Management plans for snakebite patients

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Introduction

Snakebite emergencies are usually unexpected sudden events in which critical decision-making at the right time points can have an enormous impact on whether or not the patient survives or dies. Snakebite can represent a serious challenge to the skills and resources of even the best staffed and resourced emergency departments in major developed countries. In an environment such as rural PNG these challenges are hugely magnified by the very basic conditions of most rural health centres and clinics. The success of treatment depends very largely on being able to meet each snakebite emergency with a consistent, practical approach that addresses the important clinical issues as early as possible in a proactive manner.

This chapter therefore deals with the issue of establishing clear plans for the consistent assessment, treatment and referral of all snakebite patients. In the absence of a clear specific, evidence-based plan snakebite patients tend to be managed very poorly, and the outcomes may be catastrophic. Poor initial clinical assessments are often accompanied by irregular reassessment, and proper patient monitoring is sometimes absent altogether. This is often because staff are unsure about what to do, either because of lack of information and knowledge; because of incorrect information; or because of confusion over the interpretation and application of standard management guidelines. In the urgency of the moment, staff may also be distracted by peripheral issues such as having to deal with large numbers of frustrated, worried relatives and wantoks. Without a plan of management there is no systematic approach and important clinical events may be overlooked or not recognised until it is too late.

One approach that can be used to overcome these problems and to bring order and consistency to the management of all snakebite patients is to develop and use clinically relevant, evidence based treatment algorithms. Accurate algorithms for the assessment and diagnosis are invaluable for maintaining consistency, and chapter will show you two different algorithmic approaches:

(a) An algorithm for the selection of the most appropriate antivenoms based on clinical features of envenomation, snake species distribution and species traits; and,

(b) Regional treatment plan algorithms that go slightly beyond that proposed in (a) by giving direction to the basic process of antivenom therapy, patient re-evaluation and monitoring.

To get the most out of these algorithmic methods you will need to carefully and thoroughly examine and assess patients, and ensure that your clinical decisions are always based on the evidence you obtain from the patient examinations and from the use of diagnostic tests such as the 20WBCT and the CSL snake venom detection kit (if it is available to you). The algorithms are intended as the basis of management plans which are both appropriate to the

available resources in your institution, while at the same time ensuring a certain minimum standard of care, and which address key problem areas with current treatment methods. To be effective access to algorithms needs to be extended to all of the staff who may be responsible for the treatment of a patient during any time of the day or night. All of these staff need to be taught how to understand and use the algorithms, and this implies that all of the staff need to have a consistent knowledge of the processes of patient assessment and diagnosis, and of the procedure for instituting treatment.

This implies the concept of operational consistency.

Operational consistency means that all of the staff in a health centre, aid post or hospital (and even within an organization such as the Department of Health) take the same consistent approach to a particular issue; in this case the process of assessing, diagnosing and treating patients with real or suspected snakebite.

Every patient who presents with real or suspected snakebite should be:

- Triaged on arrival according to resuscitation status
  - checking vital signs: heart rate (HR), blood pressure (BP), respiratory rate (RR), peripheral oxygen saturation (SpO_2), and temperature (T);
  - resuscitating the patient with respect to **Airway, Breathing and Circulation;**
  - instituting monitoring (depending on availability – ECG, oximetry).
- supportive care: proper patient positioning, oxygen as required, IV fluids, an indwelling urinary catheter (in the patient with respiratory muscle weakness).
- Examined for the same signs of envenomation, for example:
  - All patients should have a 20WBCT performed as soon after arrival at the health centre as possible to determine whether or no blood is clotting normally;
  - All patients should be assessed for the presence of signs that indicate neurotoxicity, such as cranial nerve paralysis (i.e.: ptosis, diplopia, dysphagia and other signs)
- Assessed on the results of the examination and any diagnostic tests in the same manner, for example:
  - Non-clotting blood should always be interpreted as an indication for antivenom being given without delay
- Treated appropriately on the basis of clinical assessment:
  - appropriate adequate antivenom if indicated;
  - secondary therapies on the basis of clinical need and justification.
- Monitored and reassessed in the same way.

The priorities of treatment are to **maintain life and limb,** and to prevent lasting significant morbidity (damage to the patient's organs and tissues), and to **do no harm** to the patient, by not administering unnecessary or incorrect treatments, or by delaying the correct treatment and referral. So priority must be given to interventions which will make a difference to the patient's outcome, and in the correct order of priority.

