

- iii) Try to wear proper shoes or boots and long trousers, especially when walking in the dark or in undergrowth.
- iv) Use a light (torch, flashlight or lamp) when walking at night.
- v) Avoid snakes as far as possible, including snakes performing for snake charmers. Never handle, threaten or attack a snake and never intentionally trap or corner a snake in an enclosed space.
- vi) If at all possible, try to avoid sleeping on the ground.
- vii) Keep young children away from areas known to be snake-infested.
- viii) Avoid or take great care handling dead snakes, or snakes that appear to be dead.
- ix) Avoid having rubble, rubbish, termite mounds or domestic animals close to human dwellings, as all of these attract snakes.
- x) Frequently check houses for snakes and, if possible, avoid types of house construction that will provide snakes with hiding places (*eg* thatched roofs with open eaves, mud and straw walls with large cracks and cavities, large unsealed spaces beneath floorboards).
- xi) To prevent sea snake bites, fishermen should avoid touching sea snakes caught in nets and on lines. The head and tail are not easily distinguishable. There is a risk of bites to bathers and those washing clothes in muddy water of estuaries, river mouths and some coastlines.

3. Symptoms and signs of snake bite

3.1 When venom has *not* been injected

Some people who are bitten by snakes or suspect or imagine that they have been bitten, may develop quite striking symptoms and signs, even when no venom has been injected. This results from an understandable fear of the consequences of a real venomous bite. Anxious people may overbreathe so that they develop pins and needles of the extremities, stiffness or tetany of their hands and feet and dizziness. Others may develop vasovagal shock after the bite or suspected bite - faintness and collapse with profound slowing of the heart. Others may become highly agitated and irrational and may develop a wide range of misleading symptoms. Another source of symptoms and signs not caused by snake venom is first aid and traditional treatments. Constricting bands or tourniquets may cause pain, swelling and congestion. Ingested herbal remedies may cause vomiting. Instillation of irritant plant juices into the eyes may cause conjunctivitis. Forcible insufflation of oils into the respiratory tract

may lead to aspiration pneumonia, bronchospasm, ruptured ear drums and pneumothorax. Incisions, cauterisation, immersion in scalding liquid and heating over a fire can result in devastating injuries.

3.2 When venom *has* been injected

3.2.1 Early symptoms and signs

Following the immediate pain of mechanical penetration of the skin by the snake's fangs, there may be increasing local pain (burning, bursting, throbbing) at the site of the bite, local swelling that gradually extends proximally up the bitten limb and tender, painful enlargement of the regional lymph nodes draining the site of the bite (in the groin - femoral or inguinal, following bites in the lower limb; at the elbow (epitrochlear) or in the axilla following bites in the upper limb). However, bites by kraits, sea snakes and Philippine cobras may be virtually painless and may cause negligible local swelling. Someone who is sleeping may not even wake up when bitten by a krait and there may be no detectable fang marks or signs of local envenoming.

3.3 Clinical pattern of envenoming by snakes in Southeast Asia

Symptoms and signs vary according to the species of snake responsible for the bite and the amount of venom injected. Sometimes the identity of the biting snake can be confirmed by examining the dead snake; it may be strongly suspected from the patient's description or the circumstances of the bite or from knowledge of the clinical effects of the venom of that species. This information will enable the doctor to choose an appropriate antivenom, anticipate the likely complications and therefore take appropriate action. If the biting species is unknown, recognition of the emerging pattern of symptoms, signs and results of laboratory tests ("the clinical syndrome"), may suggest which species was responsible.

3.3.1 Local symptoms and signs in the bitten part

- fang marks (Fig 25)
- local pain
- local bleeding (Fig 26)
- bruising
- lymphangitis
- lymph node enlargement
- inflammation (swelling, redness, heat)
- blistering (Fig 27)
- local infection, abscess formation
- necrosis (Fig 28)

