

# Patient Assessment and Diagnosis

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## Introduction

The objective of this chapter is to teach the essentials of initial and ongoing patient assessment, diagnosis and monitoring. A practical standard protocol is presented that will provide the best possible model for correct diagnosis and hence the implementation of appropriate early treatment.

Many snakebite case histories lack clear patient histories. The history of the actual snakebite circumstances and the events occurring subsequently is usually incomplete.

There are also often deficiencies in the extent of the initial patient examination, in the subsequent interpretation of findings, and hence in the diagnosis. There is often confusion over the interpretation of symptoms and signs and the results of tests. As a result, antivenom might not be given when indicated, or given late, leading to more severe venom effects and secondary complications for the patient. For example, a positive 20WBCT (whole blood unclotted at 20 minutes) is sometimes ignored as a clear indication for antivenom, or the test is simply not performed at all.

Good, frequent, ongoing assessments and regular monitoring are also not always routine - though they should be - to monitor the progress of the patient. Patients are sometimes allowed to “sleep” for hours between examinations, when in fact they may have complete ptosis and severe neurotoxicity, and even coma from cerebral hypoxia. Standard measures such as GCS (Glasgow Coma Score – developed for use in the assessment and management of head injury) are not of great value.

As noted in Chapter 4, the **assessment** of a patient with possible or definite snakebite must include a thorough, but focussed:

- history, including the history of the bite and the subsequent symptoms,
- examination, determining the vital signs and any signs of envenomation, and complications of envenomation, and
- investigations (which will depend on what tests are available at your health care facility).

This chapter will look again at these aspects, in more detail than before. The importance of clear and complete patient histories is emphasised. It will end with a suggested diagnostic algorithm.

Ongoing assessment, critical to the safe management of snakebite patients, is discussed briefly here, and in more detail in Chapter 14 (*Management plans for snakebite patients*).

## Assessment

### History

The history is vital, as in the medical assessment of all conditions, and will give vital clues as to the possible, or likely, snake. It will also give you a good idea if the patient has already experienced symptoms likely to be ascribed to envenomation, and so alert you to look for specific signs of snakebite when you examine the patient, which would provide you with an acceptable indication for antivenom (for Indications for Antivenom, see Chapter 11).

The important aspects of the history are the timing of the snakebite, activity performed since and first aid employed, both traditional and modern, and the presence and absence of specific symptoms and signs.

Obtaining a history from envenomed patients can be difficult, especially if the patient has neurotoxic effects of envenomation, though there will usually be family members present to assist. Small children pose much the same problem when they have been bitten. However, beware that those present with the patient often guess aspects of the history so as not to disappoint the person questioning them.

A clear succinct history should include questions listed in the tables below. History-taking should include open-ended questions so as to not influence answers.

You must be sure to cover all types of symptoms and organ systems likely to be affected in snakebite. That is, you must ask about:

- local/bite site symptoms,
- regional symptoms
- systemic symptoms
- non-specific and specific symptoms

The follow are examples of the types of information needed.

## Sample Snakebite Assessment and Admission Form

### History

Patient name:		Village & district:	
Age:		Date:	
Sex:		Time:	

### Snakebite Details:

Time of snakebite		Place where snakebite occurred, eg. home, garden	
Location, village, district		Activity being undertaken when bitten	
Description of the snake (length, girth, colouring, head, neck, body, tail)			
Body site bitten		Number of strikes/bites	
Other snake behaviour, eg. chased patient, moved away slowly, held on when biting			
Conditions, ie. wet, dry, swampy, long grass, roadside, village or bush track			

### Pre-hospital Care

Activity since snakebite, eg. ran, walked, carried, and for how far/how long	
Traditional first aid methods used – cutting (scarification), black stone, grass/bark or fabric tourniquet, other	
Modern first aid methods used – pressure bandaging, splinting, patient immobilisation	