With this in mind, staff caring for snakebite patients must make every effort to ensure that they are in a position to provide optimal management within the limits of their clinical circumstances. This means replacing used stock, maintaining and being careful with, vital equipment, and ensuring their knowledge is kept at a high level.

Inconsistencies in management protocols frequently contribute to poor outcomes. Internally consistent protocols should provide a reliable basis for decision-making, but all staff involved in the management of snakebite patients must be aware of the locally agreed protocols for the

management of snakebite. This will greatly reduce errors in management which have previously lead to patient deaths. A consistent approach to snakebite management that is evidence-based, easy to follow, and easy to implement also has the important function of helping to protect inexperienced staff from making errors of judgement that might lead to adverse patient outcomes and the resultant difficulties with the patient's wantoks.

The management of snakebite must be based on good evidence and proven scientific facts, for the safety of the patient. Unproven therapies should not be used in a health care facility.

Standard Management Algorithms

The following algorithms are designed to provide an elementary guide to planned patient management and should only ever be used to make clinical decisions if the exact conditions of the algorithm are met. In conjunction with the algorithms you should always:

- Ensure that the clinical signs have been properly elucidated, and use signs that you have observed or elicited directly yourself rather than less reliable symptoms reported by the patient/relative.
- Record the answers you reach for each question in the algorithm on the patient record to ensure that the decision making process is clear to you and to others who treat the patient.
- You must ensure that the 20WBCT was properly performed to ensure a valid test result of either 'positive' or 'negative' for incoagulable blood.
- Any description obtained must be offered without prodding or suggesting answers, i.e.: ask only open-ended questions. For example; do not ask a patient/relative "*Did the snake have a red back*", just ask them "*What did the snake look like*?" The reason for this is that people are often very eager to be able to help, and if you ask them a question that suggests the type of answer you want (i.e.: did the snake have a red back) they will often say 'yes' if it they do not know, simply to try and be helpful.
- The algorithm will only work if you follow all of the steps in the process, all of the time, with all patients who have either real or suspected snakebite.

Use the algorithm cautiously, and if you still have doubts, select the general purpose CSL polyvalent antivenom.

There are two types of algorithms on the next four pages:

Snake Identification Algorithm

This enables you to ask and answer a series of questions that will give you an indication of the most likely species responsible for snakebite. This enables you to make an informed choice of antivenom in the absence of being able to use a CSL snake venom detection kit test.

This algorithm can be used in the case of snakebite in any province of Papua New Guinea.

Regional Snakebite Management Algorithms

There are three regional snakebite management algorithms that are each specific to one particular group of provinces. These are diagnosis and treatment plan guides.

Be certain that you use the correct algorithm for the province in which the snakebite occurred; even if the patient is referred to a Central province hospital from a health centre in the Sepik, you still need to use the algorithm designed for Sepik snakebites