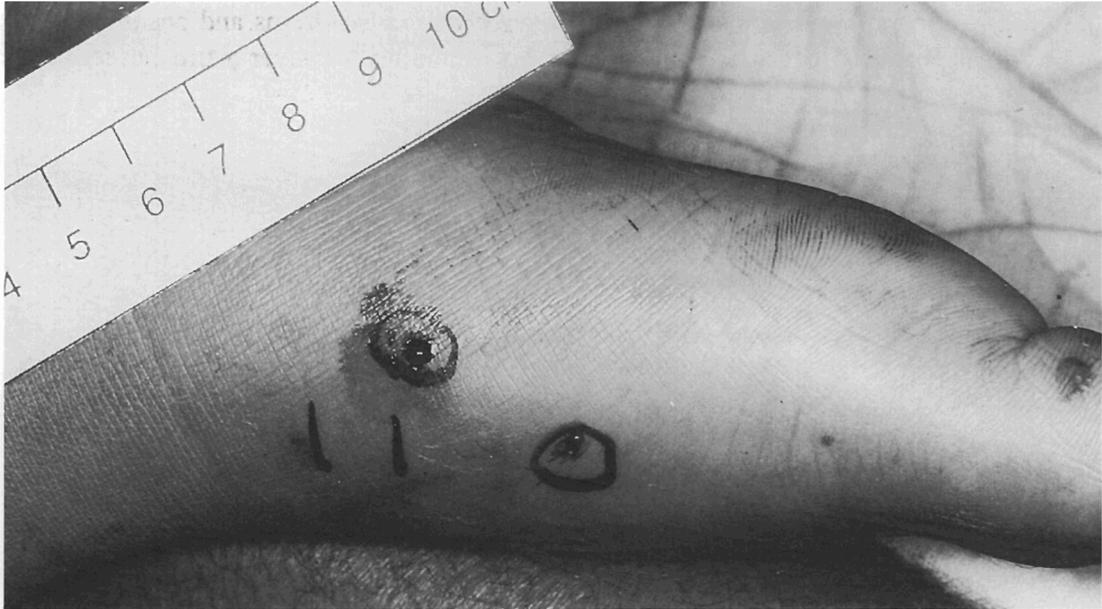


Figure 25 : Fang marks made by Russell's viper. (Copyright DA Warrell)



Figure 26 : Local bleeding from fang marks made by Malayan pit viper. (Copyright DA Warrell)

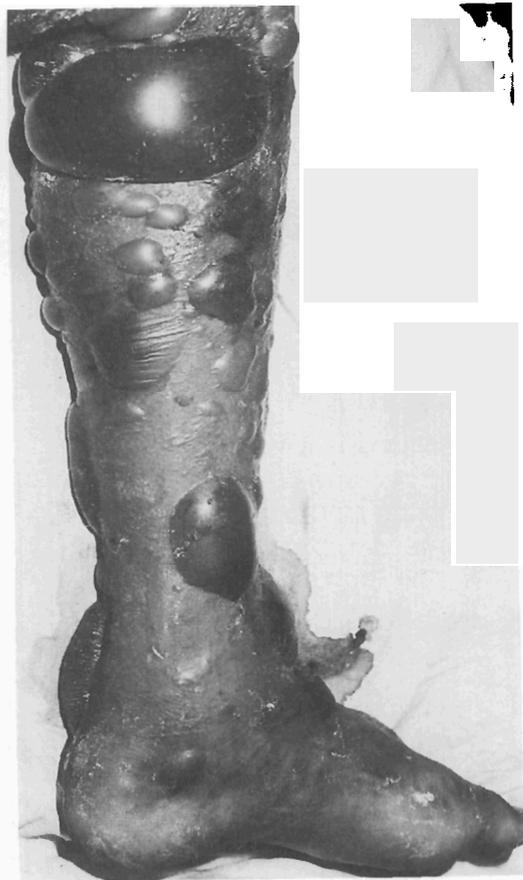
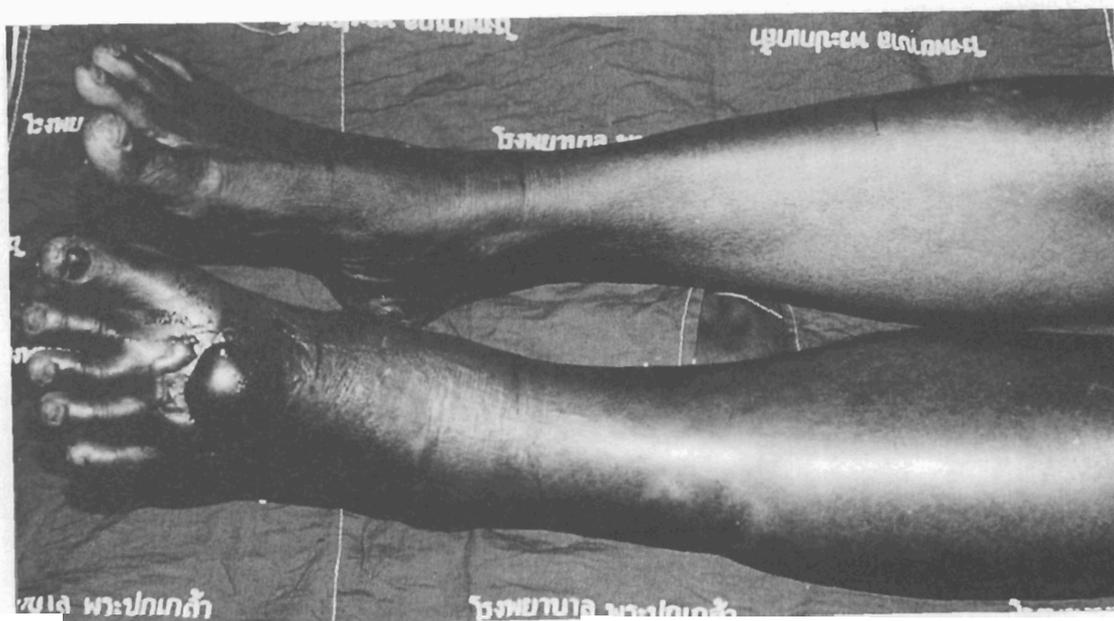


