Treatment Overview

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Introduction

This chapter reviews the general principles and key issues associated with each aspect of the management of snakebite patients. The focus will be more on the rural setting with minimal resources, but some detail of advanced management will be mentioned. Further detail is presented in other chapters. It is hoped that the resources and capabilities of health care facilities, both in urban and in rural Papua New Guinea, will be developed and improved over the coming years; in such circumstances, such extra knowledge will come to be useful.

The emphasis will be on presenting an introduction to a practical, resource-appropriate model treatment strategy and plan for the management of snakebite for rural health centres. It is hoped that this will help you to develop a practical, resource-appropriate model for your particular health care facility. This will be discussed in more detail in Chapter 14.

In the 4 decades since the first snakebite research was carried out in PNG, and the first treatment and management guidelines were introduced by the National Department of Health of PNG, with the help of Campbell's work (1961-1969), a lot of new knowledge has been acquired. A large amount of research, laboratory and clinical, has been carried out in Australia, in PNG, and around the world, on Australian and Papua New Guinean snakes, which are clearly, and very closely, related. Much of this has been, and will be, discussed in other chapters. It is important that Papua New Guineans who are bitten by snakes benefit from this new knowledge; the course, which this Handbook accompanies, is one way of achieving this.

The most important achievement in improving the outcome for bitten patients throughout the world has been the development of **antivenoms**. Australia is one of the first countries to develop highly effective and safe antivenoms, for Australian snakes. Clinical experience and a limited amount of research has proven these to be effective in neutralising the venoms of most, if not all, venomous Papua New Guinean snakes, provided they are administered appropriately – that is the **correct antivenom** is given **early**, in the **required dose**, and with the **correct supportive care** given to the patient.

The second most important advance has been the development of an excellent method of first aid, **pressure immobilisation bandaging**, developed by Sutherland (1979). This has led to vast improvements in the survival of snakebite patients where it is used correctly, in combination with patient immobilisation, in Australia and for neurotoxic bites by elapid snakes in Africa. It is also highly appropriate in the mainland and islands of PNG and West Papua, but is rarely used, or used correctly; the use of traditional methods, or no first aid at all, is the norm.

This chapter will attempt to address many of the errors and misconceptions that accompany the management of bitten patients.

Firstly, priorities and objectives of treatment are discussed, and a general treatment and nursing strategy is presented. This is discussed in more detail in Chapter 14 (which discusses management plans for snakebite patients, the importance of having a specific, evidence-based plan, and the importance of consistency of such plans).

Secondly, a practical overview of treatment is presented. Specific treatments are introduced for the clinical effects of snakebite, and current controversies are discussed; more detail about most of these is given in the chapters specific to the particular clinical issues. And finally, the referral and transportation (disposition) of snakebite patients is discussed, and guidelines for these processes presented.

Priorities and Objectives

The priorities of treatment are to **maintain life and limb,** 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 stocks of consumable items,
- maintaining, and being careful with, vital equipment,
- ensuring their knowledge and skills are kept at a high level,
- knowing when to refer patients to a higher level facility and when to seek advice, and actually doing these things, when necessary.

Specifically, staff must ensure that they attend to the following needs of the patient:

- the institution of first aid on arrival, if possibly of value,
- appropriate early antivenom, where this is indicated,
- good airway management,
- good respiratory (ventilatory) support,
- dealing appropriately with bleeding and coagulopathy,
- dealing with the effects of myolysis,
- dealing with cardiac effects, and
- supportive care of all vital functions, including hydration, and renal function monitoring.

General Treatment and Nursing Strategy

Essentially, this part of the care of snakebite patients is about basic supportive and nursing care. It overlaps with the monitoring and frequent reassessment of patients that should be performed as well. The **treatment** of a patient with possible or definite snakebite must include **concurrent (**at the same time):

- applying pressure-immobilisation bandaging, and splinting, where indicated,
- checking the **vital signs** :
  - heart rate (HR),
  - blood pressure (BP),
  - respiratory rate (RR),
  - peripheral oxygen saturation (SpO2),
  - temperature (T),
- instituting **monitoring** (depending on availability – ECG, oximetry), and frequently recording and **acting on** the vital signs,
- resuscitating the patient with respect to:
  - **Airway,**
  - **Breathing,**
  - **Circulation,**

followed by:

- supportive care
  - proper patient positioning,
  - regular gentle suctioning (whether the patient is intubated or not)
  - oxygen as required,
  - IV fluids,
  - an indwelling urinary catheter, in the patient with respiratory muscle weakness, to prevent urinary retention, monitor urine output, and watch for a change in urine colour (suggesting haematuria or myoglobinuria),
  - care of potential pressure areas,
  - reassurance of patient and relatives (<u>often neglected</u>),
- specific, or definitive, treatments, as outlined below, including
  - antivenom,
  - airway management and intubation if required,
  - possibly the use of atropine to dry secretions if unable to intubate,
  - oxygen,
  - treatment of shock,
  - treatment of coagulopathy,
  - treatment of the complications of rhabdomyolysis and managing pain,
  - treatment of primary and secondary cardiac effects of envenomation,
  - antibiotic treatment and tetanus vaccination, where and when indicated,
  - wound care,
- ongoing monitoring and recording (hourly) of
  - vital signs,
  - secretions,
  - respiratory effort,
  - urine output (volume and colour),
- frequent (hourly at first) reassessments (re-examination); this is best performed using pre-formatted <u>Snakebite Observation sheets</u> such as that provided by the NDoH).

Specific Treatments

This section specifically discusses controversial treatments, and outlines the essentials of treatment in each of the major areas.

Snakebite happens to children as well as to adults. It is critical that children are given the correct, weight-calculated dose for all medications, except for antivenom, which is the same dose as for adults (though it should be diluted in a smaller, weight-based volume of fluid).

Controversial and Unsupported Therapies

The following therapies are controversial. For some, there is no proven benefit and no research base to support their use.

For others, their use has been traditional, and though they might not have been reported to be detrimental to patients, there are clear reasons why they can be. For yet others, some recent research guides us a little about their use and usefulness.

- The routine use of promethazine for premedication – which may be harmful (see below).
- The routine use of hydrocortisone for premedication – often no benefit (see below).
- The routine use of penicillin – benefit in only a few circumstances (see below).
- The use of adrenaline premedication – often omitted or given in an inappropriate way (see below).
- The routine use of IV fluids (see below).
- The use of sedative drugs in the anxious, bitten patient (see below).

With each of these therapies, and considering the resource-limited environment in which each of you works, the time, money, syringes, and needles used to administer them, and the drugs themselves, could often be more usefully be used for other patients with other conditions.

Traditional First Aid Methods

The vast majority of traditional first aid methods are totally ineffective in preventing venom entering the circulation; in fact, many are harmful, and this is discussed in more detail in Chapters 4 & 5. You should be looking for complications of these when assessing a snakebite patient, as outlined in Chapter 5.

Potential benefit

- Little, other than potentially allaying anxiety, which may have a small effect in delaying the entry of the venom into the circulation.

Potential harm

- Failure to use effective first aid, and hence no impediment to the development of toxic effects from the venom.
- Delay in seeking definitive medical care (antivenom, in the case of the patient envenomed by a dangerous snake).
- Muscle ischaemia and necrosis from tourniquet use.
- Burns from hot vessels.
- Toxicity from oral herbal preparations and snakebite pills.

Promethazine

Potential benefit

- There is a quoted benefit in reducing the incidence and severity of antivenom reactions (but this is unsupported by published data). It may have been appropriate a few decades ago, when the antivenoms produced were much less pure, and reactions to them were common. The current reaction rate in Australia, without premedication, is low. It is, however, probably of benefit when given in the case of an allergic reaction, once it has occurred.
- It may reduce airway (oral and bronchial) secretions, due to its mild anticholinergic effect, and delay the onset pulmonary aspiration (atropine would be more effective).

Potential harm

- Giving it can distract and delay staff from giving life-saving antivenom.
- It may cause hypotension, particularly in a patient who is already
  - hypoxic from respiratory failure,
  - volume depleted from vomiting or haemorrhage,
  - anaemic from haemorrhage,
  - suffering adverse cardiac effects from venom components, such as tachycardia.
- It will cause sedation in an otherwise unwell patient, by
  - its known antihistaminic and anticholinergic effects, (worsening conscious state in a patient where this is already impaired for some reason),
  - worsening respiratory function in a patient with neurotoxicity and causing hypoxia,
  - worsening pre-existing hypotension to the point where cerebral circulation is impaired,
  - being given in an excessive dose (particularly when given to children).