### Past medical history

Previous snakebite history if applicable	
• approximate date of previous snakebite	
• antivenom given/no. of ampoules	
• any history of adverse antivenom reaction	
History of atopy – asthma, eczema, hay fever	
Medications	
Drug and food allergies	
Past and present medical problems including heart disease, lung disease, renal disease, bleeding tendency	

### Treatment already given elsewhere

Premedication	
• adrenaline SC – 0.25mg (0.005 mg/kg)	
• other drugs (such as promethazine, hydrocortisone)	
• Antivenom (type, amount, time given after bite, time taken to give the infusion, time when infusion ended)	
• Tetanus toxoid given	
• Other medications given [IV fluids (type, amount), penicillin]	
• Resolution of symptoms/signs since antivenom given	
• Hospital contacted for advice or referral?	
• Mode of transport to the hospital	

## Examination

Initial attention should be made to the patient's Airway; Breathing and Circulation. Once you are happy with the above, a more focused examination should be conducted.

Vital signs:	Reading	Time	Time	Time	Time	Time	Time
Heart rate							
Blood pressure							
Respiratory rate							
Peripheral oxygen saturation							
Temperature							
Urine output							

Standard measures such as GCS (Glasgow Coma Score) are of limited value since a paralysed, **but awake**, patient may be unable to speak, eye-open or follow commands, but may be fully conscious. Subtle signs such as the patient complaining of blurred vision, early collapse, decrease in respiratory function or bleeding of the gums are of much more value.

### Other Symptoms and signs

#### Local

- pain
- swelling
- bleeding, oozing


#### Bite site

- single or double puncture marks or scratch marks
- multiple punctures, likely to have more severe envenomation


#### Regional

- limb swelling
- painful/tender lymph nodes


#### Systemic:

- painful/tender muscles
- headache
- nausea/vomiting
- abdominal pain/tenderness


#### Neurotoxicity

- early collapse
- blurred vision
- cranial nerves: ptosis (a "sleepy/sleeping" patient); unable to look upwards ophthalmoplegia ("fixed eyeballs"); facial muscle weakness (expressionless face); poor mouth-opening (this is NOT trismus); poor tongue protrusion; pharyngeal muscle weakness (poor swallow, excessive saliva, pooling of oral secretions); laryngeal muscle weakness (weak or hoarse voice, "thick speech" ~ bulbar palsy)


Other Symptoms and signs (continued)

Neurotoxicity continued

- peripheral nerves: respiratory muscle weakness (breathless/dyspnoea, poor expansion, poor cough, weak voice, low SpO<sub>2</sub>; diaphragm, intercostals)
- limb and truncal muscle function (eg. can't walk, sit): limb power; limb reflexes; abdominal muscle tone and power

Coagulopathy

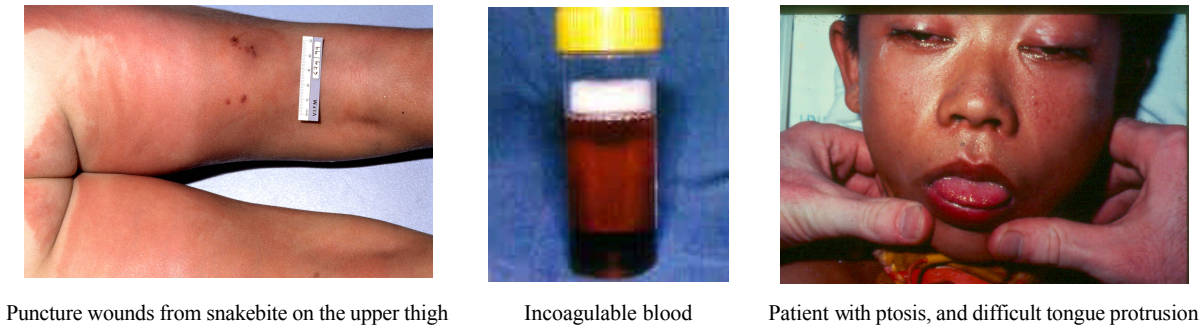
- bleeding (bite site, gums, scarifications/lacerations, haemoptysis, haematemesis, spitting blood)
- 20WBCT positive (blood unclotted at 20 min.)