Snake Identification Algorithm

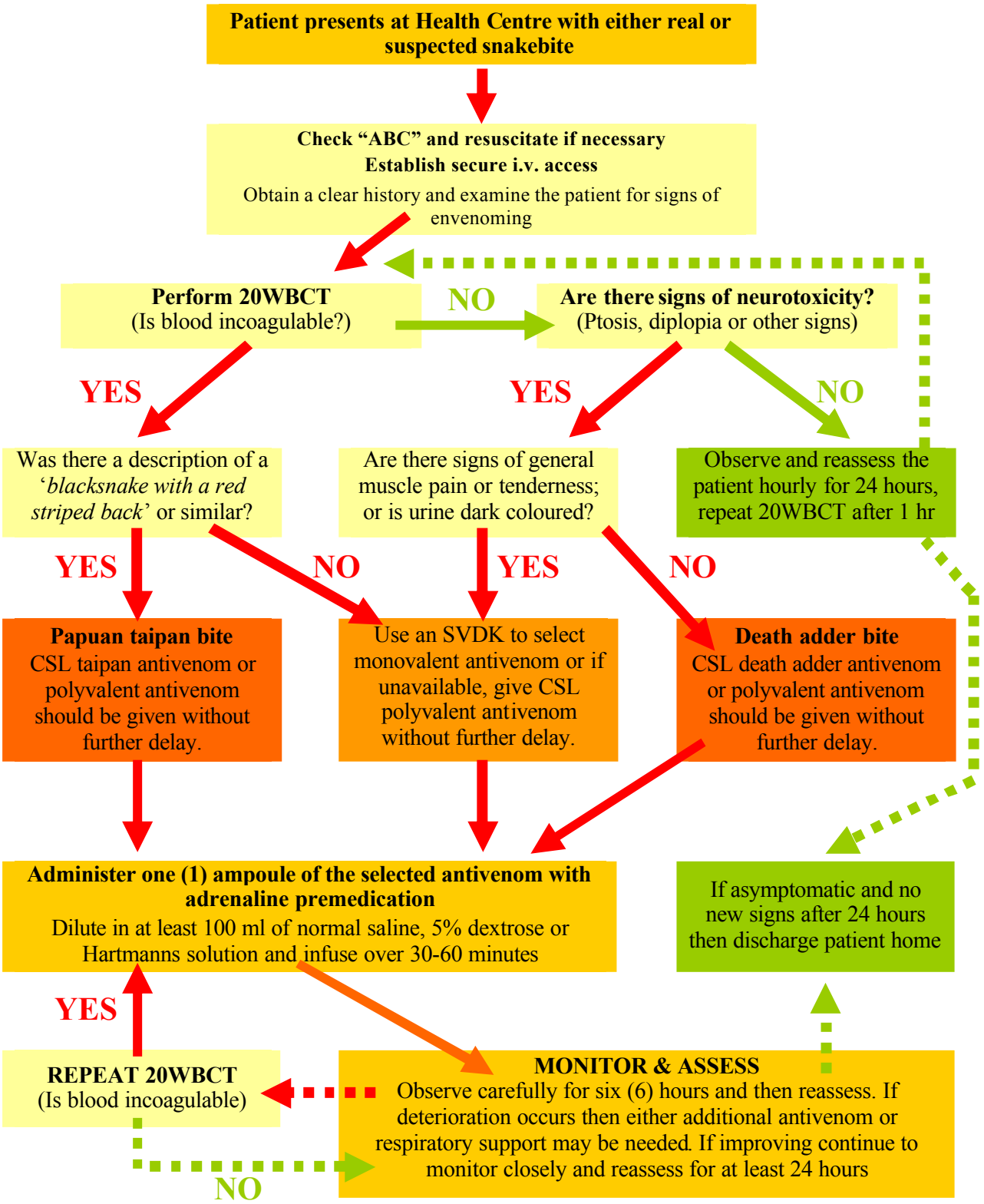
Can be used at any location throughout Papua New Guinea to help select antivenom

1. Whereabouts in PNG did the bite occur?	
(a) MBAY, ORO, CENT, NCD, GULF, WEST?	Go to 2
(b) MOR, SIM, E.HIGH, S.HIGH, W.HIGH, ENGA, SAND, E.SEP, MAD?	Go to 4
(c) MAN, WNB, ENB, N.IRE, N.SOL?	Go to 7
2. What was the result of the 20WBCT for incoagulable blood?	
(a) Positive test (20WBCT > 20 min.)	Go to 3
(b) Negative test (20WBCT < 20 min.)	Go to 4
3. Was there a description of the snake that referred to it having "*a red stripe on the back*" or being a *"blacksnake with a red back"*?	
(a) Yes	**Papuan taipan (***Oxyuranus scutellatus canni***)** CSL taipan or CSL polyvalent antivenom is recommended
(b) No	Perform a Snake Venom Detection Kit Test (SVDK) or if unavailable, CSL polyvalent antivenom is recommended
4. Are there observed or elicited signs of ptosis, diplopia, or other neurotoxicity?	
(a) Yes	Go to 5
(b) No	Observe and reassess the patient hourly for 24 hours
5. Is there generalised muscle pain, muscle tenderness or dark coloured urine?	
(a) Yes	Go to 6
(b) No	**Death adder (***Acanthophis* spp.) CSL death adder antivenom is recommended
6. Is there a description of the snake as being:	
(a) '*a white snake*' or a '*pale snake with a dark head*'?	**Small-eyed snake (***Micropechis ikaheka***)** CSL polyvalent antivenom is recommended
(b) '*a black snake*' or a '*Papuan black*'?	**Papuan blacksnake** (*Pseudechis papuanus*) CSL blacksnake antivenom is recommended
(c) There was no description	Perform a Snake Venom Detection Kit Test (SVDK) or if unavailable, CSL polyvalent antivenom is recommended
7. Did the bite occur in the ocean, close to the ocean foreshore or in a coastal river?	
(d) Yes	**CSL seasnake antivenom** (Sea krait or true seasnake)
(e) No	Perform a Snake Venom Detection Kit Test (SVDK) or if unavailable, CSL polyvalent antivenom is recommended

This algorithm should be used with caution; if available a SVDK test is preferable.