Hydrocortisone

Potential benefits

- It is not proven to reduce the incidence of antivenom reactions, particularly if given immediately before the antivenom, though there is a quoted (but unsupported by published data) benefit in reducing the incidence and severity of antivenom reactions, except in special circumstances. It may have been appropriate a few decades ago, when the antivenoms produced were much less pure, and reactions to them were common. The current reaction rate in Australia, without premedication, is low. It is, however, probably of benefit when given in the case of an allergic reaction, once it has occurred.
- It may be of benefit when given 30-60 minutes before antivenom, in the patient who has received the same antivenom before (either as a monovalent antivenom or as polyvalent antivenom). However, health care workers administering antivenom in this, and in all circumstances, must be alert and ready to treat any allergic reactions, which can still occur, even with premedication with steroid.
- It may reduce the incidence of allergic reactions in atopic people, i.e.: those with asthma, eczema, hay fever or multiple food or drug allergies.

Potential harm

- It has no significant adverse effects other than distracting staff from giving necessary treatments, such as early antivenom.

Penicillin

Potential benefits

- If there is established infection, a wound with a foreign body or that is grossly contaminated, penicillin will potentially be a suitable antibiotic.

Potential harm

- Allergic reactions to penicillin do occur. Care should be taken to ensure any antibiotic is given only after a previous history of drug allergy has been sought.
- The administration of an unnecessary drug can delay the administration of antivenom, and so increase the chance of significant complications such as worsening respiratory failure.

Intravenous Fluids

Potential benefits

- shock
- persistent vomiting
- the administration of antivenom
- for maintenance of hydration when nil by mouth because of respiratory failure or intubation, or because of an altered conscious state
- treatment of renal impairment and maintenance of urine output in myoglobinuria

Potential Harm

- when administering it delays the administration of antivenom
- the presence of an altered conscious state due to intracerebral haemorrhage – excessive IV fluid administration can further increase intracranial pressure
- can worsen respiratory function in the patient with severe renal failure pulmonary oedema (a risk in the severely oliguric and anuric patient)
- multiple failed attempts to insert an IV line at rural health centres is often noted at PMGH; these patients rarely appear to have needed the fluid, and the many attempts have caused them discomfort; the sites often subsequently become multiple sites of bleeding once a coagulopathy develops.
- may worsen a coagulopathy by further diluting low levels of clotting factors and platelets.

The specific treatments that do potentially provide significant benefit for the patient are listed below, and most are discussed in detail in subsequent chapters.

First Aid

Health care workers should teach this to the population in the area from which they draw their patients. It is a way they can help people to help themselves. They should also teach people how to AVOID snakebite (discussed in Chapter 5). Then they should note the results of their education efforts: are people presenting more promptly after snakebite, and more often with correct first aid having been applied? Have they been teaching proper first aid in a way that people can understand?

The first aid method taught in this course, and in Chapter 5, is proven to be of great benefit for delaying the onset of toxicity from elapid snakes, such as those found in Australia and Papua New Guinea. This Pressure Immobilisation Bandaging method, which essentially prevents the flow of venom components through the lymphatic system back to the heart, and thence to the blood circulation, from where it moves on to the various organs to exert its observed effects.

The following is a summary of the essential aspects of the recommended first aid:

- Move away from the snake; do not attempt to chase it away, to catch it or to kill it, but note its characteristics, if possible.
- The bitten person should sit or lie down.
- Those with them should try to calm them – they will be very anxious.
- Do not interfere with the bite site at all. Do not apply a tourniquet or other traditional first aid to the limb.
- Pressure immobilisation bandaging should be applied to the entire limb, ideally with elastic ("crepe") bandages as described previously.
- A splint should also be applied to the entire limb to prevent movement at knee and ankle, or at the elbow and wrist joints.
- If the bitten part is not on a limb, place a large pad over the wound and bandage this firmly in place.
- Do not allow the patient to walk or move unnecessarily.
- Transport the patient, by carrying or by vehicle, to the nearest health care facility where either the patient can be assessed and antivenom given, or to a place from where they can be urgently transported to such a place.
- Do not remove the first aid until the person is in a health care facility where antivenom is available, the correct antivenom chosen and ready to give.
- If a patient arrives at a health care facility soon after a bite (within 3 hours), the late application of pressure-immobilisation bandaging may be beneficial.

