# Snake bite in Animals

Presented by: Ansuya Rajput
J-20-BV-1298

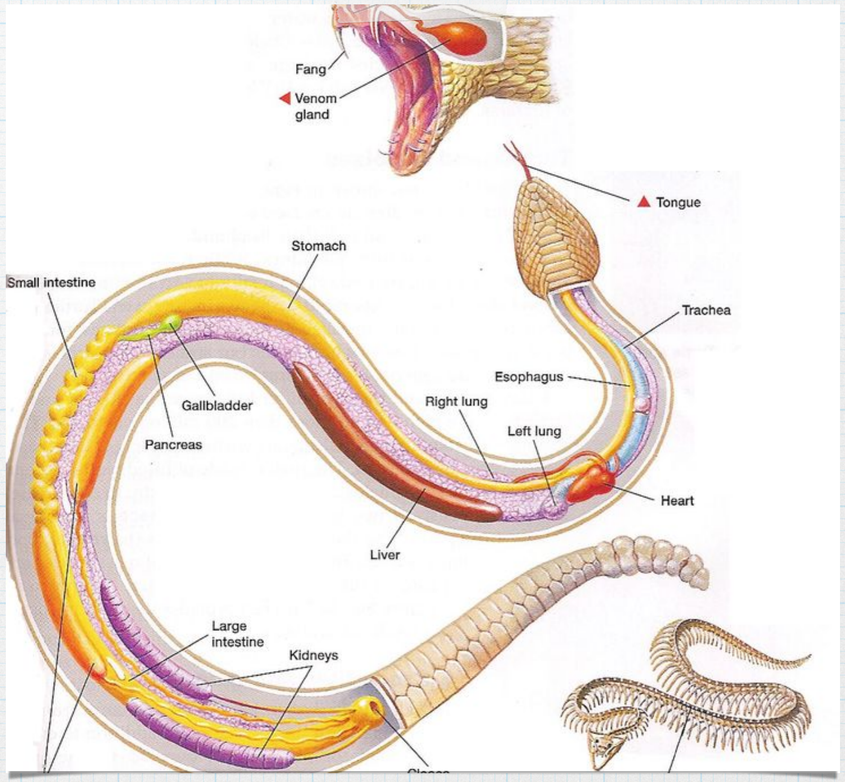
* India is estimated to have the highest snakebite in world
* Snakebite is an occupational hazard in an agricultural country like India
* Snakebites are more common in rural areas especially during monsoon season
* Out of 3000 species of snake, 375 species are poisonous. Venomous snakebites are responsible for more than 1,00,000 deaths in the world annually.
* Farm animals are more likely to bitten on jaw, limbs. Pigs are not highly susceptible due to extensive subcutaneous fat depots. Sheep may be bitten on udder.
* Horse appears mostly to be much more susceptible to venomous than any other species.



* The snakes are distributed in the world, according to their preference to the climate along with habitat
* Envenoming by snakes often faced by farmers, farm labourers, hunters & shepherds of tropical & subtropical countries.
* Inadequate facilities at primary health Center, ignorance of conventional treatment of snake bite by doctors; further delays appropriate treatment of victims and continue to increase morbidity and mortality.

# Snake morphology

* Anatomically, the skeletons of snakes lack limbs, with vestiges of such retained in more primitive groups like boids
* The backbone may consist of over 300 vertebrae with ribs that articulate with the same.
* A well muscled body, flexible skeleton and moving ribs enable snakes to move forward using variations of motion of lateral undulation, rectilinear movement and that resembling a concertina, as well as side-winding on loose ground.
* Snake skin is entirely covered in scales of different shapes and is dry to touch, with a texture resembling slightly rough upholstery.



# Taxonomy of snake

* Class : Reptilia - Reptiles
* Subclass: Lepidosauria
* Order : Squamata - scaled reptiles
* Suborder : Ophidia, serpentes - snake

There are 14 families under the title of non - venomous snakes and 4 families of a venomous type are listed below under the Colubroidea superfamily.

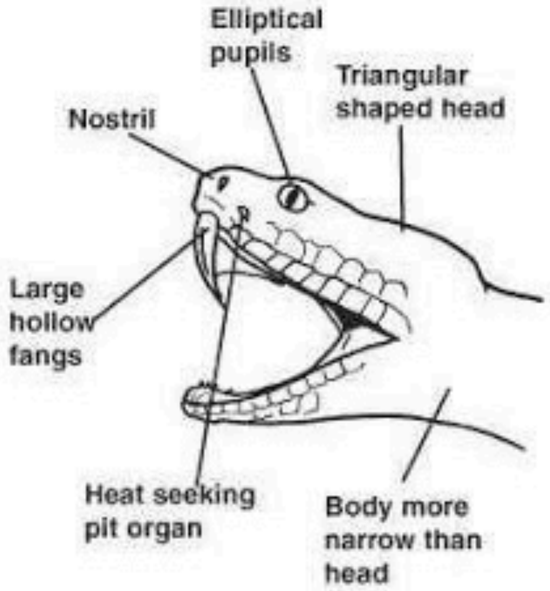
Superfamily: Colubroidea - Colubroid snakes

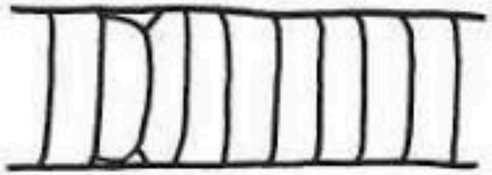
- Family: Colubridae- Colubrid snakes
- Family: Atractaspididae - Burrowing asps
- Family: Viperidae - Viperids
- Family: Elapidae - Elapids

| Venomous Snake | Non Venomous Snakes |
| --- | --- |
| Tail : may be compressed or flat | Tail : not compressed |
| Head scale: Large or small (viper) | Several small teeth. |
| Fang: two grooved/ tubular and bite leaves two puncture | No fang. Bite leaves semi circular teeth marks. |
| Belly plate : transverse plate touching sides (may or may not) | Transverse plates not completely across to sides or little plates |

| Venomous snake: Elapines | Venomous snake: Viperines |
| --- | --- |
| Species : cobra,  krait, mamba , coral snake | Species : Russel viper, rattle snake, pit viper, puffadder |
| Fang : short, hangs on and chew to envenomate | Fang : long, hollow and hinges, inject venom on strike and withdraw |
| Pupil : circular | Pupil : elliptical |
| Toxin : mostly neurotoxic | Toxin : mostly haemotoxic (pro and anti coagulant) , necrotising |
| Death : paralysis of respiratory centre and muscles (curariform effect) | Death due to septicaemia |

## Venomous



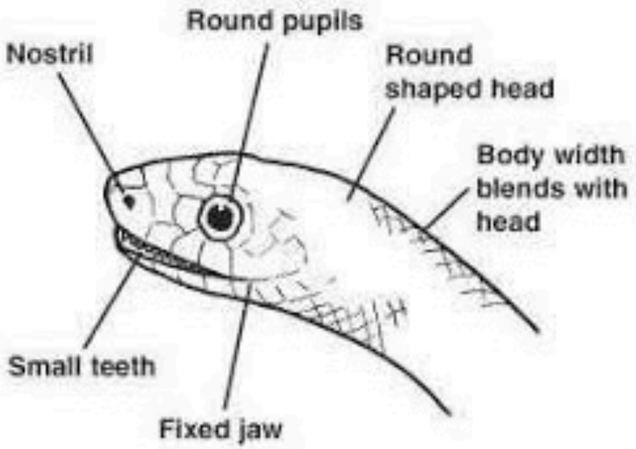
Scales on underside of tail in a single row

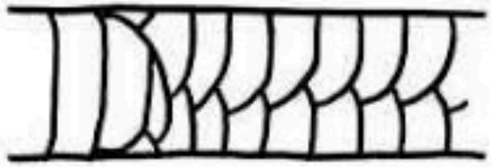


Rattlesnake tail is made up of loosely linked buttons




## Non venomous and Coral Snake



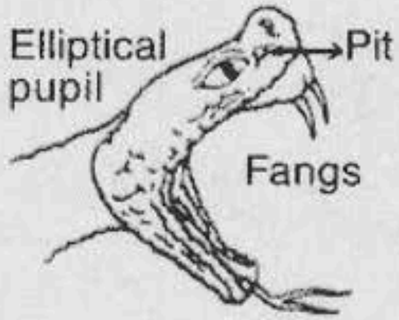
Scales on underside of tail normally in a double row

