CASE REPORT

Achieving Full Neurological Recovery in Snakebite using Best Supportive Care

Sally Wright, Genevieve Haddock

Magbenteh Community
Hospital, Makeni, Sierra Leone

Correspondence to
Dr Sally Wright,
sallyeawright@doctors.org.uk

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SUMMARY

A 29-year-old woman presented to a community hospital in Sierra Leone 2 hours after being bitten by an unknown snake. On arrival, she was agitated though alert, however deteriorated into respiratory arrest. There was no local availability of antivenom. The patient remained in respiratory arrest undergoing best supportive care in a low-resource setting for 2 hours 55 minutes before returning to spontaneous ventilation. She went on to make a full neurological recovery. Though spontaneous recovery following snakebite envenoming is rare, this case showcases that good communication and basic manoeuvres can have a hugely positive impact on patient outcome. Alongside this, it highlights the need for staff and community engagement and implementation of local protocols in order to improve confidence and achieve consistent practice.

BACKGROUND

A neglected tropical disease, snakebite is a significant cause of morbidity and mortality in the low-resource setting. While the frequency varies, there are thought to be 100 000 envenomings per year in Sub-Saharan West Africa with an incidence of between 8 and 93/100 000 population per annum (p.a.). This results in up to 18 500 deaths p.a.¹ Additionally, there is significant morbidity related to limb injury, amputation and renal failure which has an ongoing social and economical impact. Disease burden is felt most by rural, often impoverished communities where there is an interface between the human population and their rural surroundings. Morbidity and mortality are then increased by limited access to healthcare facilities and scarcity of antivenom.¹

The clinical pattern of envenoming varies hugely; there is vast difference between species and the clinical syndromes that result from envenoming. Following early local signs such as pain, swelling and tissue necrosis, there can be a variety of systemic symptoms. Haemorrhagin activity may lead to coagulopathy and life-threatening bleeding, with hypotension related to haemorrhage, regional oedema or cardiotoxicity. Alternatively, neurotoxins can result in progressive paralysis, respiratory arrest and coma.^{2,3}

Sierra Leone is home to 40 species of snake in a variety of habitats. While many of these are not venomous, the Western Green Mamba and select species of vipers and elapids (including cobras) pose a significant risk to humans.^{4,5} Each species' venom may contain a variety of cytotoxins, haemorrhagins, neurotoxins and myotoxins to differing extents.⁶

While supportive treatment of haemorrhage, hypotension and respiratory paralysis is of great importance, the definitive treatment for envenoming remains antivenom.

Antivenoms are a mixture of polyclonal antibodies which may be monovalent (single species) or polyvalent (effective against many species).⁷ Not only must the available antivenom be appropriate for local species, there is considerable variability in the neutralising capacity and quality of antivenom available. In addition, it is expensive and often difficult to obtain in low-resource settings.^{7,8} Other considerations besides the availability of antivenom include the level of supportive care available at local health facilities and ability to transfer patients safely to hospitals providing higher levels of care. All of these factors contribute to morbidity and mortality related to envenoming in impoverished areas.

This case highlights both that full recovery is possible even in the absence of antivenom, and that effective communication, basic clinical and non-technical skills can help secure a positive outcome in low resource environments.

CASE PRESENTATION

A 29 year old patient presented having been bitten by an unknown snake approximately 2 hours previously. She was generally fit and well, took no regular medications and had no known drug allergies. She had been well prior to the bite.

She had initially been treated by a traditional healer before presenting to hospital. On arrival, she was agitated, confused and had been vomiting. Following assessment by the community health officer, the patient was treated with antiemetics (metoclopramide and promethazine), analgesia and prophylactic ampicillin and gentamicin. Intravenous hydrocortisone and chlorphenamine were also administered prior to sourcing antivenom. Unfortunately, there was no availability of antivenom in the hospital and therefore discussions were ongoing regarding sourcing treatment and/or transferring the patient to an alternative facility.

The patient deteriorated over the course of 1 hour, becoming unresponsive and proceeding to respiratory arrest. On arrival of the on-call doctor, the following ABCDE assessment was made:

Airway management was being achieved by jaw thrust with bag-valve-mask (BVM) ventilation; however, there was a poor seal from BVM with audible secretions. There was global air entry on auscultation with oxygen in situ. Oxygen saturations were 73% on 4 L/min by nasal cannulae. The

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patient was cardiovascularly stable, and there was no evidence of haemorrhage. Glasgow Coma Score (GCS) equalled 3/15 with sluggish but reactive pupils bilaterally. She had global hypotonia with reduced reflexes. Blood glucose was 7.9 mmol/dL. A left leg tourniquet was in situ having been placed in the community; however, the peripheral pulse was palpable. There was no evidence of wound, localised skin necrosis or oedema surrounding the bite site on her left ankle.

Impression: flaccid paralysis and respiratory arrest secondary to envenoming (species unknown however likely neuromuscular toxin).

Following this initial assessment best supportive care was optimised, primarily through airway maintenance. An oral pharyngeal airway was inserted following suction, and a two-man BVM technique incorporated. In addition a nasogastric tube was inserted in order to decompress the stomach. With these interventions, the patient's oxygen saturations rose to >90% with oxygen via nasal cannulae. First aid was administered to the affected limb including removal of the tourniquet. A whole clotting blood test was performed in a dry tube which showed no delay in clotting. Haemoglobin was 11 g/dL (measured by haemocue).