Antivenom

This is covered in depth in Chapter 11; only the essentials are covered here.

Premedication

Adrenaline

Potential benefits

- There is proven benefit from premedication with adrenaline in reducing the incidence and severity of antivenom reactions. It must be given by the correct route (subcutaneously, SC) and in the correct dose, or it will be either less effective or harmful, as with any medication given for any reason; further adrenaline should be available at the bedside.
- In hospitals, if the patient is in the care of senior staff, it may be appropriate to give no adrenaline, but to have an adrenaline infusion (6 mg in 1000ml 0.9% saline = 6 µg/ml) ready to give if needed starting at 1.0 ml/min. (or, alternatively, 6 mg in 100 ml starting at 0.1 ml/min.), i.e.: 6µg/min., and titrate upwards as required monitoring HR, BP & ECG.

Potential Harm

- There is clear evidence that adrenaline given intravenously increases the risk of hypertension, and therefore of bleeding, particularly intracranial bleeding, in coagulopathic patients, and deaths have occurred as a result. It is, therefore, no longer recommended in Australia.
- Adrenaline given intramuscularly can cause hypertension; this route is not recommended when giving it as a premedicant, though this route is accepted for the treatment of moderate to severe allergic reactions to antivenom, as is very cautious IV administration (0.5-1.0 µ/kg boluses initially); it can cause significant intramuscular haematoma, and be painful, and perhaps erratically absorbed, in patients with extensive myolysis.

Hydrocortisone

Based on the limited available evidence, this course recommends that this is given to the following people, ideally 30-60 minutes before antivenom, though it should not delay the administration of the antivenom:

- those with a previous history of antivenom administration,
- those working extensively with horses,
- atopic individuals (asthma, hayfever, eczema, nasal polyps),
- those with multiple food or drug allergies, or a previous life-threatening allergic reaction,
- those receiving multiple doses of antivenom,
- possibly those receiving polyvalent antivenom.

Indications for antivenom

(As in Chapter 12)

The indications for antivenom are specific symptoms or signs such as

- early collapse,
- cranial nerve weakness,
- abnormal bleeding,
- generalised muscular pain and tenderness,
- grossly discoloured urine (red or dark brown), or the pathology test results of
- incoagulable blood, by the whole blood clotting test (20WBCT),
- a grossly elevated serum creatine kinase level,
- haematuria, haemoglobinuria or myoglobinuria, or
- a positive SVDK test on a urine sample in the presence of non-specific or specific symptoms or signs of envenomation.

Selection of the most appropriate antivenom

This will be discussed elsewhere. *(See Chapter 11)*

Dosage and administration

In general, all patients require at least one ampoule of antivenom. The use of half ampoules is strongly discouraged, since the antivenom in one ampoule is apparently equivalent to the venom yield expressed in an average 'milking'. Experience in Australia has shown that people often require more than one, and up to 3 (except in the case of the western brown snake, where up to 25 ampoules has been needed to fully neutralise the venom effects). Children receive the same dose as adults, but diluted in a weight-adjusted volume of crystalloid.

Serum Sickness

This is a syndrome of rash, arthralgia, fever, lymphadenopathy, and a 'flu-like illness, and other less common symptoms such as headache, pleuritis, pericarditis, nephritis. It is due the deposition of immune complexes (venom-antivenom) in tissues. It occurs predictably 5-10 days after the administration of the antivenom, and may last a week.

Both the incidence and the severity of delayed serum sickness may be reduced by the having the patient take prednisone, at a dose of 50 mg (adult), or 1 mg/kg (child), once daily for five days after the administration of the antivenom. This is recommended after polyvalent antivenom, and after multiple doses of monovalent antivenom.