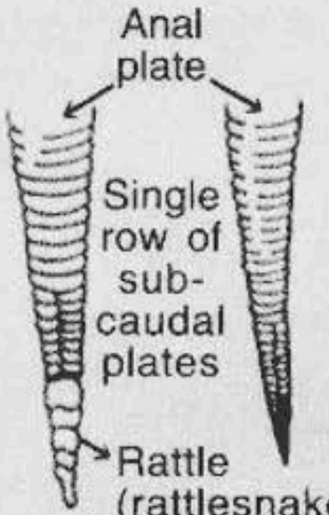
**NOTE: The Coral Snake is venomous and has round pupils and hooked teeth, as opposed to fangs!**

## Poisonous Snake



Triangle-shaped head



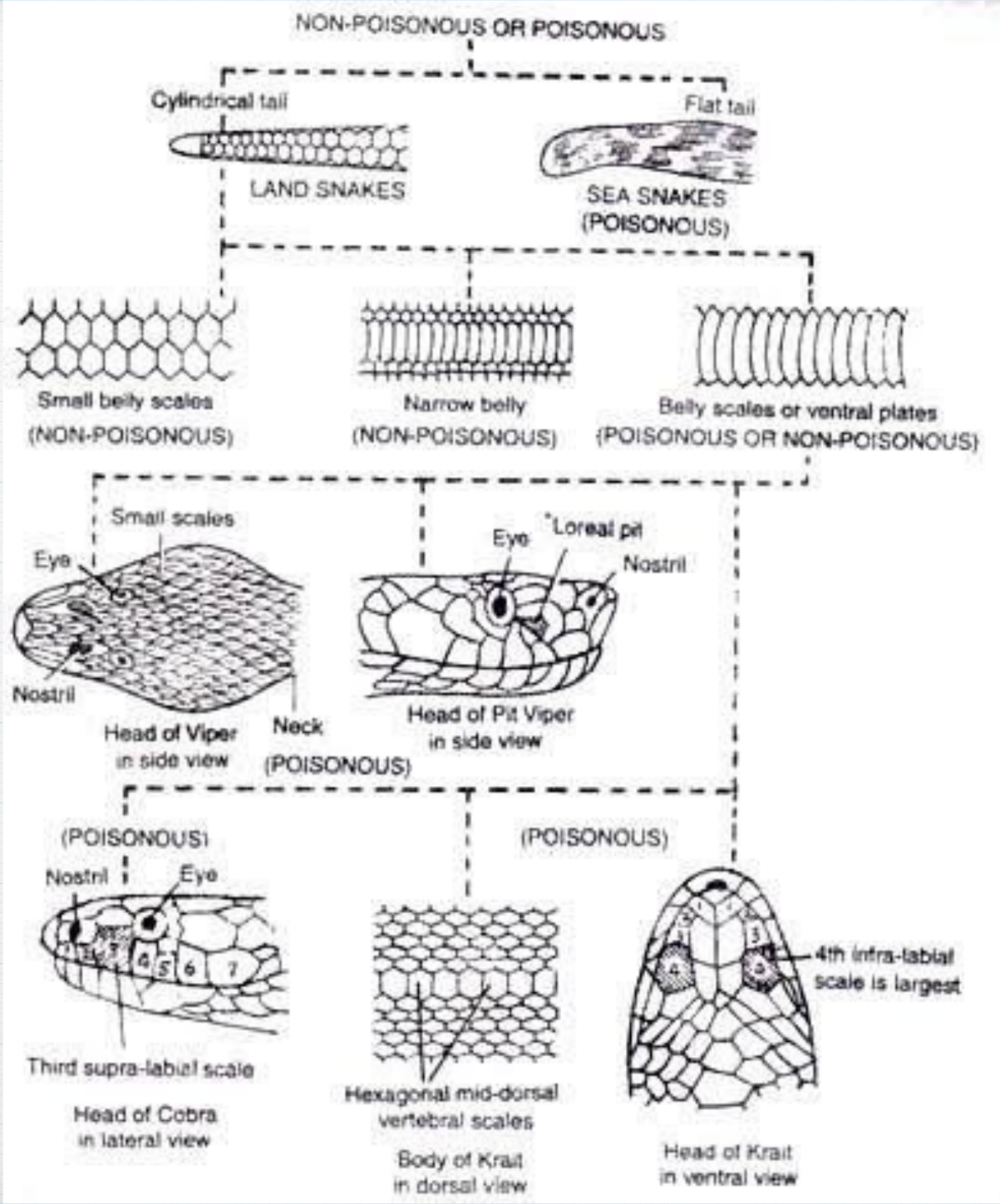

## Non-Poisonous Snake



Rounded head







NON-POISONOUS OR POISONOUS
Cylindrical tail
Flat tail
LAND SNAKES
SEA SNAKES
(POISONOUS)
Small belly scales
(NON-POISONOUS)
Narrow belly
(NON-POISONOUS)
Belly scales or ventral plates
(POISONOUS OR NON-POISONOUS)
Small scales
Eye
Nostril
Head of Viper
in side view
Neck
(POISONOUS)
Eye
Loreal pit
Nostril
Head of Pit Viper
in side view
(POISONOUS)
Nostril
Eye
1
2
3
4
5
6
7
Third supra-labial scale
Head of Cobra
in lateral view
(POISONOUS)
Hexagonal mid-dorsal
vertebral scales
Body of Krait
in dorsal view
1
2
3
4
5
4th infra-labial
scale is largest
Head of Krait
in ventral view

# Venomous snakes in India

In India around 60 venomous snakes species are present , out of which four are the deadliest, referred as "Big four"

1. Russell's viper ( Daboia russelii )
2. Common krait (Bungarus caeruleus)
3. Indian cobra ( Naja naja)
4. Saw- scaled viper (Echis carinatus)

# Russell's viper

- Pitless viper
- Cause maximum no of deaths in India
- Found in almost all parts of India
- Body is short (upto 1.5 metres)
- Body is light brown colour. Dark black or brown rings are present all along the body.
- Triangular head
- Venom is hemotoxic



# Common krait (Bungarus caeruleus)



- It is bluish black or black colour. Several cross bands of white or light coloured present along the body.
- Head is narrow
- Body is elongated and cylindrical.
- Hexagonal enlarged dorsal shield is present.
- Venom is neurotoxic.



# Indian cobra

- Body : brown to black in colour. Length: 2m
- Commonly called as Nag.
- It can dilates the neck and can be identified by dark mark on the dorsal side of head.
- Fangs are small .
- Third supra labial shield touch the nostril and eye
- Venom is neurotoxic





# Saw-scaled viper

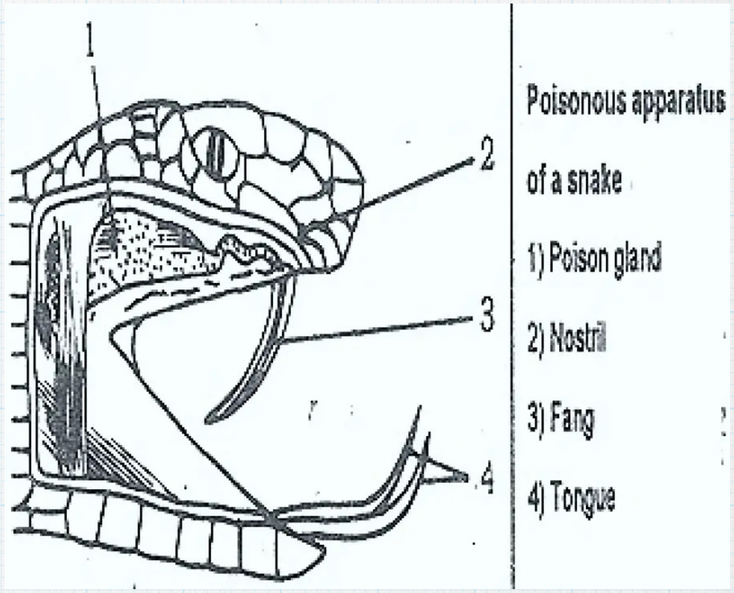
- After Russell's viper, it is the most common viper in India. Smallest among big four (0.3 to 0.5 m)
- Colour is light to dark and sandy brown to grey. It shows camouflage in the background
- They have zigzag darker pattern all over the body. Large eye and wide head .
- It coils it's body in the shape of 8. Scales are rough and it produce sound of a saw cutting wood by rubbing its scale.
- Venom is hemotoxic.