Differential diagnoses should be considered when snakebite cannot be confirmed as the cause of the patient symptoms. These might include:

- infection
- stroke
- myocardial infarction
- allergic reaction
- hypoglycaemia/hyperglycaemia
- drug overdose
- closed head injury

Focal neurological signs should prompt suspicion of either a complication of envenomation such as head injury, intracranial bleeding, or another diagnosis such as central nervous system infection, particularly Tb meningitis or cryptococcal abscess, stroke, CNS tumour, or hyperosmolar non-ketotic diabetic coma.

FIGURE 1: Some features of snakebite



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## Temporal relationship of signs and symptoms of snakebite

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### **LESS THAN 1 HOUR AFTER THE BITE**

- Transient hypotension associated with confusion or loss of consciousness
  - Transient or persistent blurring of the vision
  - Headache
  - Nausea, vomiting, abdominal pain
  - Coagulopathy (20WBCT or laboratory testing)
  - Regional lymphadenitis
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### **1 TO 3 HOURS LATER**

- Paresis/paralysis of cranial nerves – ptosis, double vision, (external) ophthalmoplegia, dysarthria, dysphonia, dysphagia, facial weakness
  - Haemorrhage from mucosal surfaces (coughing, spitting or vomiting blood) and needle punctures
  - Tachycardia, or bradycardia, hypotension or hypertension
  - Tachypnoea, shallow respirations
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### **MORE THAN 3 HOURS LATER**

- Paresis/paralysis of truncal and limb muscles
  - Paresis/paralysis of respiratory muscles, bradypnoea and respiratory failure
  - Rhabdomyolysis
  - Dark urine (due to myoglobinuria or haemoglobinuria)
  - Renal failure
  - Coma; possibly due to hypoxaemia or shock.
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*(Adapted from Dr G. Didei, Chapter 8)*

## Investigations

### **Bedside tests**

There are a variety of fundamental and special diagnostic tests available. Most of these should also form part of your ongoing assessment and monitoring of patients after snakebite.

### ***Blood tests:***

- 20WBCT Test (see Chapter 9)

This is a simple effective test of envenomation, where whole blood is placed in a glass container/bottle and left untouched for 20 minutes out of direct sunlight, and then reassessed to see if it has clotted; if the blood has not clotted the patient has a coagulation problem and the likelihood of envenomation, is high (Positive Predictive Value 98.4%, Specificity 99.6% for the subsequent development of neurotoxicity).

- **Blood Glucose level**

This is a vital bedside test (using a hand-held glucometer) for any patient with a possibly altered conscious state (difficult to assess accurately in the paralysed patient), for diabetics, and for those who have been fitting; it should also be performed on every patient who requires resuscitation.

***Respiratory function tests:***

- A peak flow meter measures the peak expiratory flow rate (monitor regularly to see if there is a decreasing reading), which is a test of abdominal and intercostal muscle strength.
- An incentive spirometer, such as is used post-operatively to encourage inspiration, is an good way to assess diaphragmatic function; the patient sucks through a tube, and sees how far up a column they can suck each of 3 balls (this will be demonstrated in the course).
- A simple measure of respiratory function could be as simple as assessing the ability of the patient to blow up a balloon and noting any deterioration in the ability to do this (this is untested; it is important to use what you have available to you).

***CSL Snake Venom Detection Kit:***

- This immunoassay test is important in identifying which monovalent antivenom should be administered to the patient – which will neutralise the venom. (It must be noted it does not tell us exactly what species of snake has envenomed the patient.)
- A negative result does not indicate the patient is not envenomed and if there are clear features of envenomation, antivenom should not be withheld.

