MANAGEMENT OF SNAKE BITE

- **DIAGNOSIS of ENVENOMATION**
  - venom is injected in 50% of bites (envenomation vs snake bite)
  - clinical signs
  - haematology tests (Coagulation tests, FBE, fdp’s)
  - snake venom detection kit test
- **FIRST-AID**
- **RESUSCITATION**
- **ANTIVENOM (selection, administration, dose)**
- **MANAGEMENT OF EFFECTS**
  - neurotoxicity
  - coagulopathy
  - rhabdomyolysis
  - shock
  - thrombocytic microangiopathy (haemolytic anaemia, thrombocytopenia, renal failure)

SYMPTOMS & SIGNS of SNAKE ENVENOMATION

- **EARLY (within 30 minutes)**
  - headache, nausea/vomiting, abdominal pain
  - coagulopathy
- **LATE (within several hours)**
  - cranial nerve palsies (ptosis, ext’ ophthalmoplegia, dysarthria, dysphonia, dysphagia)
  - limb & truncal weakness
  - respiratory failure
  - haemorrhage
- **VERY LATE (delayed presentation, wrong/inadequate treatment)**
  - prolonged paralysis
  - renal failure
  - uncontrollable haemorrhage

TOXINS IN AUSTRALIAN SNAKE VENOMS

- **SPECIES SPECIFIC, but in general venoms contain ...**
- **NEUROTOXINS** (pre & post-synaptic neuromuscular junction blockers)
- **PROCOAGULANTS** (strong)
- **ANTI-COAGULANTS** (weak)
- **Rhabdomyolysins**
- **Haemolysins** (weak)

TOXINS in TIGER SNAKE VENOM

- **NEUROTOXINS** (Numerous)
  - Notexin – single chain 119 aa protein, 13.5 kDa. Inhibits release of acetylcholine, MYOLYTIC
  - Notechis II-5, Notexin II-5b, Notechis 11’2, Notexin N, Toxins 1 & 2, Hta-1
- **PROCOAGULANT**
  - Prothrombin activator (Factor Xa-like activity), Protein 54kDa.
- **OTHERS**
  - Anticoagulant (very weak)
  - Haemolysin (very weak)
  - Smooth Muscle Stimulant
  - Lymphotoxic factor
  - Sensory nerve ending toxin

OUTCOME of SNAKE BITE in AUSTRALIA

- **MORTALITY**
  - 2-3/year (World 125,000)
  - Brown Snakes 38%, Tiger Snakes 19%
  - Early cardiorespiratory collapse 29%
- **MORBIDITY**
  - occasional long-term peripheral neurological deficits (loss of smell, numbness)
  - Renal failure

DISTRIBUTION OF DANGEROUS VENOMOUS SNAKES

Be aware of local species!

Ophiophobes – look away now!
Tiger snakes (*Notechis spp*)

- Eastern or Mainland Tiger snake
  
  (*N. scutatus*)

Black Tiger snakes

- eg: Chappell Island
  
  (*N. ater serventyi*)

Eastern or Mainland Tiger snake

(*N. scutatus*)

Brown Snake bite

Tiger Snake bite

Red-bellied Black Snake bite

Unidentified snake

Snake venom detection kit (enzyme immunoassay)

Dectes venom of Tiger, Brown, Black, Death Adder, Taipan genera in bite site swab, urine, blood, other biological samples. Indicates which antivenom to use (if clinically indicated)

Snake venom detection kit

SNAKE BITES

Brown Snake bite

Tiger Snake bite

Red-bellied Black Snake bite

Unidentified snake

SNAKE ANTIVENOM

- indications
- administration
  - premedication
  - infusion
- dose

SNAKE ANTIVENOMS

- Equine immunoglobulins - F(ab)_2

- Neutralising dose
  - Antivenom ampoules contain enough to neutralise (in vitro) average yield of venom from ‘miking’
  - Brown snake: Venom milked 4 - 67 mg. Venom injected 0.05-9.5 mg.
  - One vial Brown snake antivenom neutralises 10 mg venom.
  - Tiger snake: Neutralising dose for effects of Tiger snake venom unknown

- Available antivenoms
  - Monovalent (Tiger, Brown, Black, Death Adder, Taipan)
  - Polyvalent
  - Beaked Sea Snake (*Enhydrina schistosa*)