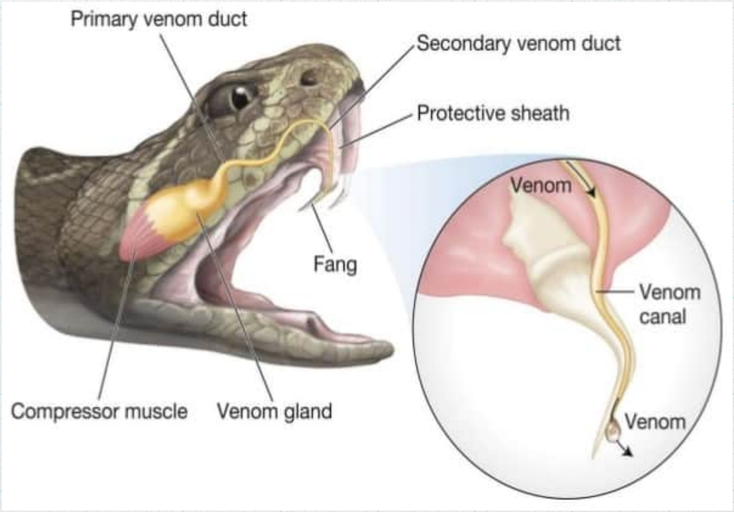
# Venom apparatus

Consist of a pair of poison glands, their ducts and a pair of fangs. In poisonous snakes the glands are situated one or either side of the upper jaw. The poison glands are possibly the superior labial glands or parotid glands. The poison glands are held in position by ligaments.




## Fangs

The fangs are sharply pointed and enlarged maxillary teeth. Fangs are long sharply pointed and hook like, being extremely hard and calcified with a superficial enamel layer. Fangs regenerates when lost. Fangs can be classified as follows:




According to the structural differences of poison fangs:

I) Open type as in cobra the poison groove are open and II) Closed type as in vipers, the poison groove forms a tunnel having two openings one at the base and one near the apex

According to the position of poison fangs:

Most snakes have several tooth bearing bones including four (the premaxilla, Maxilla, pterygoid and palatine) in the upper jaw and dentine in the lower jaw. The teeth of modern snakes are classically divided into four types, three of which are classically called fangs . The name of all the teeth involves the Greek word glyph, which means grooves . They are :

## Solenoglyphous

**Ex : vipers and rattle snakes.**

Fangs are long and tubular and attached to snake's maxillary bone. The maxilla is hinged so that the fangs can be folded back parallel to the jaws when the mouth is closed or erected perpendicular to the jaw when snake is striking. They have hollow core that receives venom from the venom gland

## Proteroglyphous

**Ex : Elapids and sea snakes**

Fangs are in front of mouth and are about three times shorter than solenoglyphous Unlike solenoglyphous, some have other teeth on maxilla behind fangs. In both Elapids and vipers, there are usually at least two fangs on each maxilla at any one time, one that is in use and one that is reserved. Smaller and rounded orifices.

