Venomous snake bites

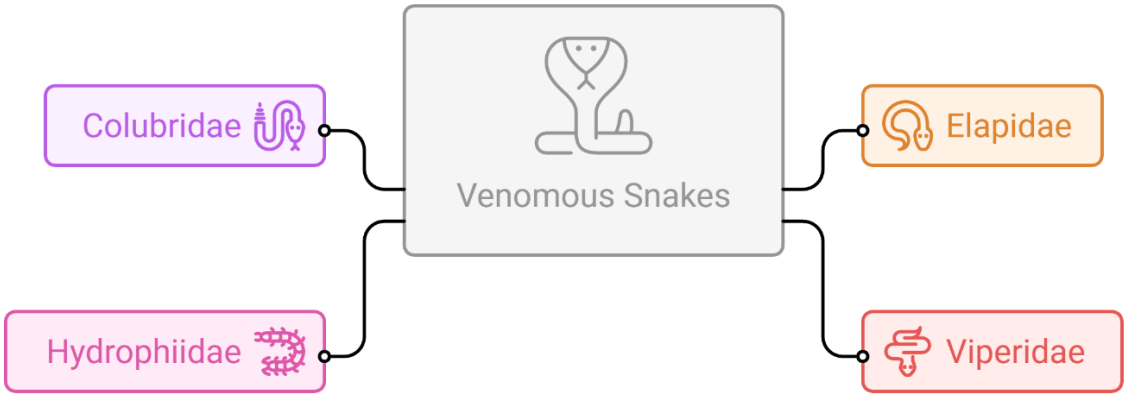
Families of Venomous Snakes

Introduction

- Venomous snakes are responsible for significant morbidity and mortality worldwide, particularly in tropical and subtropical regions.
- In clinical toxicology, understanding the taxonomy of venomous snakes is crucial, as it helps predict the type of envenomation syndrome and select appropriate antivenom therapy.

Major Families of Venomous Snakes

- There are **four main families** of venomous snakes relevant to human envenomation.
- Among these, the first three are of highest clinical significance:



A. Elapidae (Fixed front-fanged snakes)

- **Common Members:** Cobras, Kraits, Coral snakes, Sea snakes
- **Geographic Distribution:** Widely found in Asia, Australia, Africa, and the Americas
- **Fang Morphology:** Short, fixed, front-fanged
- **Venom Type:** *Primarily neurotoxic*
- **Example (India):**
  - *Naja naja* (Indian cobra)
  - *Bungarus caeruleus* (Common krait)

Effects:

- Neurotoxicity (paralysis)
- Minimal local tissue damage
- Respiratory failure in severe cases

B. Viperidae (Long front-fanged snakes)

- **Common Members:** True vipers and pit vipers

- **Geographic Distribution:** Worldwide (excluding Antarctica and Australia)
- **Fang Morphology:** Long, hinged, front-fanged (foldable)
- **Venom Type:** *Hemotoxic and cytotoxic*
- **Example (India):**
  - *Daboia russelii* (Russell's viper)
  - *Echis carinatus* (Saw-scaled viper)

Effects:

- Hemorrhage
- Coagulopathy
- Tissue necrosis
- Shock

C. Hydrophiidae (Sea snakes)

- **Common Members:** Beaked sea snake (*Enhydrina schistosa*)
- **Geographic Distribution:** Coastal waters of Indian and Pacific Oceans
- **Venom Type:** *Potent neurotoxin + myotoxin*
- **Envenomation Characteristics:**
  - Rhabdomyolysis
  - Myoglobinuria
  - Paralysis
  - Acute kidney injury

D. Colubridae (Rear-fanged snakes — mostly non-venomous)

- **Common Members:** Boomslang, Twig snakes
- **Note:** Majority are non-venomous or mildly venomous
- **Clinical Relevance:** Some, like the boomslang, have fatal hemotoxic venom, though envenomation is rare

Clinical Effects of Venoms

- The clinical presentation of snake venom toxicity depends on the species, type of venom, quantity injected, site of bite, and individual host factors (e.g., age, health status).

Neurotoxic Effects

Primarily seen with Elapidae (Cobras, Kraits, Sea snakes)

Mechanism:

- Neurotoxins block neuromuscular transmission.
  - **Presynaptic blockade:** prevents acetylcholine release (e.g., krait)
  - **Postsynaptic blockade:** blocks acetylcholine receptors (e.g., cobra)

Clinical Features:

- Ptosis (drooping eyelids)
- Diplopia (double vision)
- Ophthalmoplegia (paralysis of eye muscles)
- Difficulty in swallowing (dysphagia)
- Respiratory muscle paralysis → *respiratory arrest* (life-threatening)

Hemotoxic Effects

Mainly with Viperidae (e.g., Russell's Viper, Saw-scaled Viper)

Mechanism:

- Procoagulant enzymes activate clotting pathways → consumption coagulopathy (DIC)
- Damages endothelial cells → bleeding
- Platelet dysfunction

Clinical Features:

- Bleeding from gums, nose, bite site
- Hematuria (blood in urine)
- Hematemesis, melena
- Ecchymosis, purpura
- Shock, hypotension
- Acute renal failure (due to hemoglobinuria or direct nephrotoxicity)

Cytotoxic and Local Tissue Effects

Seen especially with Vipers

Mechanism:

- Enzymes like phospholipase A2 and metalloproteinases damage tissues

Clinical Features:

- Local pain and swelling
- Blister formation
- Hemorrhagic bullae
- Necrosis and gangrene

- Compartment syndrome (increased pressure within muscle compartments)
- May require surgical debridement or amputation

Myotoxic Effects

Prominent in Sea Snake and some Krait envenomation

Mechanism:

- Muscle breakdown → release of myoglobin into circulation

Clinical Features:

- Muscle tenderness, stiffness
- Dark red or cola-colored urine (myoglobinuria)
- Hyperkalemia → cardiac arrhythmias
- Acute kidney injury (from myoglobin deposits in renal tubules)

Systemic Manifestations

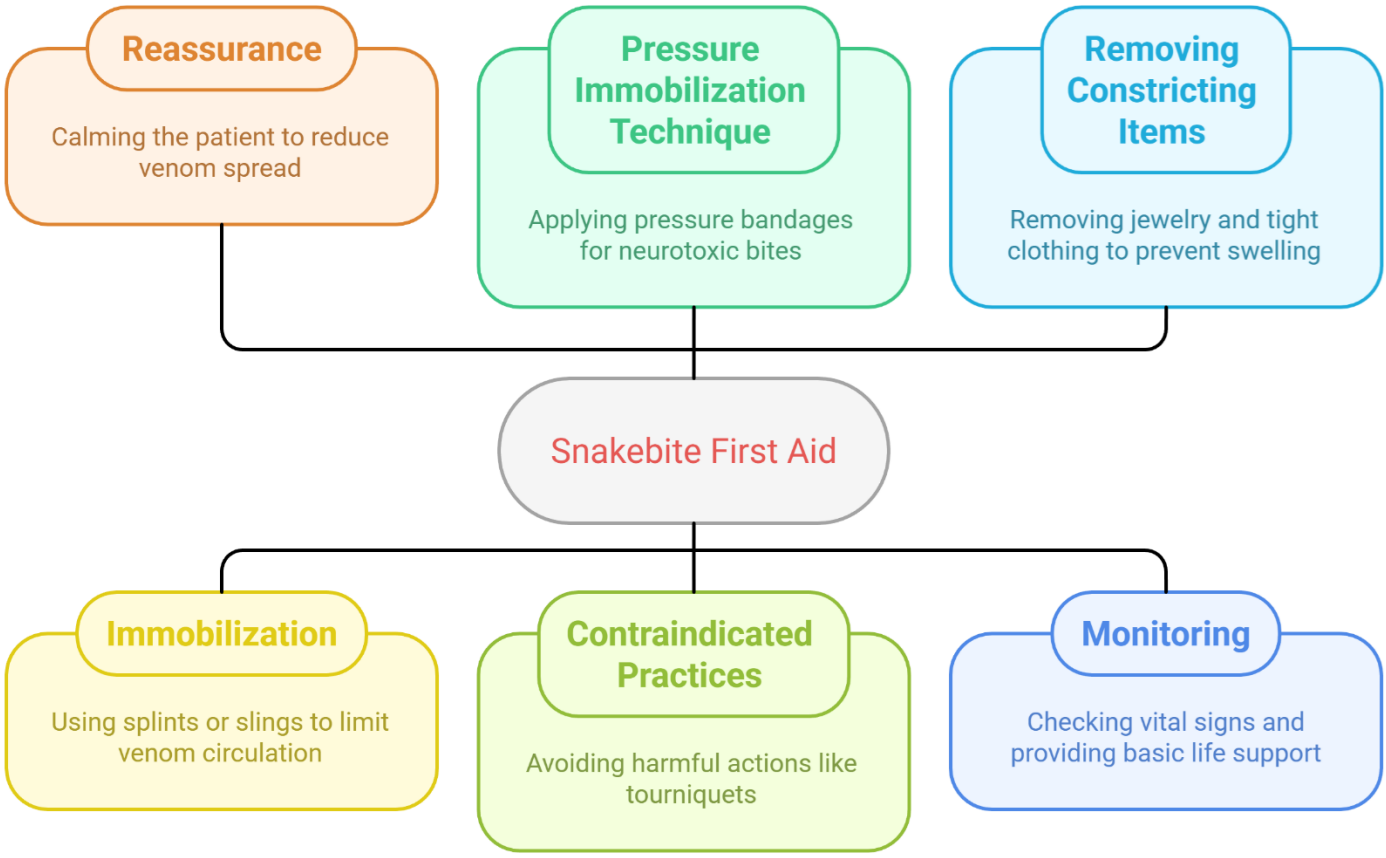
- Fever, chills
- Nausea, vomiting
- Hypotension, tachycardia
- Anaphylaxis (rare, usually from antivenom or repeated bites)

General Management as First Aid (Venomous snake bites)

Immediate Goals

- Prevent venom spread
- Preserve life and limb
- Minimize systemic absorption
- Rapidly transport the patient to a medical facility

Recommended First Aid Measures



1. Reassure and Calm the Patient

- Anxiety can increase heart rate and spread venom more rapidly.
- Reassurance reduces catecholamine-induced systemic venom absorption.

2. Immobilization of the Affected Limb

- Use a **splint** or a **sling** to immobilize the limb.
- Keep the limb at or **slightly below heart level** to reduce venom circulation.

3. Pressure Immobilization Technique (PIT)

- Recommended **only for neurotoxic bites** (e.g., elapids like kraits, cobras).
- Not advised for cytotoxic or hemotoxic bites (e.g., vipers) due to increased risk of local necrosis.

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