Snakebite Management Algorithm

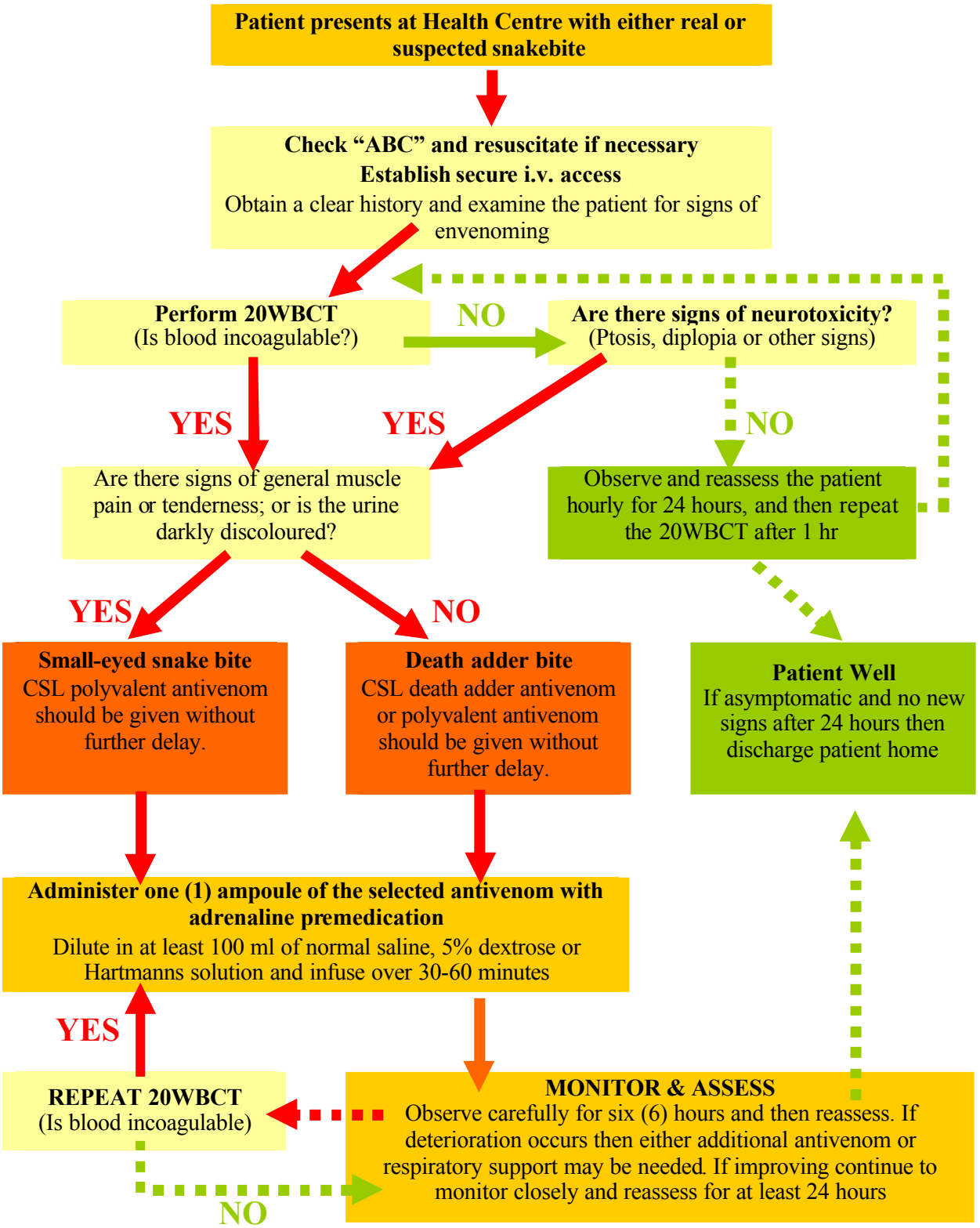
For Oro, Milne Bay, Central, NCD, Gulf and Western Provinces