Figure 27 : Local swelling and blistering. (Top) With bruising, following a bite by a Malayan pit viper. (Copyright DA Warrell)

(Bottom) With early necrosis following a bite by a monocellate cobra (*Naja kaouthia*). (Copyright DA Warrell)



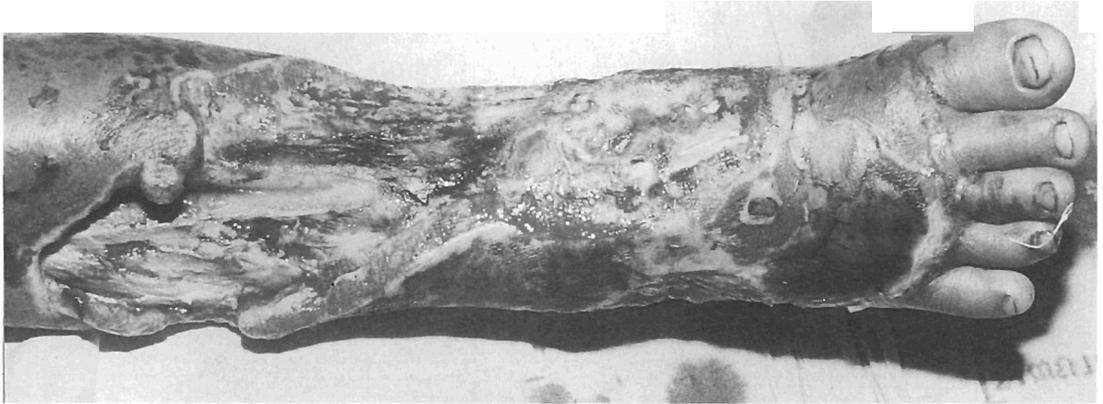


Figure 28a : Tissue necrosis following a bite by a Malayan pit viper. (Copyright DA Warrell)

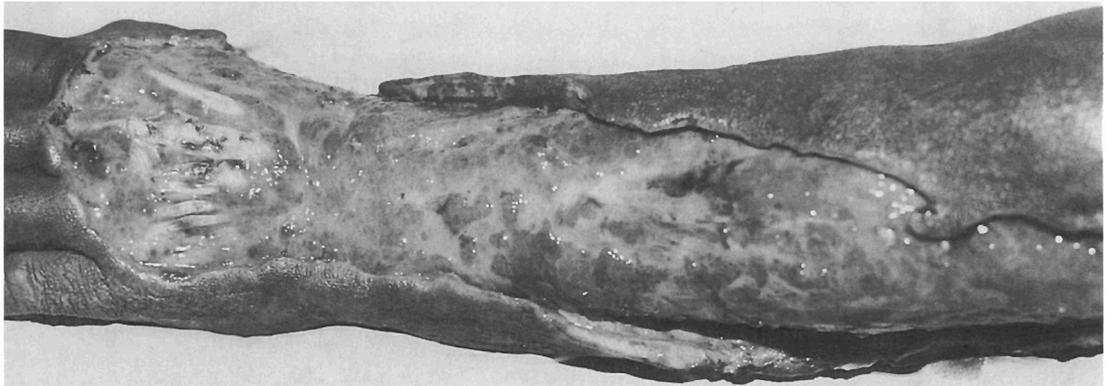


Figure 28b : Tissue necrosis following a bite by an Indo-Chinese spitting cobra (*Naja siamensis*). (Copyright Sornchai Looareesuwan)

