This is a large snake, reaching around 150 cm (59.1 inches) in total length. Its head is broad and triangular [4]. It is located in four areas in Lebanon: Tripoli, Beirut, Saida and at the Lebanese borders with Israel (area of Lake Hula) [12]. It is an endangered viper **(Figure 2)**. It causes blood clotting or bleeding through the presence of pro- and anticoagulants in its venom [13]. First described in 1938 by Werner, it is endemic to the Lebanese mountains with high altitudes above 1800 m; it has been reported in Bcharre, Oyoun el siman, and Mont hermon [14]. This snake is smaller than the two

**Figure 3:** Vipera bornmuelleri (known in Arabic as "af'aa Al Jabal") [14]
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viper species previously described, with a maximum lengthof 55 cm and unlike them, it rarely overlaps with human habitation. It was listed in 2006 as endangered by the International Union for Conservation of Nature **(Figure 3)**. Envenoming with this snake perturbs the coagulation cascade, leading to disturbance of tissue repair and fatal bleeding but also clotting from pro-coagulant effect is possible [15].

## STUDIES TO BE DONE UPON PATIENT'S PRESENTATION TO THE EMERGENCY DEPARTMENT

Upon arrival to the emergency department (ED), blood should be withdrawn to search for end-organ damage **(Table 1)**. The following test should be done initially:

- Coagulopathy: complete blood count, fibrinogen level, prothrombin time (PT)/International normalized ratio (INR) and activated partial thromboplastin time (aPTT).

- Renal failure and rhabdomyolysis: rapid urine dipstick for blood, urine for myoglobin, urinalysis, serum creatine kinase, serum electrolytes, calcium, phosphate, uric acid, blood urea nitrogen, creatinine and 12-lead electrocardiogram.

## MANAGEMENT IN THE FIELD

The injured part should be immobilized in a functional position, to limit venom absorption. If the venomous snakebite is by viperalebetina, where local toxicity is a concern, the bite wound should be placed at the level of the heart to decrease local swelling. However, in the setting of Vipera palaestinae and Vipera bornmuelleri envenomation, where systemic toxicity is a concern, the bite wound should be kept below the level of the heart to slow the systemic absorption. Envenomation is defined as the combination of a snakebite and the evidence of tissue injury.

Pressure immobilization with an elastic bandage should not be used with bites by Vipera lebetina, because it worsens tissue damage [16]. However, its use is supported for the other two vipers especially if transport to a medical care is delayed, even though it lacks evidence that it helps [17]. Antivenom, if indicated, should be given prior to removing the pressure immobilization.

Few methods must be avoided, like sucking the wound, which increases the risk of infection without removing the poison. In fact, a study done with a mechanical suction device showed that suction reduced the total body venom burden by only 2% [18]. In addition, applying a tourniquet may damageunderlying tissues. Other misconceptions are cryotherapy and electric shock therapy. If possible, it is preferred to take a picture of the culprit snake or bring it for identification; however, the head should not be manipulated since even dead vipers can bite through the persistence of their bite reflex [19].

## ED MANAGEMENT

### a. Airway compromise

In case of respiratory failure, intubation should be done with caution because of the risk of bleed and proper sedation should be given during rapid sequence intubation. Among the three venomous snakes discussed, viperalebetina can cause paralysis; therefore, during rapid sequence intubation, giving paralytics may mask the clinical picture. It should be given on a case-by-case basis. Furthermore, oxygen therapy in such cases of neurotoxicity may impair detection of respiratory failure and should be used with caution.

### b. Shock

Vipera palaestinae and Vipera bornmuelleri can cause hemorrhagic shock from disturbance in coagulopathy and vasodilation. Therefore, fluid resuscitation is essential, followed by blood products and vasopressors if shock persists. We should not rely on coagulative studies if proper antivenom was given because they lag behind the clinical improvement and may take many hours to correct [19].

### c. Asymptomatic bite

As we discussed earlier, the majority of Lebanese snakes do not result in envenomation. These cases should be monitored closely. In view of the coagulative disturbances as a major cause of envenomation, observation should be at least for 12 hours and up to 24 hours [19].

Local necrosis may mimic compartment syndrome. Hence, fasciotomies should only be performed after checking the intracompartmental pressure especially when coagulopathy is a concern.

Tetanus prophylaxis should be provided in the absence of coagulation abnormalities. Prophylactic antibiotics are not needed. The wound should be checked for signs of infection twice daily.

### d. Antivenom

Antivenoms are produced by immunizing animals, usually horses, to the venom. There are two types of antivenoms: Monovalent, targeting a single species, and polyvalent, raised against multiples species that share a geographic region. Antivenom is indicated when the patient starts to show signs of systemic envenomation, involving organs and tissues away from the part of the body that has been bitten (summarized in **Table 1**) or if there is rapid extension of the bitten lesion [19].

For some patients, the administration of antivenom may be lifesaving. The earlier the administration better is the outcome. Although delaying its administration decreases its effectiveness, it is better than not giving it; therefore, there is no timeframe for its administration [7].