## Opisthoglyphous

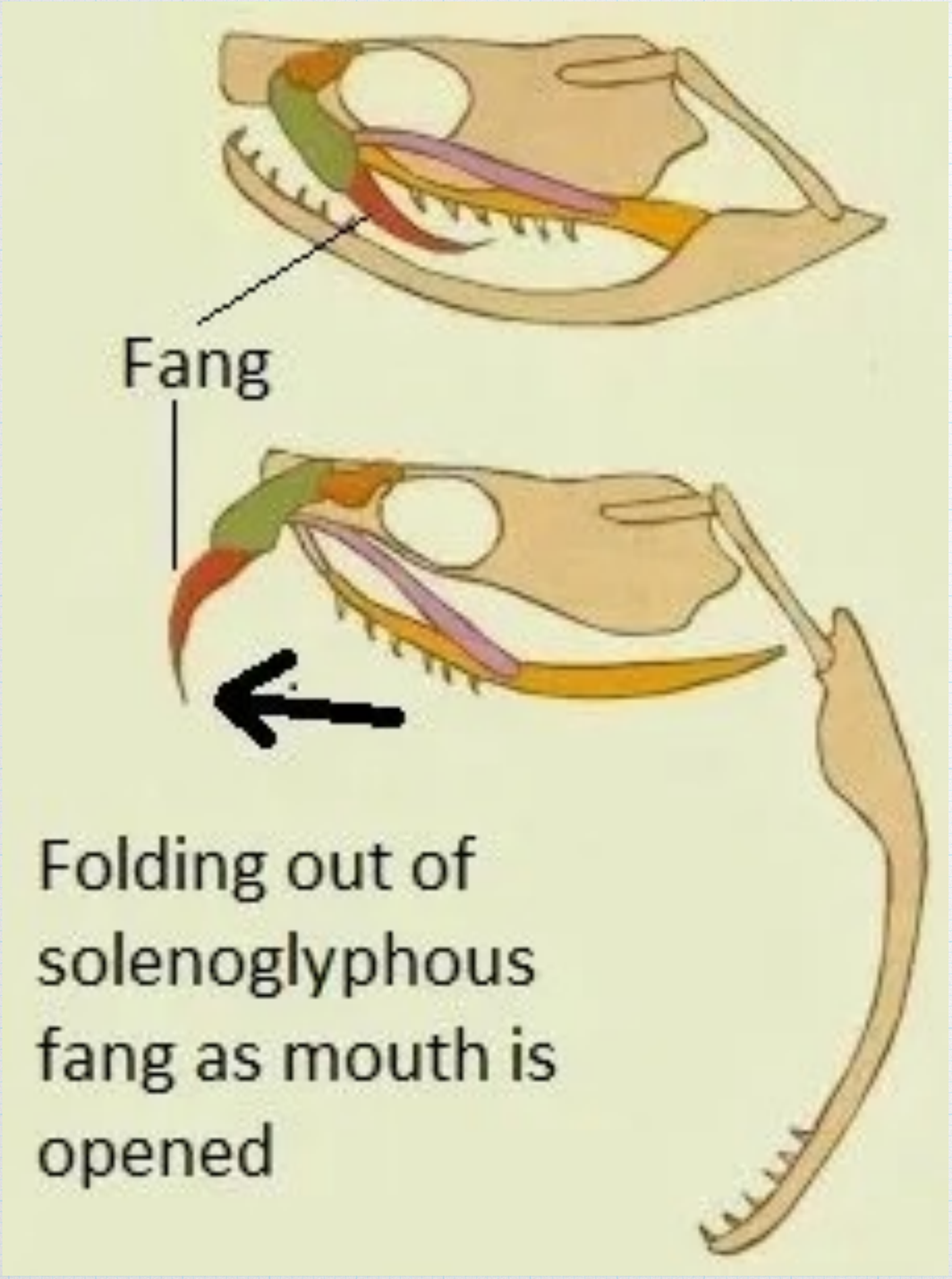
**Ex : some colubrids snakes**

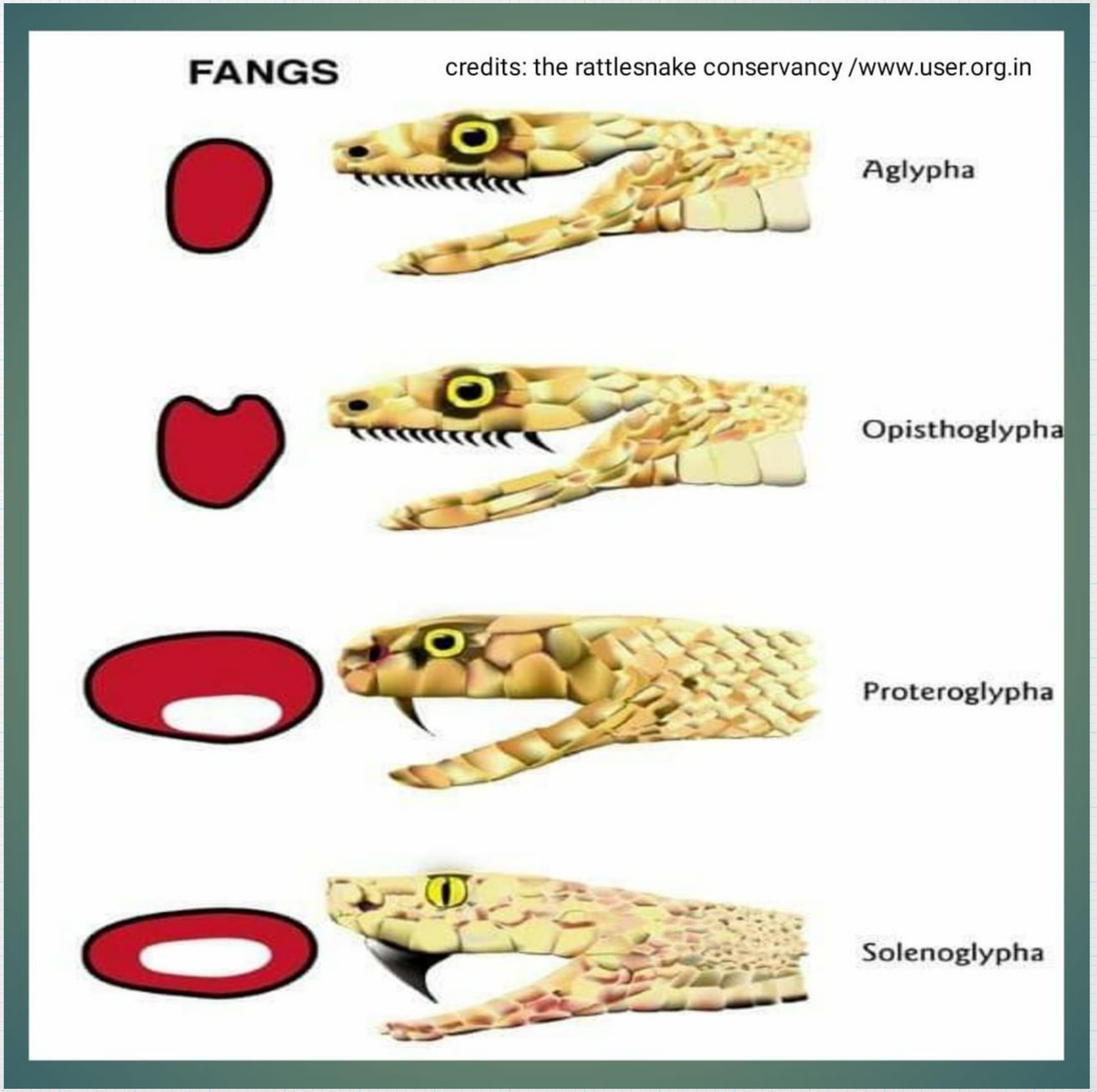
These are grooved rather than hollow and are found near the back of the maxilla, behind normal teeth. Most opisthoglyphous fangs are connected to Duvernoy's gland which differ from true venom glands as they lack associated muscles to generate the pressure to evacuate venom.

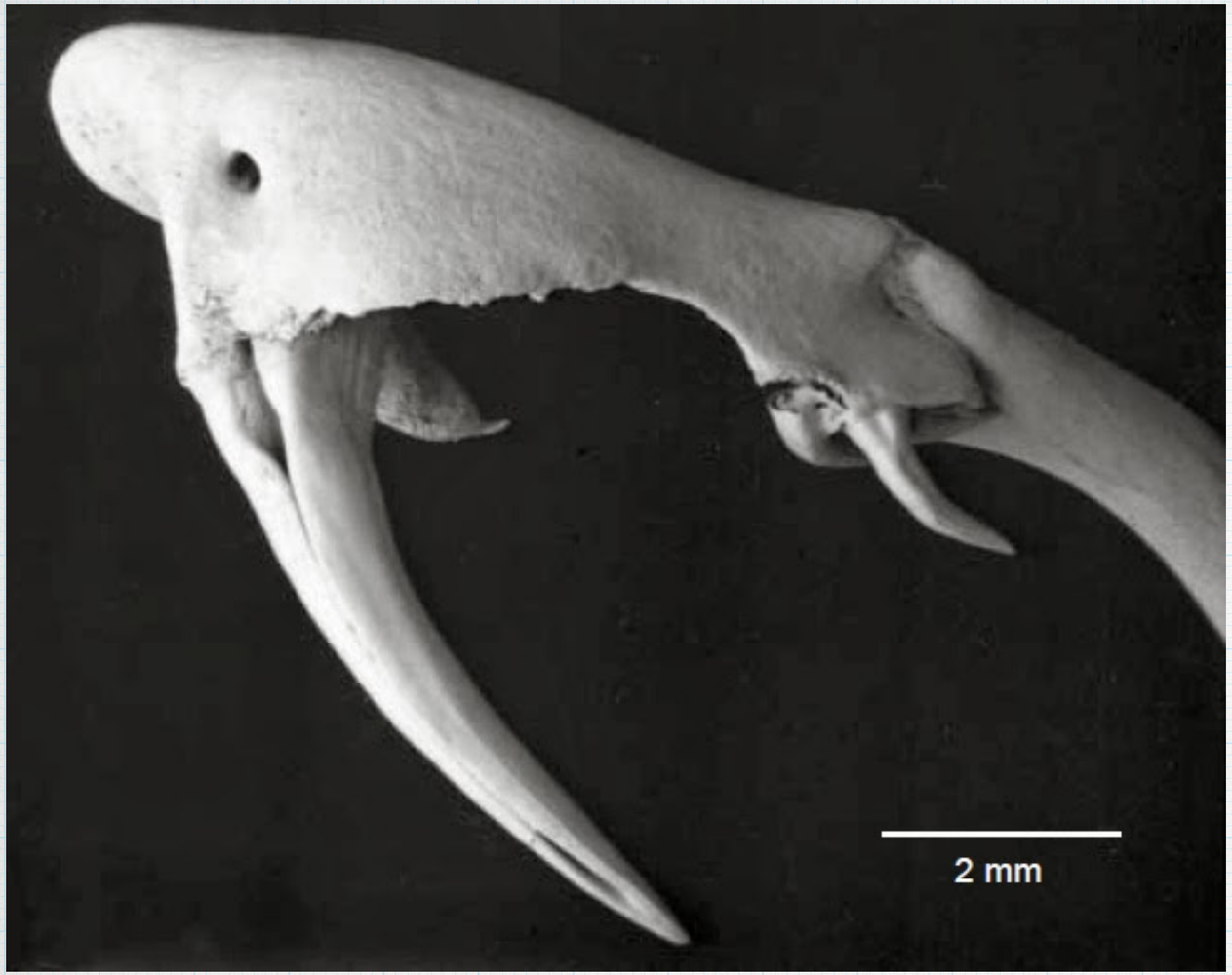
## Aglyphous

**Ex: python and boa**

This word is used to describe u modified teeth, essentially non fangs. All snakes, even those that possess fangs of the first three types have aglyphous teeth which they use for grasping their prey. This species has enlarged posterior maxillary teeth that lack grooves.


Fang
Folding out of solenoglyphous fang as mouth is opened

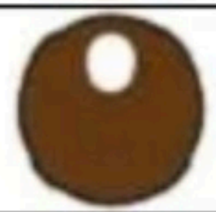
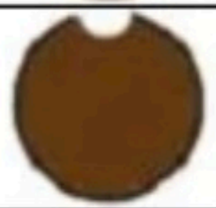

FANGS
credits: the rattlesnake conservancy /www.user.org.in
Aglypha
Opisthoglypha
Proteroglypha
Solenoglypha




Maxilla of proteroglyphous snake



Opisthoglyphous fangs of Boomslang (Dispholidus typhus)

| | Meaning | Cross-section | Position in mouth | Example snake |
|---|---|---|---|---|
| Aglyphous tooth | "no groove" |  | General | Python, blind "worm" |
| Solenoglyphous fang | "pipe grooved" |  | Front/hinged | Puff adder, Gaboon viper |
| Proteroglyphous fang | "forward grooved" |  | Front/fixed | Cobra, mamba |
| Opisthoglyphous fang | "rear grooved" |  | Back | Boomslang |

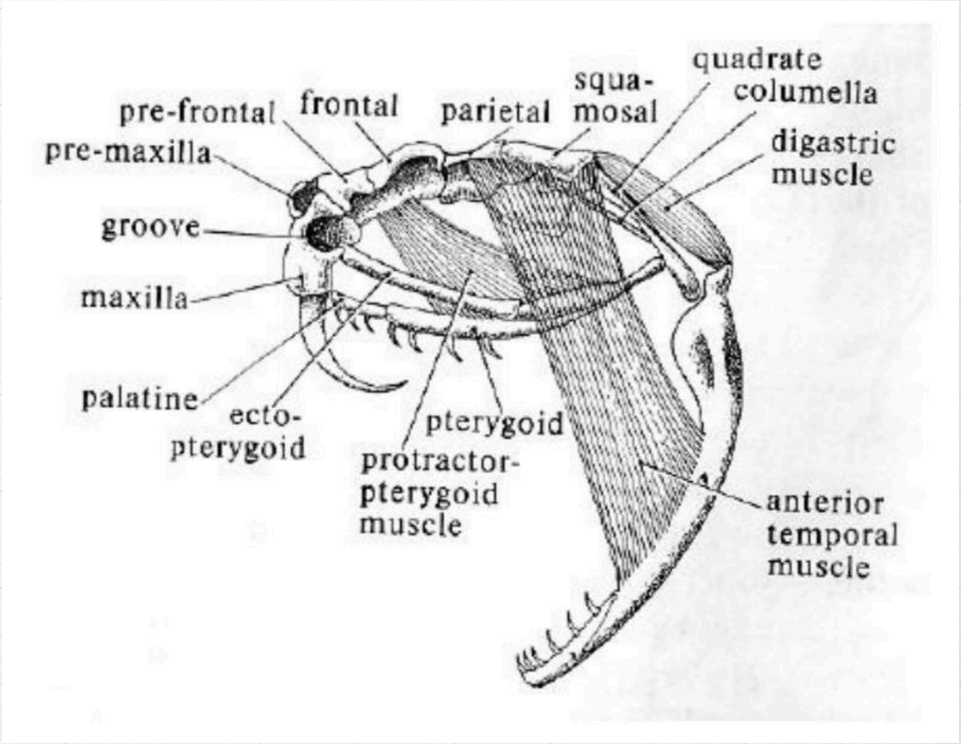
# Muscles associated with snake biting mechanism

The poison apparatus is associated with specialised bands of three types of muscles viz

1. Digastric muscle - attached to squamosal of the skull at one end and articular of the lower jaw at the other end. It helps in opening the jaw.