Treatment of Paralysis and Neurotoxicity

(See also Chapter 8)

The most important point in the care of the patient with neurotoxicity is that people die because of airway obstruction and aspiration before they would have died because of a lack of respiratory effort. This is particularly the case for patients with relatively healthy lungs. Those with co-morbidities will succumb sooner. Either way, they die a slow, hypoxic death that is both readily **preventable**, from good first aid, early appropriate antivenom, and good airway management and ventilatory support; it is not something that they can do anything about themselves, because all voluntary muscle is paralysed.

The treatment of neurotoxicity includes the following:

- Correct first aid, applied early.
- Rapid transport to the nearest antivenom supply with someone capable of correctly prescribing it.
- Appropriate patient positioning.
- Gentle oropharyngeal suction.
- Use of regular atropine to reduce oropharyngeal secretions, if intubation not possible.
- Supplemental oxygen to balance the reduced respiratory effort.
- The use of upper airway devices (Guedel, nasopharyngeal airways).
- Endotracheal intubation.
- Assisted or controlled ventilation.

Anticholinesterase drugs

(See Chapter 12)

The use of long-acting anticholinesterase drugs such as neostigmine can reverse the post-synaptic neurotoxicity of death adder venom. It has been used alone, with prolonged first aid, and as an adjunct to antivenom when this is in short supply. The unwanted muscarinic effects (bradycardia, salivation, sweating) are controlled with the use of atropine.

Treatment of Coagulation Disturbances

(See Chapter 9)

This has been fraught with misconceptions in the past. These are dealt with in Chapter 9. Essentially, the treatment for coagulopathy (a persistently positive 20WBCT or ongoing bleeding) is more antivenom. Only when adequate antivenom has been given (1-3 ampoules) and the patient has liver function impairment, or is bleeding heavily, should FFP and other blood products containing clotting factors be given.

Administering clotting factors when there is un-neutralised venom in the circulation will only lead to further clot formation, risking worsening organ dysfunction and further depletion of remaining clotting factors, and hence worsening of bleeding.

Additionally, the patient with frank unilateral pulmonary haemorrhage may need intubation, with the ETT passed into the other lung (the cuff in the other main bronchus), to secure oxygenation and prevent contamination of the opposite lung with blood.

Treatment of Rhabdomyolysis

(Chapter 10)

This centres around the maintenance of an alkaline urine, and a high urine output (2 ml/kg/hr), to reduce the toxic effects of filtered myoglobin on the renal tubules.

The aim is to reduce the severity of renal impairment that results. This is the primary cause of death in a number of patients admitted with snakebite.

Hyperkalaemia is another potentially dangerous effect of extensive myolysis, often made worse by renal impairment and subsequent metabolic acidosis. The most significant effects are cardiac, with ECG changes, bradycardias and ventricular tachycardia's, the effects of increasing levels. Aggressive treatment is warranted, as detailed in Chapter 10.

Compartment syndrome, where muscular blood supply is impaired by massive swelling of the muscles in that compartment, can lead to permanent injury, though the normal result of myolysis is complete recovery. Surgical intervention should be discouraged, since overseas experience has shown that this worsens the long-term outcome.

The final notable effect of extensive myolysis is pain. This should be treated first with paracetamol and codeine, and the addition of morphine only when maximal doses are being given regularly. Non-steroidal anti-inflammatory drugs are contraindicated because of the risks of worsened coagulopathy, and causing gastric bleeding and worsening of renal impairment.

Treatment of Cardiovascular Effects

(Chapter 10)

These rarely require active treatment. The exceptions are

- Hypotension, without significant blood loss; give IV crystalloid and monitor its effect.
- Severe bradycardia (less than 35 bpm), due to conduction and AV or SA nodal effects, may respond to the cautious administration of atropine. Note that the BP is not a reliable indicator of peripheral perfusion in bradycardia, and peripheral warmth and capillary return may be a better guide. Beware the child with a bradycardia – in children and infants this immediately precedes cardiac arrest due to hypoxia or volume loss. Also look for hypoxia due to respiratory failure in adults, as a cause of bradycardia.
- Hyperkalaemia, as above.

Conduction defects, dysrhythmias (tachycardia's and bradycardia's), and ST-segment changes may respond to a further dose of antivenom.