***Urinalysis:***

- Naked eye – haematuria and haemoglobinuria will appear red, while myoglobinuria will be evident as dark brown urine, which may develop white strands upon standing.
- Bedside assessment of urine is possible with a variety of dipsticks, to supplement the assessment of the naked eye. These note the presence of blood, haemoglobin (cannot distinguish this, normally, from myoglobin), protein, glucose, bilirubin, as well as pH (you should be aiming for a **pH of 7** in the treatment of rhabdomyolysis) and specific gravity (for example, a concentrated urine, with a high SG indicates not only well functioning kidneys, but inadequate hydration).

**Laboratory tests**

The relevance and availability of these tests in PNG is very variable, depending on the institution. Generally, little equipment is available for blood testing, and this is often broken down, there are no reagents, or there is no-one to run the tests. This is why the bedside tests are so important. However, when they can be performed, the following tests contribute significantly to the appropriate and precise management of a snakebite patient:

- blood film for malaria parasites
- renal function tests and electrolytes
- clotting studies INR/PT, APTT, ACT, D-dimer, X-FDP, fibrinogen for details of the coagulopathy
- creatine kinase for myolysis
- urinalysis for haemoglobin, myoglobin

## Blood collection

### *Principles*

Snake venom especially that of the taipan, affects the coagulation pathways and interferes with the normal clotting process. Disseminated intravascular coagulation (DIC) is also a complication of snakebites. The overall effects are reduced levels of coagulation factors, platelets and haemoglobin if there is significant bleeding or haemolysis. Patients may have established abnormal bleeding and anaemia upon presentation.

Kidney function and liver function may also be altered. The blood glucose should be checked, especially if the patient is comatose and has not been eating or drinking (this is particularly the case with small children, who have limited reserves of glycogen to make glucose for cells, and a limited ability to manufacture glucose from protein).

### Materials required:

- 20 ml plastic syringe
- 22 or 23 gauge needle
- EDTA bottle (5 ml, pink top) or as provided your laboratory
- Citrate bottle (5 ml)
- 2 plain bottles (10-15 ml)
- Centrifuge (if unavailable, use 1 plain bottle with gel clot activator, though this type cannot be used for the 20WBCT)
- Blood glucose bottle (3 ml), if you do not have access to a bedside glucometer

### *Procedure*

Blood is ideally collected from the antecubital vein, or through the newly-placed IV cannula, and the skin must be 'clean'. Swab this area well with 70% alcohol swab (e.g. isopropanol) once you have identified a good vein. Collect 10-20 ml of venous blood using a 19-21 gauge needle (or through the cannula) in adults and 23-25 gauge in young children, attached to a 20ml syringe. Remove the needle to avoid haemolysis before filling the bottles (unless you are using Vacutainers). Place 4.5 ml into your 5 ml citrate bottle (9:1 ratio) and mix well. Add 3-4 ml into the EDTA bottle and mix thoroughly. Add another 3 ml into the glucose bottle and mix this as well and the rest should go into the plain bottles. A drop of blood can be used to measure the venous glucose with a glucometer at the bedside (a cheaper and quicker method).

If you are in a hospital with a laboratory technician or technologists, all the separation and preparation is done by them. However if you are alone, the following should be done:

### *Serum and plasma separation*

Serum is obtained from the blood sample in the plain bottle. Placing this sample in a 37°C water bath enhances the clotting process. Centrifuge for 15 minutes. Serum is the straw-coloured fluid which makes up the top layer above the red cells. If you do not have a centrifuge, a container with gel clot activator should have the same effect or alternatively leave it in 37°C water bath for 1-2 hours and then separate the serum.

Plasma, on the other hand, is obtained from centrifuging the citrate sample for 15 minutes at 4000 rpm in a standard bench centrifuge. Unfortunately there is no other alternative for achieving plasma apart from centrifugation. For the EDTA bottle, make a thin blood film and send this with the sample without any separation.