3.3.2 Generalised (systemic) symptoms and signs

General

Nausea, vomiting, malaise, abdominal pain, weakness, drowsiness, prostration

Cardiovascular (Viperidae)

Visual disturbances, dizziness, faintness, collapse, shock, hypotension, cardiac arrhythmias, pulmonary oedema, conjunctival oedema (Fig 29)

Bleeding and clotting disorders (Viperidae)

- bleeding from recent wounds (including fang marks (Fig 26), venepunctures etc) and from old partly-healed wounds

- spontaneous systemic bleeding - from gums (Fig 30), epistaxis, bleeding into the tears, haemoptysis, haematemesis, rectal bleeding or melaena, haematuria, vaginal bleeding, bleeding into the skin (petechiae, purpura, ecchymoses) and mucosae [*eg conjunctivae* (Fig 31)], intracranial haemorrhage (meningism from subarachnoid haemorrhage, lateralising signs and/or coma from cerebral haemorrhage)

Neurological (Elapidae, Russell's viper)

Drowsiness, paraesthesiae, abnormalities of taste and smell, "heavy" eyelids, ptosis (Fig 32), external ophthalmoplegia (Fig 33), paralysis of facial muscles and other muscles innervated by the cranial nerves, aphonia, difficulty in swallowing secretions, respiratory and generalised flaccid paralysis

Skeletal muscle breakdown (sea snakes, Russell's viper) Generalised pain, stiffness and tenderness of muscles, trismus, myoglobinuria (Fig 34), hyperkalaemia, cardiac arrest, acute renal failure

Renal (Viperidae, sea snakes)

Loin (lower back) pain, haematuria, haemoglobinuria, myoglobinuria, oliguria/anuria, symptoms and signs of uraemia (acidotic breathing, hiccups, nausea, pleuritic chest pain etc)

Endocrine (acute pituitary/adrenal insufficiency) (Russell's viper)

Acute phase : shock, hypoglycaemia

Chronic phase (months to years after the bite) : weakness, loss of secondary sexual hair, amenorrhoea, testicular atrophy, hypothyroidism etc (Fig 35)



Figure 29 : Bilateral conjunctival oedema (chemosis) after a bite by a Burmese Russell's viper. (Copyright DA Warrell)



Figure 30 : Bleeding from gingival sulci in a patient bitten by a saw-scaled viper. (Copyright DA Warrell)



Figure 31 : Subconjunctival haemorrhages in a patient bitten by a Burmese Russell's viper. (Copyright DA Warrell)



Figure 32 : Bilateral ptosis (Left) in a patient bitten by a common krait (*Copyright DA Warrell*), (Right) in a patient bitten by a Sri Lankan Russell's viper. (*Copyright DA Warrell*)



Figure 33 : External ophthalmoplegia in a patient bitten by a Russell's viper in Sri Lanka. The patient is attempting to look to his right. The eyes are held open because of the bilateral ptosis. (*Copyright DA Warrell*)



Figure 34 : Patient bitten by a Sri Lankan Russell's viper who began to pass dark brown urine containing myoglobin and haemoglobin 8 hours after the bite. (Copyright DA Warrell)