Treatment of Renal Effects

(See Chapter 10)

This is essentially the same as for the treatment of rhabdomyolysis. In the absence of significant myolysis, a urine output of around 1 ml/kg/hr should be the goal, to ensure that adequate hydration is being achieved, and to ensure excretion of venom components and venom-antivenom complexes.

Renal function may also be threatened by

- hypoxia, from airway obstruction, pulmonary aspiration, respiratory failure,
- hypotension, from any cause,
- severe anaemia,
- the effect of procoagulant toxins (DIC and intravascular thrombosis),
- direct nephrotoxic effects,
- delayed serum sickness and the glomerular deposition of immune complexes,

and these should be avoided or anticipated, and treated, where possible.

Treatment of Infections

(See Chapter 10)

Prophylactic antibiotics

This has been discussed above.
Antibiotics are only advised in the case of gross wound contamination, imbedded foreign bodies (remove them!), and established wound infection. Additionally, when pulmonary aspiration leads to a clinical pneumonia, broad spectrum antibiotic cover, including gram negative and anaerobic cover, is advisable.

Referral and transport of snakebite patients

Patient referral

Many snakebite patients are managed quite satisfactorily in rural centres, and generally only those patients who have developed significantly complications are sent to a larger centre for more specialised care. Generally this will be somewhere where there is a specialist physician, anaesthetist or paediatrician.

Sometimes, though, patients are referred on because of a lack of antivenom; this is very unfortunate because of the negative effects this has on patient care:

- greatly delayed antivenom administration,
- secondary increase in complications from envenomation,
- serious dangers of transporting an envenomed patient over long distances, often by road, often without a nursing or medical escort, and often by PMV,
- potential loss of one staff member who acts as escort,
- inconvenience and cost for the family.

It is vital that staff know when to refer patients to a higher level facility and when to seek advice, and that they actually do these things, when necessary.

Requests for advice should be sought in the event that the staff dealing with the patient are unable to decide what to do next for a patient; this advice may be sought from

- the senior medical person at that facility,
- a senior medical officer at the provincial hospital,
- the senior medical officer on duty in the Emergency Department at PMGH, or
- the consultant emergency physician at PMGH.

Patient Transport

The general principle of transporting a patient is that the standard of care should not drop from referring hospital to transport, transport to receiving hospital. While this is potentially difficult, the principle is exists 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 also often not possible, due to the state of the roads, or to the lack, or poor repair, of the local "ambulance". PMV 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 pickup, 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, 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 issues:

- Patient ready
    - family aware and available to also accompany the patient,
    - stable, and any ongoing treatment can be carried out in the transport vehicle (better to be intubated before transport, than during transport),
    - antivenom given, if indicated and available,
    - first aid applied, if indicated, and traditional first aid removed,
    - Any IV line well-secured.
- Staff member ready
    - capable of dealing with any likely problems with the patient en route,
    - personal items.
- Drugs and equipment ready
    - oxygen (enough for the journey),
    - resuscitation drugs and equipment (OP and NP airways, portable suction device, atropine, intubation equipment, Ambu-bag, IV fluid, adrenaline, morphine, diazepam); the facility that refers a lot of unwell of unstable patients should consider developing a Transport Bag for just this purpose.
- Communication complete
    - shift covered,
    - receiving hospital aware,
    - referral letter, results and x-rays with patient.

What to teach families if no staff member can accompany the patient:

- patient positioning
  - sitting up if still breathing reasonably well, and clearing secretions;
  - left or right lateral if there is pooling of secretions;
  - keep them in this position the entire journey, including when carrying them into the hospital;
- basic airway manoeuvres – chin lift and jaw thrust;
- 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;
- IV line care (if the decision is made that the patient needs to continue with this en route).

The family must also be given to take and give to the receiving hospital, a detailed letter, or a complete copy of the patient's notes for that admission, detailing the following:

- the bite history,
- initial and subsequent examination findings,
- the results and times of investigations,
- details and timing of any treatment,
- response to treatment,
- other progress,
- ongoing concerns and reasons for referral.

They should also bring any CXR, and the snake, if caught (only to PMGH, where DNA will be taken for research purposes; otherwise it should be kept in methylated spirits for later collection, the date and site of collection noted on the container).

The referring professional should note his/her name clearly on the letter, with a contact telephone number or radio frequency, so that they might receive feedback about their patient.