2. Sphenopterygoid - attached anteriorly to the spheroidal region and posteriorly to the dorsal surface of pterygoid. It assists in pulling the pterygoid forward

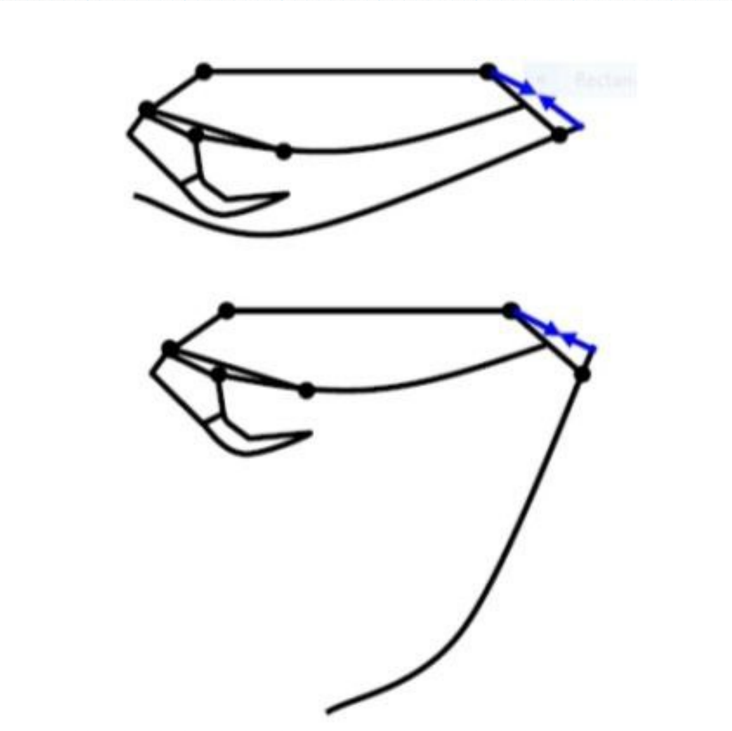
3. Anterior and posterior temporalis- attached to the side walls of the cranium and the lower jaw. They help in closing the lower jaw.



# Biting mechanism

## 1. Opening of the mouth :

By the contraction of digastric muscles the mouth opened ( lower jaw moves down) .

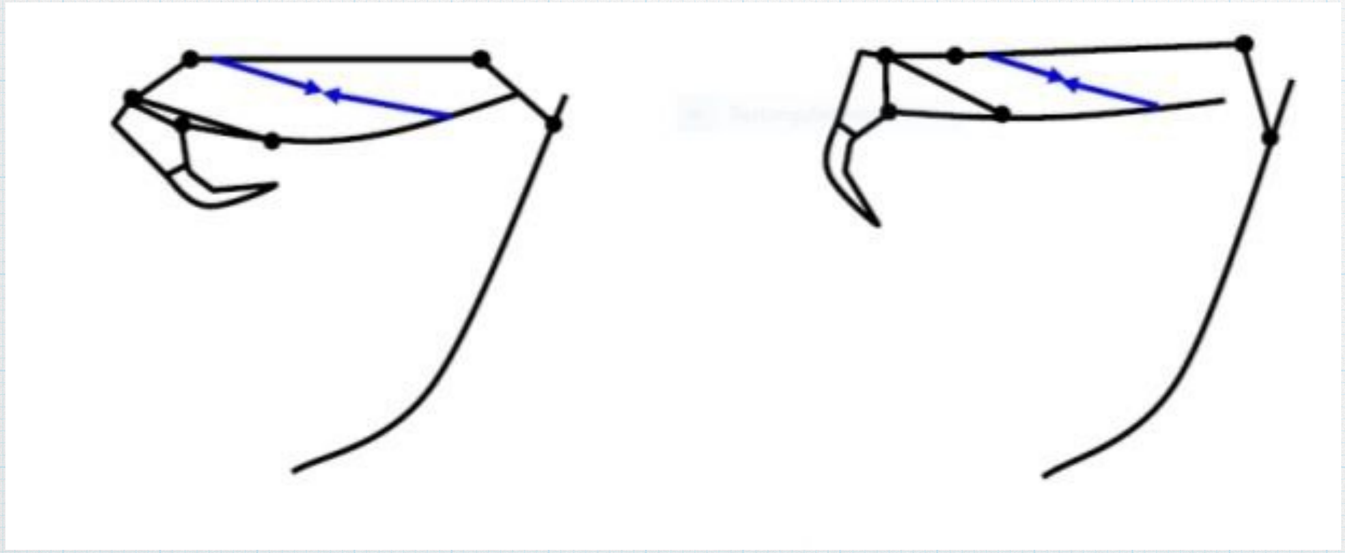


Contraction of digastric bring about opening of mouth

# 2. Rotation of Maxilla

* As the mouth opens the lower jaw moves down and the lower end of quadrate moves forward. Quadrate and squamosal are very movable. The pterygoid is movably attached to the palatine. Quadrate pushes the pterygoid forward and the pterygo - palatine joint belt.

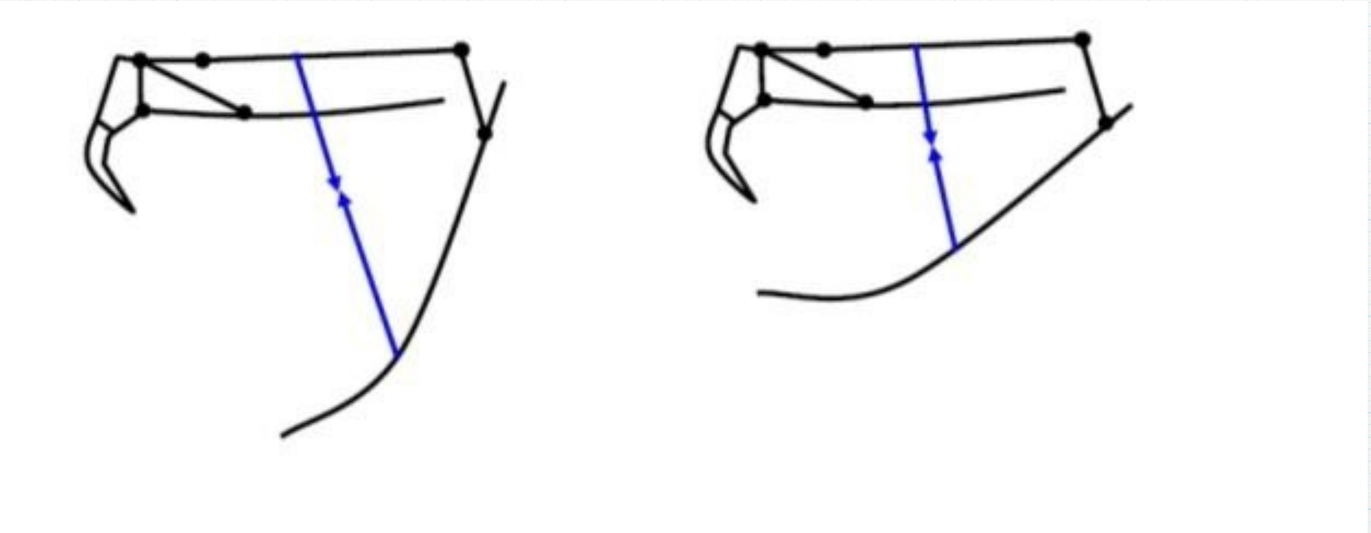
* This forward movement of the pterygoid is conveyed by the trans palatine bone to the maxilla and causes it to rotate through 90 degrees upon its prefrontal articulation in such a way that the surface to which the fang is attached is carried forward and ventral ward and the fang is erected i.e made to project downwards at the front end of the mouth. The contraction of sphenopterygoid muscles also helps in the movement of pterygoid forward.