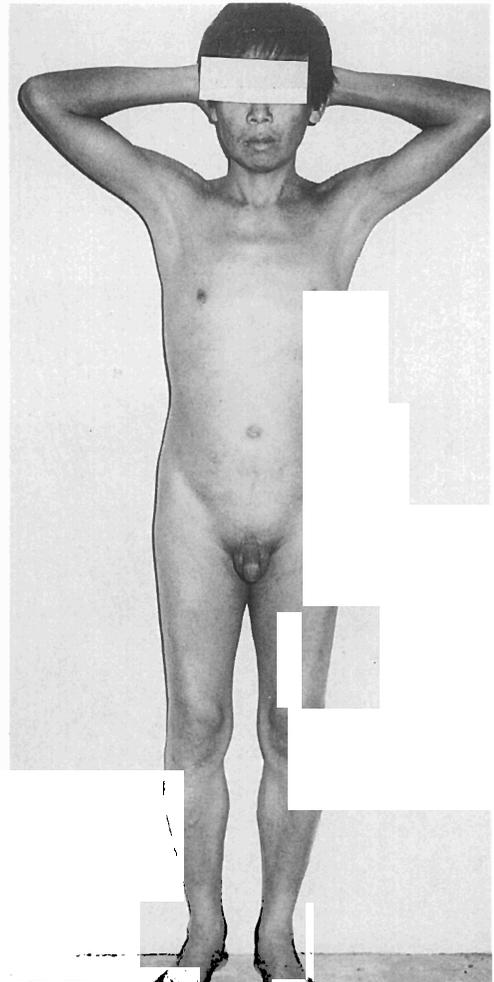
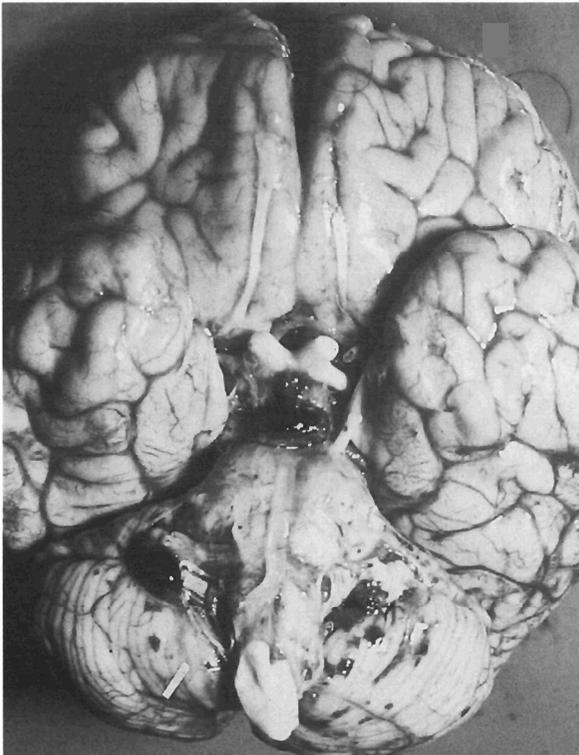


Figure 35 : (Left) Haemorrhagic infarction of the anterior pituitary (Sheehan's-like syndrome) after a bite by a Burmese Russell's viper. (Copyright U Hla-Mon)
(Right) Patient bitten by a Burmese Russell's viper three years previously, showing clinical signs of panhypopituitarism : loss of secondary sexual hair and testicular atrophy. (Copyright DA Warrell)

3.4 Clinical syndromes of snake bite in Southeast Asia

3.4.1 Limitations of syndromic approach

The more carefully the clinical effects of snake bites are studied, the more it is realised that the range of activities of a particular venom is very wide. For example, some elapid venoms, such as those of Asian cobras, can cause severe local envenoming (Fig 28b), formerly thought to be an effect only of viper venoms. In Sri Lanka and South India, Russell's viper venom causes paralytic signs (ptosis etc) (Fig 32), suggesting elapid neurotoxicity, and muscle pains and dark brown urine (Fig 34), suggesting sea snake rhabdomyolysis. Although there may be considerable overlap of clinical features caused by venoms of different species of snake, a "syndromic approach" may still be useful, especially when the snake has not been identified and only monospecific antivenoms are available (see Annex 1 and 2).

SYNDROME 1

Local envenoming (swelling etc) with bleeding/clotting disturbances
= **Viperidae (all species)**

SYNDROME 2

Local envenoming (swelling etc) with bleeding/clotting disturbances, shock or renal failure

= **Russell's viper (and possibly saw-scaled viper - Echis species - in some areas)**

with conjunctival oedema (chemosis) and acute pituitary insufficiency

= **Russell's viper, Myanmar**

with ptosis, external ophthalmoplegia, facial paralysis etc and dark brown urine

= **Russell's viper, Sri Lanka and South India**

SYNDROME 3

Local envenoming (swelling etc) with paralysis

= **cobra or king cobra**

SYNDROME 4

Paralysis with minimal or no local envenoming
Bite on land while sleeping, outside the Philippines = **krait**
in the Philippines = **cobra**
(*Naja philippinensis*)
Bite in the sea = **sea snake**

SYNDROME 5

Paralysis with dark brown urine and renal failure:
Bite on land (with bleeding/clotting disturbance) = **Russell's viper, Sri Lanka/
South India**
Bite in the sea (no bleeding/clotting disturbances) = **sea snake**

3.5 Long term complications (sequelae) of snake bite

At the site of the bite, loss of tissue may result from sloughing or surgical débridement of necrotic areas or amputation : chronic ulceration, infection, osteomyelitis or arthritis may persist causing severe physical disability (Fig 36). Malignant transformation may occur in skin ulcers after a number of years (Fig 37).

