



CAUTIONARY TALE

A snake in the clinical grass: late compartment syndrome in a child bitten by an adder

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SUMMARY. Snakebite envenomation is an uncommon condition in the UK, but requires vigilance with regard to both the systemic effects of the venom and the locoregional impact on the soft tissues. We describe a case requiring delayed fasciotomies for closed compartment syndrome of the leg and thigh, and discuss in detail the controversies surrounding decompression in such a case. Adder bites are uncommon in the UK, but can result in envenomation of varying severity. Apart from the numerous possible systemic effects that require attention, there are local effects that, very rarely, can be limb threatening. Of these, elevated limb compartment pressures are of paramount importance, and recognition of closed compartment ischaemia is vital if the limb is to be saved by surgical decompression. Guidelines on threshold compartment pressures and fasciotomies are indistinct regarding snakebite, with diagnostic emphasis still placed on clinical signs and symptoms. In the paediatric setting, measurement of compartment pressures is a valuable adjunct to clinical suspicion in the diagnosis of acute compartment syndrome secondary to snakebite. © 2002 The British Association of Plastic Surgeons

Keywords: snakebite, envenomation, compartment syndrome, fasciotomy.

Case report

A 10-year-old girl presented with a painful left ankle, having sustained an adder bite 4 cm superior to the medial malleolus whilst walking on Dartmoor. The leg was immobilised and venous compression bandages applied at a primary-care centre. There were no systemic symptoms, and biochemical and haematological parameters were normal, apart from a slightly abnormal APTR of 0.79 and fibrinogen of 2.8 g l^{-1} . She was previously fit and well with no past medical history of note and no allergies; she was taking no regular medication.

After 24 h the leg had become oedematous, erythematous and tender. This extended to above the knee. There was minimal pain only on passive flexion and extension of the toes. Using a Stryker intracompartmental pressure measuring device, the anterior and posterior compartment pressures were both found to be 30 mmHg (normal range: 0–9 mmHg). These reduced to 20–23 mmHg after elevation for 12 h, and to 7 mmHg (anterior) and 14 mmHg (posterior) by 24 h, in conjunction with clinical improvement. The difference between the compartment pressure and the diastolic blood pressure was always greater than 30 mmHg. There was no distal neurovascular deficit.

After 3 days, further proximal extension of the oedema and ecchymosis into the thigh (Fig. 1), increasing pain and a creatine phosphokinase level of more than 3200 IU l^{-1} prompted us to administer antivenom and perform fasciotomies of the lower leg and thigh. At surgery, haemorrhagic fat and fascia were found around the puncture site and tense fascia was found in the thigh, but, importantly, the underlying muscle appeared healthy.

The wounds were left open for 6 days and then closed. Cultures from all swabs taken intraoperatively were sterile. The postoperative recovery was uneventful.



Figure 1—Left leg showing bite puncture marks and bruising extending proximally.

Discussion

The adder (*Vipera berus* L.) is the only venomous snake native to the UK; it is most active in the summer months and can inject venom via its fangs from birth.¹ The cytotoxic and haemorrhagic effects of envenomation are due mainly to the protease, hyaluronidase and peptide hydrolase components of the venom. Cardiotoxic effects, systemic haemorrhage and coagulopathy are rare, although death can occur, the last reported case being in 1975.²

Almost 40% of bites are on the foot and ankle, and approximately 70% of bites result in mild or minimal symptoms; a proportion do not result in envenomation.³ Local and systemic effects severe enough to cause death

can occur from 6 h to 60 h after the bite. Local effects usually consist of pain from the bite itself, together with oedema and bruising, which usually settles after 3 days. This is principally caused by increased vascular permeability allowing third space accumulation as a secondary cytotoxic effect of the venom on the vascular endothelium. Systemic effects can appear within minutes, and may include hypotension secondary to hypovolaemia.

The initial management involves close observation of the effects of envenomation. Attempts to remove venom from the wound and the application of a tourniquet or ice packs are contraindicated. The tetanus status should also be determined.

Biochemical and haematological investigation is required to monitor for systemic effects. Antivenom administered intravenously reduces morbidity, convalescence time and the risk of death. There is a small, but significant, risk of anaphylaxis caused by the antivenom, particularly in patients with a history of hypersensitivity or allergy. It has been proposed, however, that the acute response following envenomation may be protective in this regard.⁴ In the absence of systemic envenomation effects, antivenom is still indicated where severe swelling of a limb (extending proximally beyond the next major joint) develops within 24 h.

An acute compartment syndrome affecting the bitten limb can develop and is a widely reported sequel to snake bite, though it has rarely been reported after adder bites. Insufficient knowledge of this condition can lead to a delay in diagnosis and a poor outcome (ischaemic contracture and occasionally limb amputation).⁵ To distinguish extrafascial from subfascial oedema direct intracompartmental pressures can be measured.⁶ Where there is clinical suspicion of compartment syndrome leading to closed compartment ischaemia, surgical decompression by fasciotomy should be performed.⁷

Guidelines on the treatment of acute compartment syndrome secondary to snake bite are the subject of some controversy, principally in terms of when to proceed to fasciotomy. Much of the literature describes closed tibial fracture or tibial-fracture fixation and compartment syndrome. Recommended threshold compartment pressures vary from author to author.⁸⁻¹² Evidence published by McQueen and Court-Brown showed no missed cases of acute compartment syndrome with the use of a differential pressure (diastolic minus compartment pressure) of 30 mmHg as a threshold for fasciotomy. This protocol is now in widespread use in the UK.¹³ All agree, however, that the value of such measurements is only as an adjunct to the more crucial and well-recognised clinical signs and symptoms of acute compartment syndrome: paraesthesiae, pulses present, pain on passive stretch of the muscle within the compartment, paresis and rest pain out of proportion to the injury. The approach to the snake-bitten limb should be no different, because the pathophysiological effect is the same: increased compartment pressure leading to closed compartment ischaemia and further neurovascular compromise.

In the assessment of children, however, emphasis is often placed on such compartment-pressure measurements. The classical signs and symptoms can be unreliable in an often scared, uncooperative, irritable and uncomfortable child.

In this case, differential pressures were calculated and fasciotomy was not indicated (according to protocol) because there was an early clinical improvement, with evidence of diminishing compartment pressures. This was followed by a rapid clinical deterioration, with the development of clear signs and symptoms of compartment syndrome.

In conclusion, though rare, the snake-bitten limb, particularly in children, should arouse suspicion of both limb-threatening and life-threatening sequelae, and constant vigilance is mandatory.

Acknowledgements

We thank the paediatric team at the Royal Devon and Exeter Hospital, who shared the care of this patient.

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Paper received 30 January 2002.

Accepted 27 May 2002, after revision.