Use this algorithm as a guide only: if respiratory distress develops after antivenom has been given then it is **imperative** that the airway be protected and steps taken to secure ventilatory support (i.e.: urgent referral to PMGH or another hospital with ventilation equipment)

Snakebite Management Algorithm

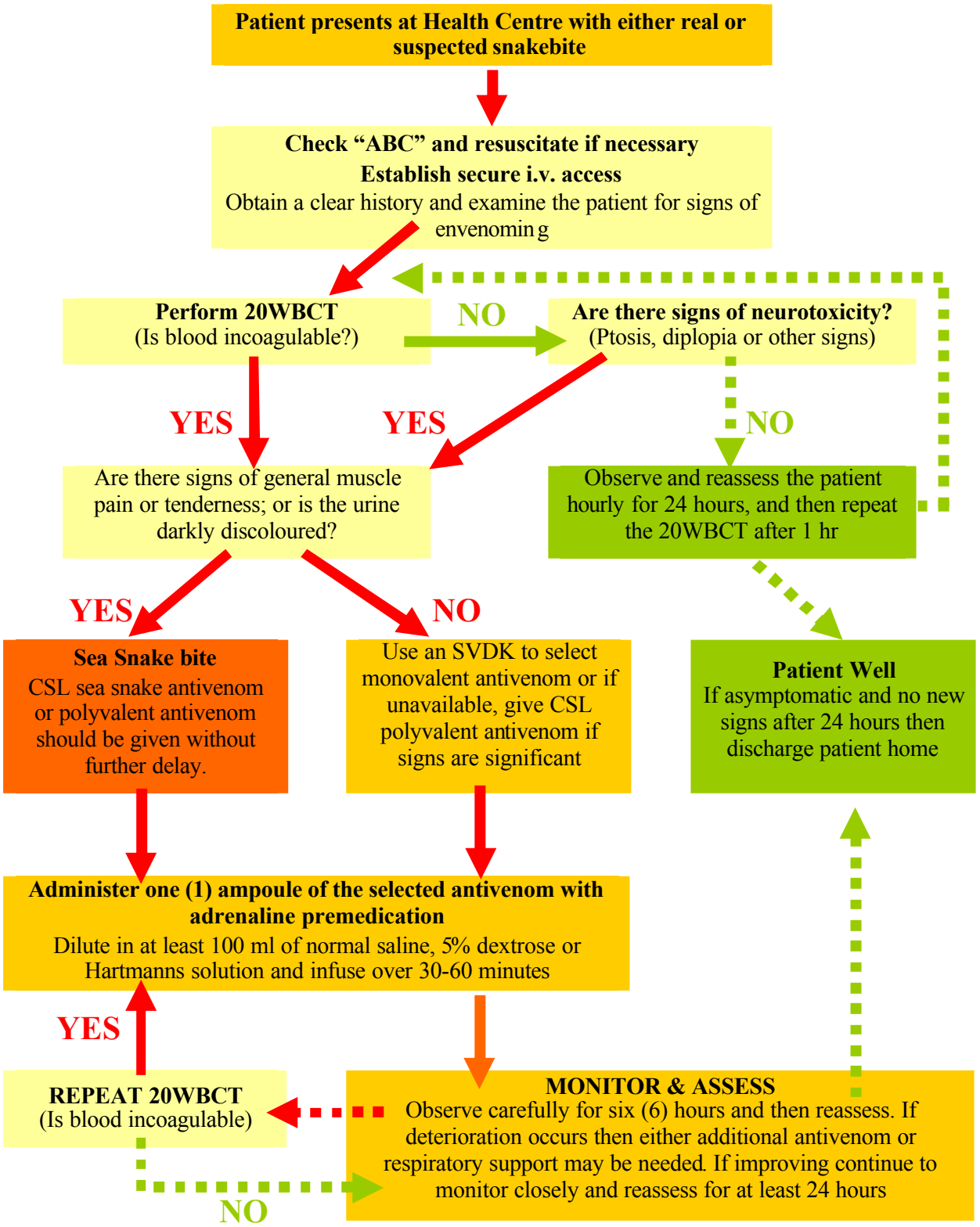
For Morobe, Simbu, Eastern Highlands, Southern Highlands, Western Highlands, Enga, Sandaun, East Sepik and Madang Provinces



Use this algorithm as a guide only: if respiratory distress develops after antivenom has been given then it is **imperative** that the airway be protected and steps taken to secure ventilatory support (i.e.: urgent referral to PMGH or another hospital with ventilation equipment)

Snakebite Management Algorithm

For Manus, West & East New Britain, New Ireland & North Solomons Provinces



Use this algorithm as a guide only: if respiratory distress develops after antivenom has been given then it is **imperative** that the airway be protected and steps taken to secure ventilatory support (i.e.: urgent referral to PMGH or another hospital with ventilation equipment)

Standard patient administration

In addition to ensuring that patients are clinically managed in a consistent and logical manner with emphasis on elicited evidence and careful assessment and diagnosis, it is also important to ensure that the process of patient administration is dealt with consistently.