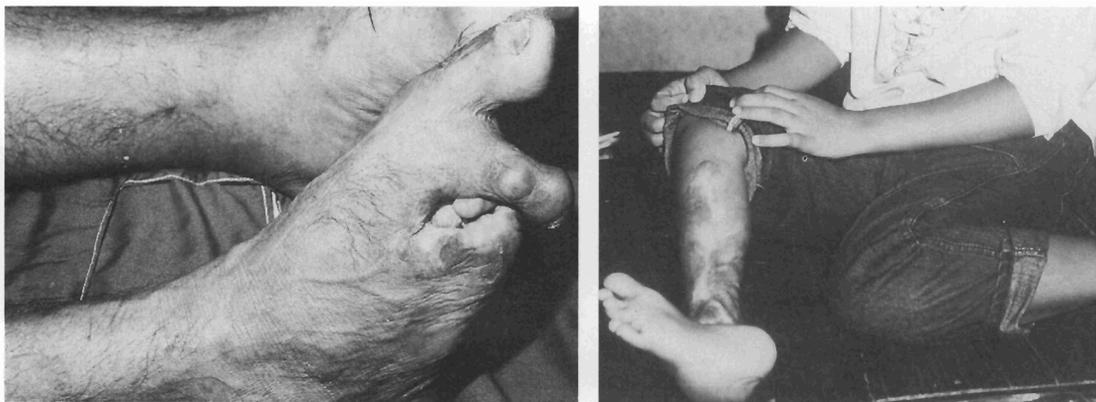


Figure 36 : (Left and Right) Chronic physical handicap resulting from necrotic envenoming by Malayan pit vipers.
(Copyright DA Warrell)



Figure 37 : Squamous cell carcinoma developing at the site of a chronic skin ulcer with osteomyelitis 8 years after a bite by a Malayan pit viper. (Copyright DA Warrell)

Chronic renal failure occurs after bilateral cortical necrosis (Russell's viper bites) and chronic panhypopituitarism or diabetes insipidus after Russell's viper bites in Myanmar and South India (Fig 35). Chronic neurological deficit is seen in the few patients who survive intracranial haemorrhages (Viperidae).

4. Symptoms and signs of cobra-spit ophthalmia (eye injuries from spitting cobras) (Fig 38)

If the “spat” venom enters the eyes, there is immediate and persistent intense burning, stinging pain, followed by profuse watering of the eyes with production of whitish discharge, congested conjunctivae, spasm and swelling of the eyelids, photophobia and clouding of vision. Corneal ulceration, permanent corneal scarring and secondary endophthalmitis are recognised complications of African spitting cobra venom but have not been described in Asia.

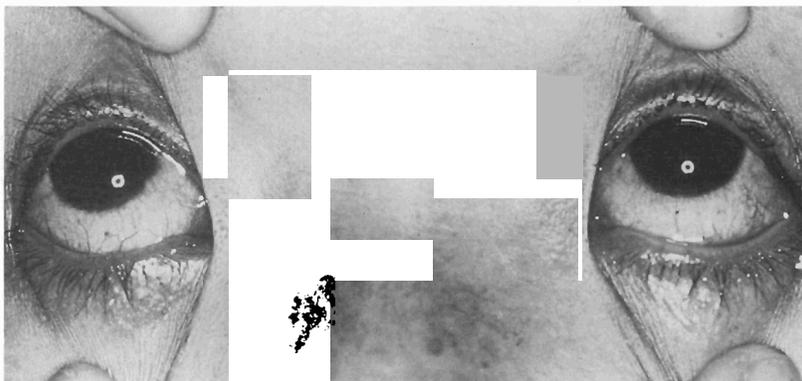


Figure 38 : Bilateral conjunctivitis in a patient who had venom spat into both eyes by an Indo-Chinese spitting cobra (*Naja siamensis*). (Copyright DA Warrell)