**Table 1:** Systemic findings.

| Type of injury | Manifestations |
|---|---|
| Neuromuscular | Ptosis<br>Diplopia<br>Dysphagia<br>Bulbar palsy<br>Dyspnea<br>Limb weakness |
| Coagulopathy | Bleeding<br>Thrombosis |
| Shock | Hypotension and hypovolemic shock<br>cardiac toxicity and cardiogenic shock<br>septic shock |
| Rhabdomyolysis | Kidney injury<br>Brown or red urine<br>Oliguria |

The main issue with antivenom administration is the risk of adverse reactions, especially anaphylaxis. That is why it is preferable to give it through a slow intramuscular (first, and at five to ten minutes if necessary) or intravenous infusion in order to stop the infusion if symptoms of anaphylaxis occur [20]. Other less preferable options are intra-osseous infusion or by aerosol (in case of respiratory signs). The rate of anaphylactic reaction can reach up to 80% with some antivenoms; therefore, it is important to have the resuscitation equipment near the patient and especially epinephrine. The dosage varies with type of the product but the dose is the same for pediatric or adult victims since the dose of the venom injected is the same irrespective of the age. The minimum dose is one vial [1]. We should expect bleeding to stop after around 20 minutes and coagulopathy to reverse within six hours. Hypotension and cardiotoxicity should be expected to reverse after 30 minutes [5]. In contrast, antivenoms were not proven to restore tissue damage (neurotoxicity, respiratory failure, etc.) even though their efficacy in stabilizing cardiovascular hemodynamics is well established [21]. We should think about inadequate dosage of antivenom if there is no clinical improvement after few hours.Patients should be monitored in the intensive care unit [22]. Please refer to the table below for a summary on the management of snakebite (**Table 2**).

## ANTIVENOM'S AVAILABILITY IN LEBANON

Ten million vials of antivenins are needed annually worldwide, which goes well below the capacity of production [5].

In fact, delayed antivenom administration is associated with an increased risk of complications [23]. Antivenom used to be supplied by Syria and Iran; however after the war in the last few years, Europe started to supply it. In a retrospective Lebanese study done from 2000 till 2014 where 24 victims were included, nine patients (37,5%) received a polyvalent antivenom manufactured in Syria [2]. It is interesting to note that the antivenom may remain potent for few weeks after the expiry date. It is better to use expired product than not using any if we face severe envenomation, however we should check that the expired liquid is not opaque and does not show precipitants, otherwise we will have increased risk of adverse effects [17].

One of the public hospitals that we contacted during our research revealed the presence of only expired antivenoms in its store. Dispensing the antivenom by the Ministry of Health is restricted to very few hospitals for fear of over usage; however, it is crucial to have access to this antivenom as soon as possible in order to reduce the risk of complications. Furthermore, the antivenom, which is sometimes imported from Saudi Arabia, does not neutralize the toxic effect of our three viper species as per the manufacturer, which exacerbates the problematic of availability [24]. Nowadays, the Ministry of Health provides the antivenom on a regularly basis to the public hospitals. The private hospitals have the choice whether or not to buy the antivenom from the Mediterranean Pharmaceutical Company (MPC pharma), the only pharmaceutical company selling the antivenom at the time of this review, under the name of "anti-snake" and its cost is around 175 Lebanese pounds. In case of emergency, the public hospitals are not allowed to sale their products to the hospital in need, so the patient must be transferred to them to have access to the antivenom since the pharmaceutical company is available only on working hours.

## CONTROL AND PREVENTION

In Lebanon, we lack strategies to control snakebites and to educate the population at risk. We also lack strategies to control the proliferation of snakes in domestic areas. Farmers should be educated about first aid methods. They need to know the importance of avoiding walking barefoot, sleeping on the ground and keeping firewood, which attract the snakes.

Furthermore, ensuring rapid transport of the victim to a center that possesses the antivenom is crucial to decrease the rate of fatal outcome.

## CONCLUSION

It is clear that we face a dramatic health problem in antivenom availability, in addition to a lack of education and support to the population at risk. This article aims to present a review on the available data on Lebanese snakebites and to shed the light on this crisis, which has been neglected for a long time.

**Table 2:** Management of snakebite injury.

| |
|---|
| **First aid** |
| Immobilize the injured part and avoid its movement |
| Apply a firm bandage |
| **Airway** |
| Immediate intubation if evidence of impending airway using the appropriate sedation. Use of paralytics should be assessed on a case by case basis |
| In case of anaphylaxis, Epinephrine 0.3 to 0.5 mg (adult) intramuscularly, preferably in the mid-outer thigh (to renew once after five to ten minutes) |
| **Circulation** |
| Establish intra-veinous (IV), or intra-osseous access |
| Treat hypotension with rapid infusion of one to two liters IV isotonic fluids. In case of no response to fluids, begin vasoactive drugs as per septic shock guidelines |
| Monitor fluid balance and vital signs continuously |
| **Coagulopathy** |
| Address coagulopathy with blood, fresh frozen plasma or platelets in case of life-threatening bleeding |
| **Wound care** |
| Wound dressing. The wound should be checked twice daily for signs of infection |
| Fasciotomy in case of confirmed compartment syndrome after treating coagulopathy |
| Tetanus prophylaxis |
| **Antivenom:** in case of systemic symptoms or rapidly evolving symptoms |
| Intravenous slow infusion (intramuscular or intraosseous less preferable) |
| Same dose for adults and pediatrics (dose varies according to the product) |

## LIMITATIONS

In our review, we tried to concentrate on our Lebanese data and reflect international studies on our local species. However, because there are no reliable data on the numbers of snakebites and deaths from the rural tropics, the true regional and global numbers of these events may differ substantially from the estimates presented here.

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