This involves ensuring that the history and treatment of the patient are correctly recorded in an appropriate fashion, and that patients are nursed appropriately. It can also be taken to include having a clear plan in place for what you will do if a patient needs to be referred to another health centre or to a larger hospital for treatment.

Record keeping

A snakebite observation and assessment chart needs to be maintained for every patient as a record of the not only the symptoms and signs that are present and the treatment that was given, but also of the process by which the patients were treated, and their subsequent progress until an outcome was reached.

There are several variations of the standard snakebite observation chart that was first drawn up over 40 years ago. Some of the things on these charts may no longer be current. For example: tracheostomy is no longer usual in treating snakebite.

Regardless of what type of form (if any) that you use it is very important to obtain information about and record the following:

- Name, sex and age of the patient.
- Where they live.
- Who is their next-of-kin (closest relative who may be contacted).
- Where they were referred from (if applicable).
- At what place they were when they were bitten, including the :
  - Time of the bite.
  - Place name of the location where the bite took place.
  - Circumstances through which they came to be bitten (i.e.: what activity were they engaged in, such as gardening, hunting, walking in the bush etc.).
- What first aid was attempted if any, and in the case of a pressure bandage; whether or not it was effectively applied (i.e.: is the bandage still firmly in place or is it loose).
- Additional history of the snakebite:
  - The description of the snake if it was seen.
  - The number of times the person was bitten.
  - Symptoms which the patient reports as having occurred since the snakebite.
- What did the person do after being bitten and before coming to the health centre.
- Record the results of the patient examination:
  - Record the results of the 20WBCT.
  - If it is available record the results of the CSL snake venom detection kit test.
  - Results of the physical examination.
- Record the use of any algorithmic decision-making process – explain how you reached the decision by listing the steps you have followed in the algorithm.
- Record the diagnosis.
- Record the plan of treatment that you propose to follow as a result of the diagnosis reached.

- Record the hourly monitoring of the patient and the process of reassessment that takes place after the initial treatment phase.
- Record patient vital signs and bodily functions (as described elsewhere, including urine output and toilet).
- Nursing staff should also record their observations of the patient and keep a clear record of abnormal signs (they should also record when and to whom these are reported).
- A record of all drugs and medicines given to the patient, including the time given, the route of administration, and dosage.
- The reasons for referral of the patient to another centre should this become necessary (you should keep a copy of the referral letter if this is possible, otherwise make a summary of your reasons in the patient file).
- A summary of the outcome of the snakebite:
  - The final formal diagnosis at the time of discharge or death
  - The date of discharge or death
  - A summary of the patient's condition at the time of discharge
  - In the case of a death from snakebite a summary of the reasons that contributed to the death (i.e.: respiratory failure, intracerebral haemorrhage etc.).