Sphenopterygoid contracts and bring about three rotation of maxilla and elevation of fangs.

# 3. Closing of mouth

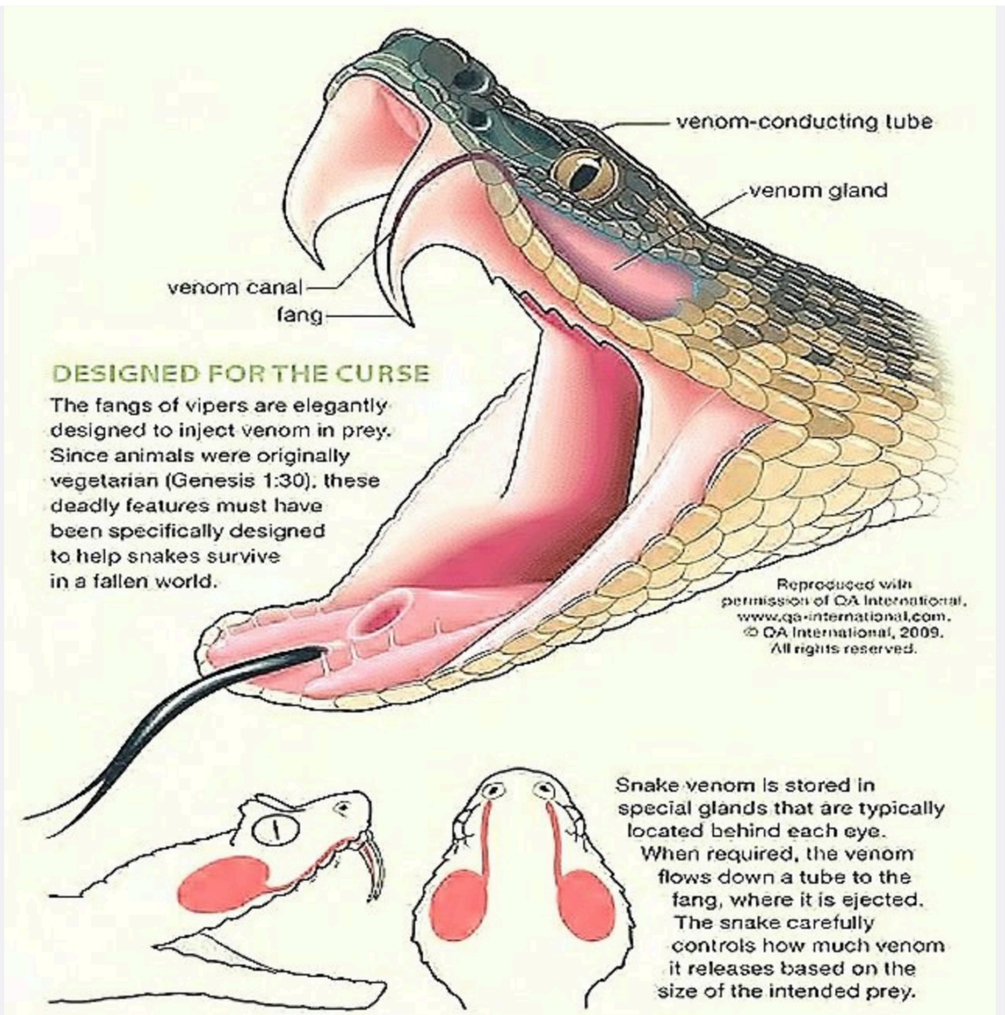
The closing of the mouth is brought about by the contraction of the temporalis and Sphenopterygoid muscles. The point of fang is directed backward while the mouth is closed. It takes longer time to open the mouth than to close it .



Temporalis helps in closing the mouth.

# Transference of venom

During the contraction of the digastric muscle the posterior ligament is relaxed and during the rotation of the squamosal bone the fan shaped ligaments are stretched to squeeze the wall of the poison gland. This makes the poison to come out of the poison gland through the poison duct and fang



# Snake venom

A pair of salivary glands secretes a powerful multipurpose enzyme fluid (venom) that flow at the time of envenoming through fine channels or grooved teeth called fangs.

Venom secretion is more in warmer months with high morbity and fatality. Darker the snake, it secretes more venom as compared to a light coloured because of the rise in body temperature of dark skin snake, the venom is in more fluid state and injected rapidly with high speed and maximum quantity in short time. Light coloured skin because of low body temp, the venom is thick and hence less amount is injected.

Most snakes inject 10% of the available venom in single strike except Russell's viper which inject 75% of stored venom in one bite due to big long sharp curved fangs. At times snake only bite without envenoming called as "defensive bite or dry bite" while the bite with envenoming is called as the "professional bite". Snake can bite and continue to secrete venom a number of times in succession.

# Composition of snake venom

The snake venom is very complex poison consisting of more than 50 components and any single venom contains a minimum of 10 compounds.

Chemically it is composed of 90% water with 5-15 numbers of enzymes and 3-12 non - enzymatic proteins, peptides, metals and amino acids, nucleotides, carbohydrates, biogenic amines and various activators and deactivators of physiological processes.

These components exert toxic or lethal effects on skin & nervous, respiratory renal & cardiovascular system.

The primary purpose of envenomation is to immobilise prey and predigest victims tissue.

Phospholipase A2 is found in the majority of venom. It destroys motochondria, RBCs, leukocytes, platelets, peripheral nerve endings, skeletal muscles, vascular endothelium, presynaptic neurotoxicity, opiate like sedative effects and auto pharmacological release of histamine (anaphylaxis)

Hyaluronidase is called the spreading factor because it cleaves hyaluronic acid in collagen, allowing rapid penetration of the other venom into the victims tissue.

Proteolytic enzymes are responsible for local changes in permeability leading edema, blistering, bruising and local necrosis.

Myotoxins destroy muscle tissue, sometimes incurring permanent damage

## Neurotoxins

Neurotoxins are the important components of Elapids snake venom. Toxins can be categorised chiefly into two types - alpha and beta neurotoxins. Proportion of alpha neurotoxin is more as compared to beta .

Alpha neurotoxin act by binding to nicotine receptors in the post synaptic location resulting into flaccid paralysis. Beta neurotoxin facilitates the nerve impulse transmission at the presynaptic nerve terminals that lead to spastic Paralysis.

# Cardiotoxins

Cardiotoxins are found in snake venom are direct lytic factor, cytotoxic & cobramine. The contractile ability of cardiac muscle is lost due to Cardiotoxins which is seen normally as a response to the stimulus. It also blocks the action of acetylcholine resulting in accumulation of acetylcholine in cardiac and skeleton muscles leading to depolarising type of neuromuscular blockade.

# Complement Activating Proteins

The snake venom contains some complement activating proteins which helps in release of anaphylotoxins that increase the vascular permeability of local blood vessels leading to quick absorption of the toxins in the blood stream.