### ***Storage and transport of samples***

Heat destroys some of the contents of blood that are for analysis. Ideally, the tests should be done within 1-4 hours of specimen collection. However, in PNG, this is not possible in isolated health centres. Samples should be stored at 4°C, or the normal kitchen refrigerator, and transported in coolers or eskies to the nearest laboratory as soon as is practical, preferably with the patient.

### ***Interpretation of results***

If a patient's coagulation pathway is affected, the 20 minute whole blood clotting test (20WBCT), a sensitive and specific screening test for coagulopathy, which can be done at the bedside, should be positive (See 20WBCT Practical). The PT and APTT should be prolonged. The PT measures the activity of coagulation factors in the extrinsic pathway and common pathway (Factors II, VII, X, Fibrinogen, Fibrin), while the APTT measures the factors in intrinsic pathway and common pathway (Factors XII, XI, X, etc). Taipan venom, for example, contains a prothrombin activator (which is a component of the common pathway).

In DIC, there is both activation of micro-clot formation, and consumption of clotting factors and platelets (consumptive coagulopathy). Therefore, in this situation, the haemoglobin (Hb) level and platelet counts may be reduced, and the FDP level should be positive or raised.

These results should guide you in deciding what blood products can be given in such situations as coagulopathy and DIC, though they may be given **only** once enough antivenom has been given to neutralize **all** the circulating venom, and if the patient is bleeding heavily or is not making enough new coagulation factors.

Kidney and liver function: monitor these organs in snakebite patients, as they can be directly and indirectly adversely affected by venom components.

Hypoglycaemia should be prevented at all costs, especially in patients who are already comatose for another reason.

### ***Urine collection***

Like most urine samples, this should be collected as a midstream specimen, when possible. Otherwise, a catheter sample is adequate. Analysis should start from the gross appearance of the colour. The difficulty arises when a patient has red or tea-coloured urine which could be due to haematuria, haemoglobinuria or myoglobinuria.

Simple dipstick urinalysis can pick up haematuria (and proteinuria), but it cannot distinguish between red blood cells, haemoglobin (Hb) from lysed red cells, and myoglobin (Mb), from lysed skeletal muscle cells. Haematuria is confirmed by the presence of red cells on the slide examined by microscope made from deposits after spinning the urine down by centrifugation.

Mb is released if there is skeletal muscle damage, and can be measured by a sensitive and specific radio-immune assay. Spectrophotometry can be used to differentiate between Hb and Mb, although they have absorption spectra which are similar, but not identical. Unfortunately, in PNG the facilities to do such tests do not currently exist in public hospitals.

Haemoglobin is released into the circulation when there is intravascular haemolysis causing haemoglobinuria; this is rarely clinically important in envenomed patients.

## Patient Monitoring and Reassessment

Patient reassessment and monitoring are critical in the care of snakebite patients. A patient with confusion or abdominal pain is much more obvious in your Emergency Department (A&E) than the person with snakebite who quietly develops respiratory paralysis. Relatives and friends should not be relied upon to alert staff to deterioration in the clinical state of their relative – they do not have the skills and knowledge to see subtle changes.

Patients who have been bitten by a snake should be kept in a central place in the department, and should not be left to quietly “sleep” in the corner.

It is critical that the vital signs (HR, BP, RR, SpO<sub>2</sub>) and urine output (much easier to monitor with an IDC in place, though an asymptomatic, or minimally-symptomatic, patient does not need one) are assessed, and recorded, at least hourly for the first 24 hours after a snakebite, and that any abnormalities are acted upon. It might be unpleasant for a patient to be woken so frequently, but it is for their own potential benefit, and this must be explained to them.

Symptoms and signs can evolve slowly or rapidly depending on the snake and degree of envenomation. Repeated re-examination of the patient is required to see if new symptoms or signs develop. This might not be noted from simply performing hourly observations, so actual reassessment of clinical signs and investigations, such as cranial nerve function, respiratory function (eg. with an incentive spirometer), limb power and the 20WBCT will be necessary. This is the purpose of recording systems such as the Snakebite Observations sheet provided by the National Department of Health.