Nursing considerations

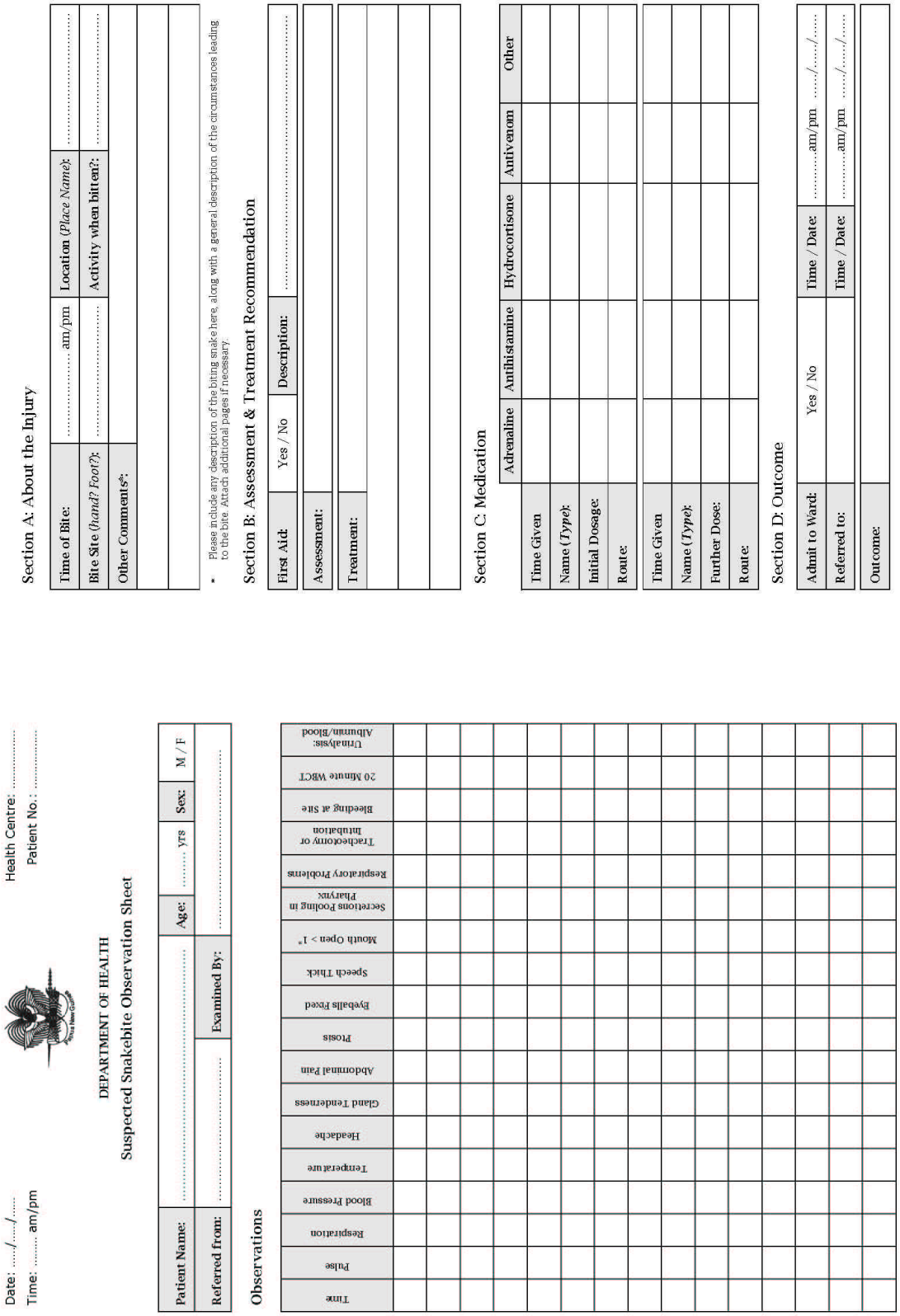
After the initial assessment, diagnosis and treatment phase of snakebite management it is essential that the subsequent nursing of the patient be consistent and that the nursing staff are appropriately trained and able to identify abnormalities as and when they occur, and then bring these to the attention of the person responsible for treatment (i.e.: the OIC of the health centre or aid post, or the treating physician or health extension officer).

There have been cases where a patient who initially responded very well to primary treatment after snakebite has subsequently deteriorated and died during the nursing phase of care because the staff were not adequately able to identify the early signs of deterioration, or neglected to inform the OIC or HEO (sometimes nurses are reluctant to disturb this person at night, and wait until the following morning before alerting anyone to the problem: by this time the patient may be in a very serious and possibly terminal condition).

As part of the planning for the management of snakebite it is therefore essential that nursing staff be properly briefed and taught how to recognise signs of deterioration in a patient. This can be accomplished by:

- Developing a written set of instructions for nursing officers which clearly indicates what the potential signs of trouble in a snakebite patient may be;
- Providing a set of written values for measurements such as heart rate, respiration rate and pattern, blood pressure, temperature etc, that tell them when to become concerned;
- Give clear instructions regarding the need for immediate notification of deteriorating condition;
- Providing ongoing training to nursing officers so that their level of knowledge and awareness is improved;
- Encourage nursing officers to record their patient observations in the patient records.

FIGURE 1: Example of a snakebite observation sheet used for recording history, assessment, diagnosis, treatment and outcome information.



Date: ...../...../.....
Time: ..... am/pm

Health Centre: .....
Patient No.: .....