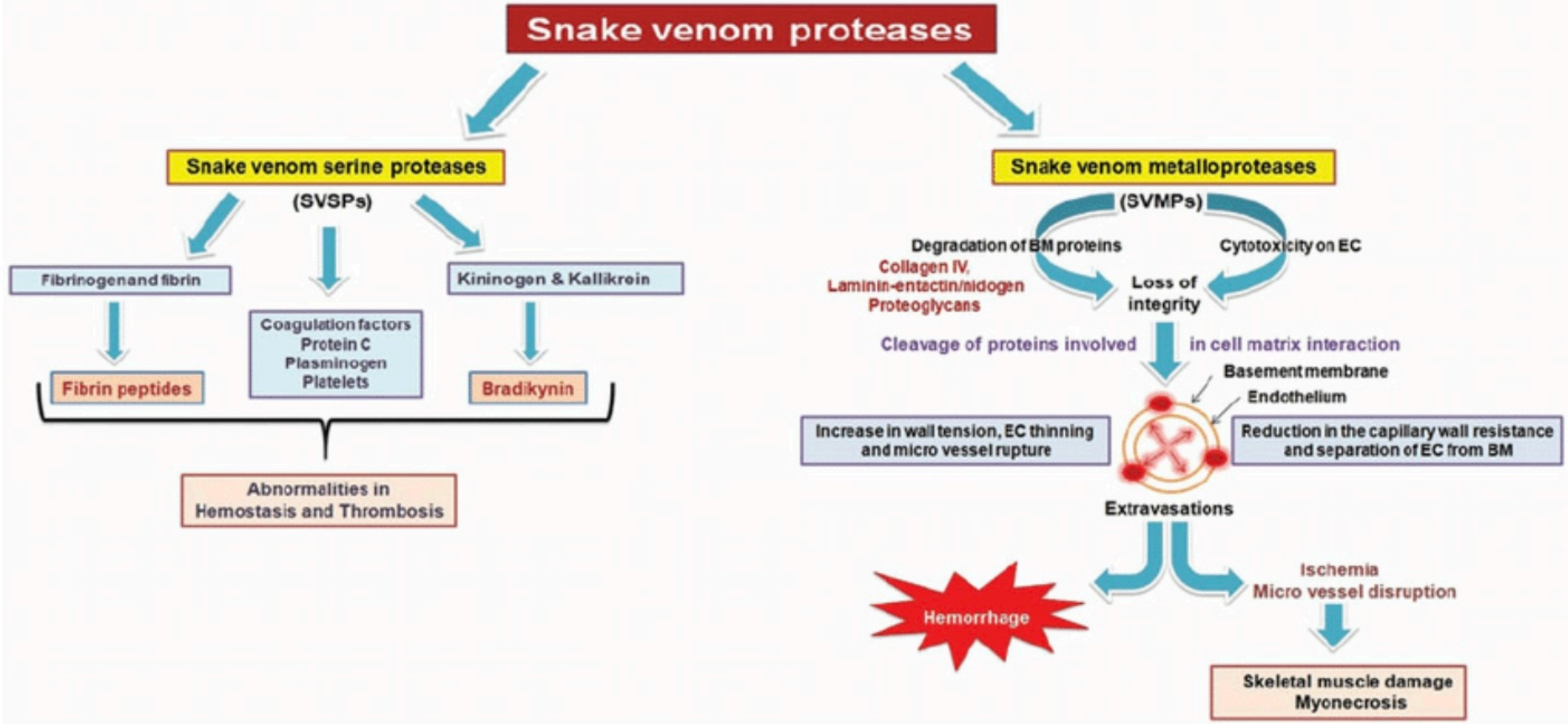
# Platelet Activating Protein

The platelet activating principles present in venom may either stimulate or deplete the platelet action. Phospholipase A2, serine proteases & glycoproteins are the Agents in the venom which stimulate the action of platelets.

# Blood clotting factors

Snake venoms are rich in a large variety of proteins and peptides that can interfere with the haemostatic system. Some enzymes like thrombocytin , ancord, Batroxobin, catroxobin, flavoxobin, and gabonase are present in the snake venom which act like thrombin, facilitating the clotting of blood.

# Pathogenesis of snake venom



# Clinical signs :

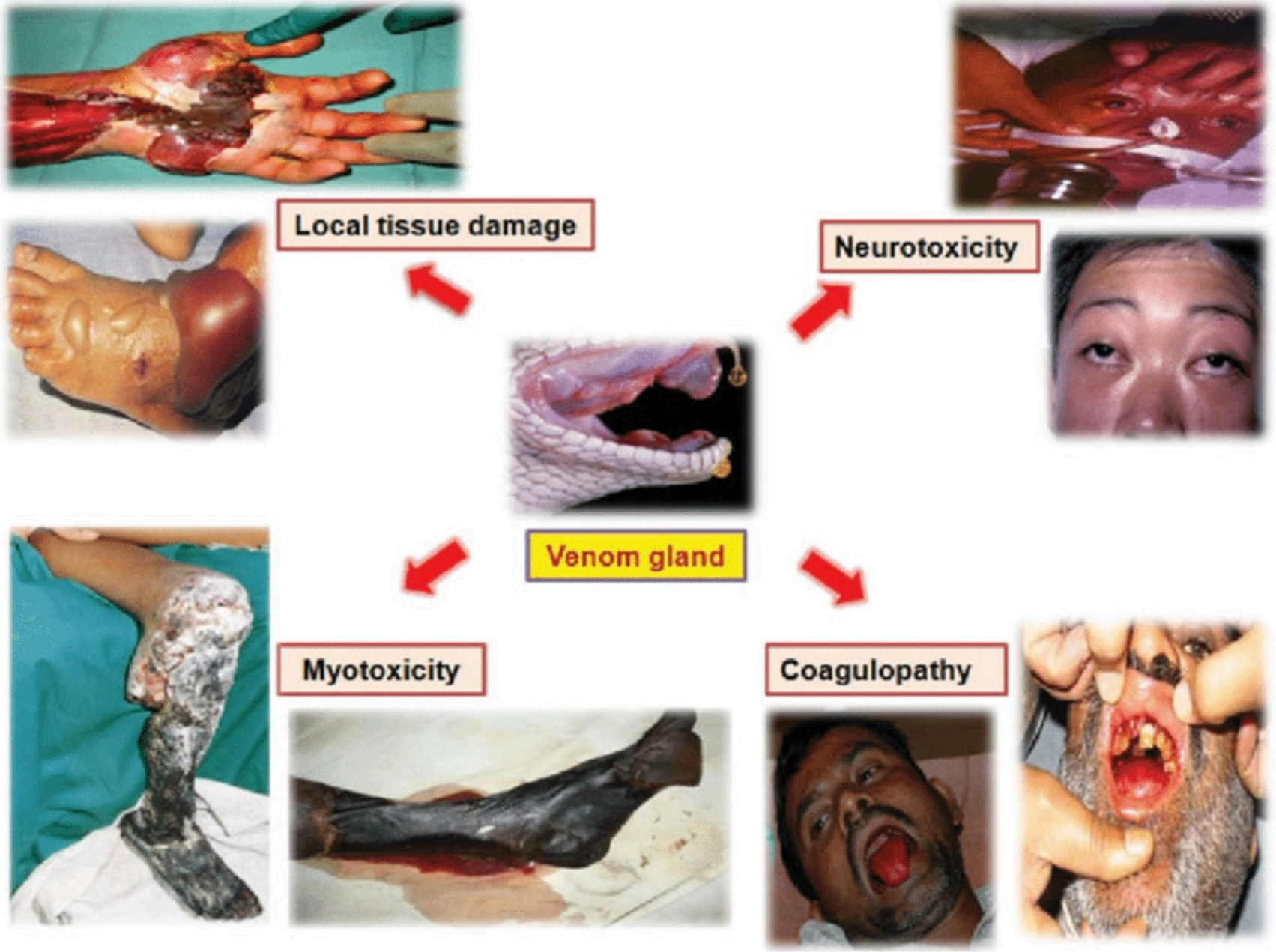
* Marked sign of snake bite.
* Lethargy
* Muscle tremors
* Dilated pupils
* Sudden onset of weakness
* Complete paralysis
* Epistaxis
* Swelling and redness around bite
* Excessive salivation







Cobra bite does not cause local swelling. If animal survived cause swelling after 3-4 days due to bacterial infection. Cobra bite causes excitement with convulsions and death due to asphyxia.




Local toxicities of venomous snakebite.

# Clinical pathology

Increase BUN, creatinine, creatinine kinase, decrease in Hb, decrease in TLC, PCV , total RBC

# Necropsy Finding

- Local swelling at the site of bite with fang marks
- Severe haemorrhage
- Myocardial necrosis
- Congestion of lung, liver, spleen