INDICATIONS FOR ANTIVENOM

- cardiorespiratory collapse/compromise
- paresis/paralysis
- coagulopathy (moderate-severe)
- general symptoms (headache, nausea/vomiting, abdominal pain) early after bite by dangerous species
DOSE of ANTIVENOM - CONTROVERSIAL

- CANNOT BE PRESCRIBED ACCURATELY
  (Although one ampoule neutralises venom in blood of victims)
- NEUTRALISATION DOSE varies according to:
  - species of snake
  - number of bites
  - location of snake
  - time since envenomation
  - effects of venom
  - size and age of victim
- TITRATE TO NEUTRALISE EFFECTS
  - eg until coagulation restored (but if used alone will lead to excess antivenom)

- “Tiger snake (Notechis spp) envenoming : Australian snake bite project (ASP-13)” Isbister et al. MJA 2012; 197: 173-177
  - Blood collected before and after antivenom
    - Antivenom dose
      - Median dose 2 vials (range 1-4 vials)
      - 10 patients: 1 vial
    - No venom in blood after 1 vial
    - Conclusion: “One vial binds all circulating venom”
  - “Snakebite in Australia: a practical approach to diagnosis and treatment” Isbister et al. MJA 2012; 197: 173-177
  - Data collected from 56 patients:
    - 39 severe coagulopathy
      - 21 coagulopathy alone
      - 10 coagulopathy + neurotoxicity
      - 7 coagulopathy + myotoxicity
      - 1 coagulopathy + neurotoxicity + myotoxicity
    - 14 partial coagulopathy
      - 10 coagulopathy alone
      - 2 coagulopathy + neurotoxicity
      - 2 coagulopathy + myotoxicity
    - 3 no coagulopathy
      - 1 neurotoxicity
      - 1 myotoxicity
      - 1 neurotoxicity + myotoxicity

Manufacturer’s (CSL Ltd, 2001) advice …

For tiger snake bites, the majority of patients will need antivenom. Any evidence of paralysis, myolysis, coagulopathy or kidney damage, or clear general symptoms of envenoming, such as vomiting or collapse, mandate the early use of antivenom. Start with at least 2 vials of CSL Tiger Snake Antivenom, or 4 if there is coagulopathy, severe paralysis, a multiple bite or the bite was by one of the larger subspecies of black tiger snake. Be prepared to give further doses to reverse the coagulopathy, or reduce the degree of severe myolysis. The extent and resolution of coagulopathy can be used to guide antivenom dosage

Manufacturers (CSL Ltd, 2013) advice ...

“Start with 1-2 vials of CSL Tiger Snake antivenom”

“It may not be possible to differentiate these cases from those that would benefit from a higher dose”

“The clinician should make the final decision regarding dosing, based on the circumstances of the individual patient”

ANTIVENOM ADMINISTRATION

- premedicate with adrenaline subcutaneously
- be prepared to treat anaphylaxis
- dilute in crystalloid and infuse slowly (rapidly in critical illness)
- prevent/treat serum sickness with steroid
  - multiple monovalent ampoules
  - polyvalent ampoule
Treatment of Consumption Coagulopathy

- Antivenom neutralises venom but does not, per se, restore coagulation factors (average 9 hrs to regenerate without FFP, 4 hours with FFP)
- Coagulation factors (FFP) if haemorrhage
- NOT heparin

ADVERSE REACTIONS to SNAKE ANTIVENOM

- ADVERSE REACTIONS (monovalent & polyvalent)
  - 8% (Trinca: MJA 1963; 1:275-280)
  - 12.9% (Sutherland & Lovering: MJA 1979; 2: 671-674)
  - 12.5% (Sutherland; MJA 1992; 157:734-739)

- TIGER SNAKE ANTIVENOM
  - 15% (Isbister et al, MJA 2012; 173-7)

- USE MONOVALENT WHEN POSSIBLE
  - less allergenic than polyvalent (7% vs 27%)

PREMEDICATION FOR SNAKE ANTIVENOM

- In a PRCT, adrenaline (0.25 mg SC) reduced acute adverse reactions to equine polyvalent antivenom from 43% to 11% (p = 0.0002), and decreased the severity of reactions.
  (Premawardhena et al. BMJ 1999; 318: 1041-43)
- RECOMMENDATION - ADRENALINE (subcutaneously)
  - 0.25 mg adult
  - 0.005-0.01 mg/kg child
  … 5-10 minutes before antivenom, once