DEPARTMENT OF HEALTH

Suspected Snakebite Observation Sheet

Patient Name:	.....	Age:	..... yrs	Sex:	M / F
Referred from:	.....	Examined By:	.....		

Observations

Time	Pulse	Respiration	Blood Pressure	Temperature	Headache	Gland Tenderness	Abdominal Pain	Ptosis	Eyeballs Fixed	Speech Thick	Mouth Open > 1"	Secretions Pooling in Pharynx	Respiratory Problems	Tracheotomy or Intubation	Bleeding at Site	20 Minute WBCT	Urinalysis: Albumin/Blood

Section A: About the Injury

Time of Bite:	..... am/pm	Location (*Place Name*):	.....
Bite Site (*hand? Foot?*):	.....	Activity when bitten?:	.....
Other Comments*:			

* Please include any description of the biting snake here, along with a general description of the circumstances leading to the bite. Attach additional pages if necessary

Section B: Assessment & Treatment Recommendation

First Aid:	Yes / No	Description:	.....
Assessment:			
Treatment:			

Section C: Medication

	Adrenaline	Antihistamine	Hydrocortisone	Antivenom	Other
Time Given					
Name (*Type*):					
Initial Dosage:					
Route:					
Time Given					
Name (*Type*):					
Further Dose:					
Route:					

Section D: Outcome

Admit to Ward:	Yes / No	Time / Date:	.....am/pm ...../...../.....
Referred to:		Time / Date:	.....am/pm ...../...../.....
Outcome:			

Patient Transport

The general principle of transporting a patient is that the standard of care should not drop from referring hospital to transport to receiving hospital. While this is potentially difficult, the principle is for the patient's best interest, and every effort should be made to sustain minimum standard of care during patient transfer that doesn't seriously compromise the safety of the patient.

While it is occasionally possible for aerial retrieval of patients from isolated areas, this is not at all to be relied upon and it tends only to be available during daylight hours. Therefore, the only option is land transport, which is often not possible, due to the state of roads, or to the lack, or poor repair, of the local "ambulance". PMV transport is often the only option, and people in smaller communities have walked long distances to reach a PMV stop, only to have none stop because they already had a full load; patients have died on the side of the road waiting for a PMV, and clearly this mode of transport cannot be relied upon.

The very unfortunate reality is that many patients die en route to hospital, or soon after arrival at the facility. There are a number of reasons for this:

- Staff "*accompanying*" the patient often sit in the front of the utility or 4WD vehicle, while the patient is in the back with the relatives, where the staff member cannot check on them.
- Accompanying staff bring no drugs or resuscitation equipment with them on the transport.
- The patient is generally transported without any oxygen or upper or lower airway device to maintain the airway; suction is certainly not carried.
- The patient is often poorly positioned in such a way that airway obstruction is likely to occur as nervous control of musculature declines.
- The patient, who often hasn't received antivenom, frequently develops life-threatening airway obstruction, pulmonary aspiration or respiratory failure en route.

If a staff member is going to accompany a patient, they should consider the following factors (already discussed in detail in Chapter 7):

- Patient ready
- Staff member ready
- Drugs and equipment ready
- Communication complete

What to teach families if no staff member can accompany the patient (See also Chapter 7):

- Patient positioning
- insertion of the Guedels airway – if not tolerated or required at the time of patient departure; consider the nasopharyngeal airway as a good alternative
- not feeding or giving oral fluid to the patient during the trip if there is any risk that their ability to protect their airway will become compromised en route.

The family must also be given a detailed letter, or a complete copy of the patient's notes for that admission (*as per Chapter 7*)

Summary

The best chance that a person has for survival after a snakebite is to be admitted to a health centre or hospital where they are treated in a consistent manner by staff who are well trained and who adhere to an organised evidence-based management plan, rather than being treated in a disorganised or disjointed manner as and when their condition worsens.

The key elements of successful management are:

- Attend to resuscitation needs early.
- Properly assess and diagnose each patient in a consistent manner.
- Use the 20WBCT for all patients as soon as they arrive at the health facility.
- Be proactive: know what the specific signs of envenomation are, and institute antivenom therapy as soon as possible using appropriate antivenom.
- Carefully monitor and reassess all patients according to a systematic management plan.
- Keep careful, thorough records.
- Nurse the patient well.
- Transport in the best manner possible with appropriate precautions if referral is necessary.