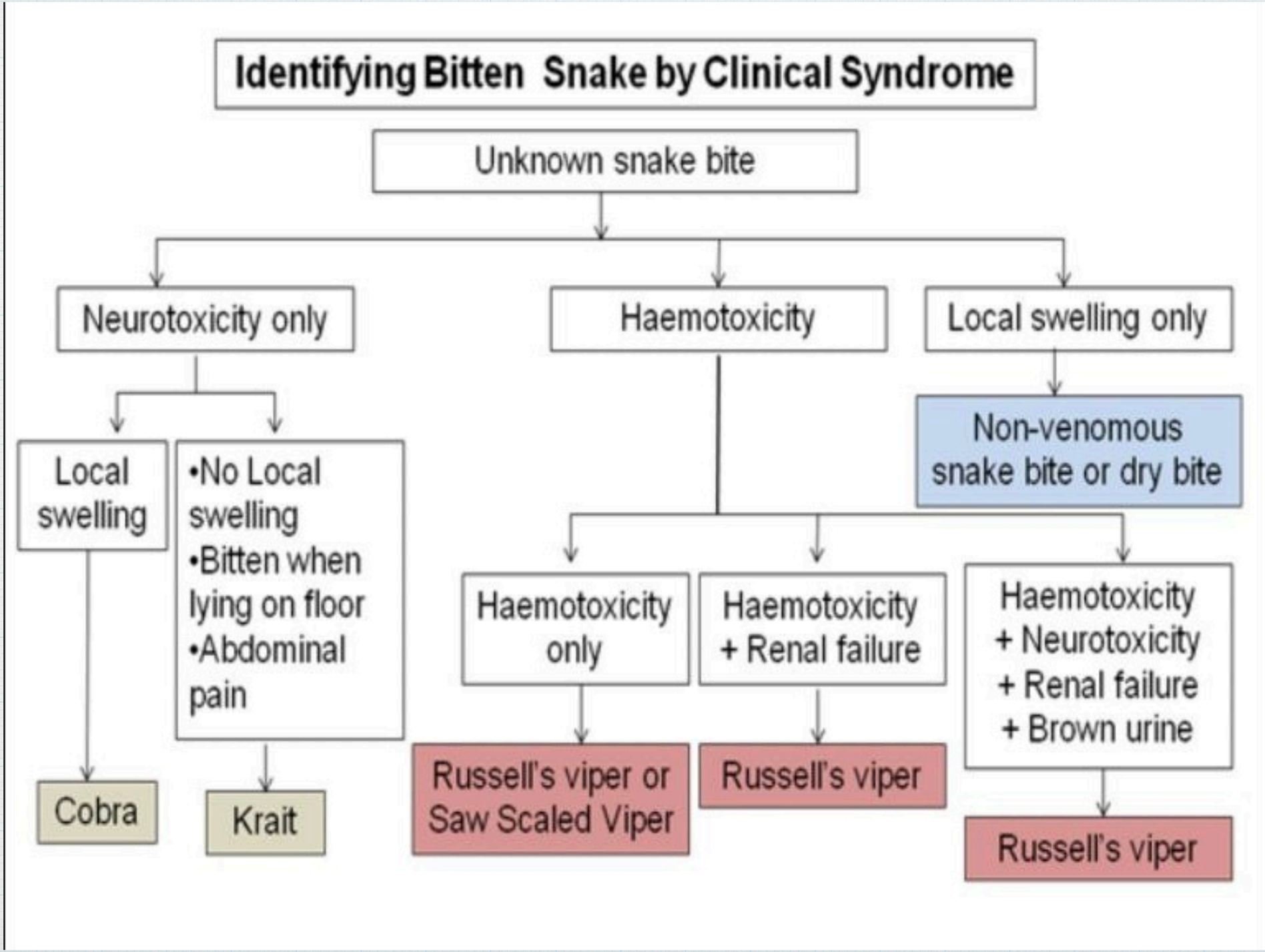
# Death time

Death is more rapid after cobra bites and prolonged after viper bites. However, the death depends on the relative absorption of the smaller venom molecules directly through the blood stream.

# Diagnosis

* History, observing fang marks, oozing of blood at the bite site, presence of snake in vicinity , cyanosis,etc
* 20 min whole blood clotting method.
* Blood chemistry analysis
* ELISA

- No both local and systemic effects - Non poisonous or dry bite
- Local swelling only - Non poisonous bite
- Local cellulitis + bleeding manifestation - All Viperidae
- Local cellulitis + Bleeding manifestation+ Neuroparalysis + dark urine - Russell's viper
- Local cellulitis + Neuromuscular paralysis. - cobra
- Only neuromuscular paralysis - krait
- Paralysis with dark coloured urine - Russell's / sea snake


Identifying Bitten Snake by Clinical Syndrome
Unknown snake bite
Neurotoxicity only
Haemotoxicity
Local swelling only
Local swelling
•No Local swelling
•Bitten when lying on floor
•Abdominal pain
Non-venomous snake bite or dry bite
Haemotoxicity only
Haemotoxicity + Renal failure
Haemotoxicity + Neurotoxicity + Renal failure + Brown urine
Cobra
Krait
Russell's viper or Saw Scaled Viper
Russell's viper
Russell's viper

# Venomous snakes leave a distinct bite mark

**Non venomous**



**Venomous**



# Differential Diagnosis

- Trauma
- Insect envenomation
- Abscessation
- Lizard bite .

# First aid treatment

- Keep calm
- Seek veterinary assistance immediately
- If possible , apply firm bandage below and above the snake bite.
- If wound is on the face or neck, remove collar
- Attempt to reduce animal's movement
- Not waste time in killing snake .

# Treatment

* Prevent or retard venom absorption locally
* Neutralise the venom
* Increase elimination of Venom from body
* Prevent local and systemic complications.

## Local management

**Pressure immobilisation** - it involves firmly but not too tightly wrapping the bitten extremity as it prevents the spread of venom by lymphatics and retain in its site. This is contraindicated in viper and other venom that cause local tissue damage. **Tourniquet are contraindicated.**

Clean bite with NSS

# Specific treatment

Anti venom (polyvalent) administration- slow IV in NSS dilution




# Supportive treatment

Antibiotics (broad spectrum), anti tetanus ,

pain management (NSAIDS),

fresh blood administration,

fluid therapy, vit C and calcium gluconate are useful in

preventing haemolysis, enzyme therapy (proteolytic enzymes may be given).

## Division of Veterinary Clinical Complex

Faculty of Veterinary Sciences & Animal Husbandry
Sher-e-Kashmir University of Agricultural Science & Technology of Jammu
R.S. Pura, Jammu - 181 102 (J&K). Telefax : 01923-252990

### Case Sheet (Medicine)

Dated : 4/10/23

Reg. No. 8450

Species Canine Breed Age 3 year Sex ♂

Owner's Name Sh. Nagender Bakshi S/o Sh. Jagdish Bakshi

Address Akhanpur Tharlar Tola Phone No. 9596019598

Name of Clinician Name of Student (s)

History :

Present History As per owner, the animal has snake bite last night. Locally Rx at Bishnah. Submandibular swelling ++

Prophylactic / Control measures

Prior disease and treatment

Management history

**General Examination :**

Behaviour Eating / Defecation

Urination Confirmation Posture/gait

Skin Abnormality

Systemic Examination of body regions :

Cranail Thoracic

Abdominal Urogenital

**Physical Examination :** Palpation/Percussion

Auscultation

**Clinical Examination :**

Temp (°F) Heart / Pulse rate (/min)

Resp (/min) M.M. Dehydration Status

**X-Ray :**

**Ultrasonography :**

**Tentative diagnosis** Snake Bite

**Lab. Findings**

**Confirmatory Diagnosis**

wt = 35 kg

| DATE | OBSERVATIONS | TREATMENT |
|---|---|---|
| 4/10/2023 | — | Inj NSS 500ml — (1.) |
| | — | Inj Bet 1ml — I/M |
| | — | Inf Snake Antivenom — (2) |
| | — | Inj Pantop 40mg x I/V |
| | — | Inj Amproxin forte 450mg x bid x IV x 3 day |
| | — | ~~Inj Ranitidine 2ml I/V~~ |
| | — | Inj Dexona - 4ml - I/V. |
| 5/10/23 | | |
| Blood clotting Time - 2 minute | | → Inj N.S.S - 500ml - (1) |
| | | → Inj Snake Antivenom - 10ml slow in N.S.S. |
| | | → Inj Amproxin - 500mg bid x I/M. |
| | | → Inj Pantop - 40mg I/V |

# Snake Antivenom

In India, polyvalent antivenom available which act against krait, cobra, Russell's viper, etc. It accelerates the dissociation of the toxin - receptor complexes and reverse paralysis.Antivenoms are purified antibodies against venoms. These are purified from serum or plasma of horse that has been immunised with the venom of one or more species of snakes. These are lyophilised.

Timings : best -within 4h ; good within 8h ; questionable after 12h.

ASV neutralises circulating venom

# Side effects of anti venom

- Cause by proteins and other antigens in the preparation.
- Allergic reactions, itching, redness
- Nausea, vomitting, higher temperature
- Hypotension, bronchospasm
- Serum sickness occur after few days. It becomes manifested by itching, articular edema, swollen lymph node, nephropathy with albuminuria
- What to do = Antivenom administration suspended temporarily. Adrenaline-0.1 % solution IV , Hydrocortisone can be used.

# Prognosis

- The prognosis of snake bite depends on the type and species of snake, location of the bite, size of victim, extent of envenomation and time interval between the bite and the institution of treatment.

- Most adult animals survive if found in time to prevent respiratory collapse. Mortality is more common in younger, smaller animals. Systemic neurological signs and severe tissue necrosis may result in permanent deficits.

# THANK YOU