Given there was no availability of general anaesthetic or ventilator support in this facility, this was the highest level of care the team were able to provide. Therefore once the patient had been optimised discussions were ongoing within the multidisciplinary team and with the patient's family regarding the best course of action. Ideally the patient would be transferred to Freetown (3 hours) where antivenom was available. However, as in Sierra Leone ambulances often do not contain any additional means to care for the patient and are instead a transfer vehicle only, transfer presented an unnecessary risk while the patient was in respiratory arrest. Coincidentally the patient's family was unable to afford this expense. Following liaison with neighbouring pharmacies, a hospital staff member was able to travel to collect the nearest antivenom (1 hour away) and return with it to our facility.

While awaiting the delivery of antivenom, the patient remained in respiratory arrest with the team achieving consistent oxygen saturations of >90%. She remained cardiovascularly intact with strong peripheral pulse and stable blood pressures. After 2 hours 55 minutes, the patient began to attempt spontaneous respiration. Over the course of the next 10 minutes, she became able to maintain her own airway and achieve bilateral air entry with a respiratory rate of 20 breaths/min, oxygen saturations 89%. Initially, she struggled to follow commands due to ongoing paralysis, however this steadily improved. Fifty minutes after return of spontaneous ventilation, the patient had returned to GCS 12/15 with (eyes 4, voice 2, motor 6); though she struggled to form words due to facial paralysis, she was able to communicate and denied pain.

A tetanus vaccine was administered, and the patient was monitored closely. Following its arrival, the antivenom was not given due to her ongoing recovery and risk of anaphylaxis with administration. There was no deterioration following removal of compression bandage and the patient continued to improve. Initially she described generalised muscle aches and particularly pain at the bite site, however these symptoms resolved prior to discharge from hospital.

OUTCOME AND FOLLOW-UP

The patient was reviewed in outpatient clinic 4 and 12 weeks later. She had been able to return to work soon after discharge

and continued to feel well in herself. There was no residual pain or weakness and the patient had made a full neurological recovery.

DISCUSSION

This case principally emphasises that while treatment options may be limited especially in comparison to a high-resource setting, the ability of a team to conduct basic management and communicate effectively can have a hugely positive impact on patient outcome. The use of simple airway manoeuvres and adjuncts (in this case an oropharyngeal airway) in combination with a two-man BVM technique and nasal oxygen were sufficient to support this patient until her spontaneous recovery.

Communication and non-technical skills were essential in the management of this patient. Not only while managing the respiratory arrest but also regarding treatment decisions, eg, sourcing antivenom, transfer facilitation and involvement of family in the decision-making process. While there may be fewer treatment options to consider in this setting due to lack of resources, these are often replaced by major decisions regarding logistics and maintaining the best possible standard of care for patients. Often this requires team discussion and an element of lateral thinking to achieve.

In this case, the administration of antivenom was not required to achieve recovery. Neurotoxins can act at either the pre or post synaptic membrane (or a combination of both).⁷ Anecdotally there are reports of spontaneous recovery following envenoming by the Green Mamba, however there is a lack of published data to substantiate this. Though the species of snake in this case is unknown, it may be that the patient was exposed to a neurotoxic venom that acted as a competitive inhibitor to acetylcholine at the postsynaptic membrane. Subsequently, over time the neurotoxic effects were outcompeted by endogenous neurotransmitter production. Therefore in this case, best supportive care with appropriate airway management and oxygen maintenance contributed to her survival and neurological recovery.

Despite the many positives to take from this case, it must be noted that some of the prescribing practice of the admitting community health officer was not in keeping with current guidance. This may be due to the relative infrequency of hospital attendance for snakebite in the area, unfamiliarity with case management and lack of local guidelines. In addition, patients who do present often do so at a late stage and die soon after admission to hospital. This is a key area of learning from this case, particularly when staff training, protocol development, education and monitoring have been shown to reduce mortality from 11% to 1.3% in rural Ghana.⁹

While this case shows the importance of best supportive care in the hospital setting, it also highlights this patient's delayed presentation to hospital. The 'three delays model', while often associated with maternal mortality, is useful when assessing the management of snakebite in this setting.¹⁰ According to this model, factors impacting on delay in receiving appropriate care and subsequent morbidity and mortality can be separated into (1) the delay to seek medical help (eg, first attending traditional healer, financial considerations, lack of trust in medical facilities), (2) the delay in arrival at medical facility (lack of transport availability) and (3) the delay in the provision of adequate care (lack of antivenom). These are issues relevant to many aspects of healthcare in the low-resource setting and show an approach involving those outside the medical team, in addition to community outreach, is required to improve patient outcomes.

It is hopeful that through staff training, appropriate patient management and the achievement of positive outcomes health-care facilities may build trust with local communities, increase engagement and encourage patients to present early to hospital.

Learning points

- ▶ Good communication and basic manoeuvres can have a hugely positive impact on patient outcome.
- ▶ The need for community engagement and liaison with traditional healers in order to improve prehospital care and promote early transfer to an inpatient facility.
- ▶ The need for staff education, implementation of local protocols and monitoring in order to improve confidence and achieve consistent practice.

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