OBSERVATIONS ON SNAKES AND SNAKE BITE IN THE EASTERN MEDITERRANEAN AREA

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INTRODUCTION

This paper is based on the author's experience while working in Israel, Egypt and Cyprus and therefore covers only these areas. From the point of view of its snake fauna, the eastern Mediterranean may be divided geographically into two parts, a northern and a southern area. The northern area, which extends north from the latitude of Jerusalem to include the southern shores of Asia Minor, the Lebanon, Israel and Cyprus, is a fertile green belt containing some mountainous districts. The southern area, with the exception of the Nile delta, is mainly desert as typified by the Suez Canal zone, the Sinai, the Negev and Aqaba.

The basic fauna of these two areas have little in common, although there is some overlap, especially in Israel where the fauna of the two areas may be found side by side. The fauna of the northern area is a continuation of that found in the European continent, the common snakes being non-poisonous Colubridae and the only common poisonous snakes being Vipera lebetina and Vipera palestina. In the southern area the snakes are those specifically associated with the deserts of North Africa and Arabia as typified by the sand vipers and the Egyptian cobra. In the northern area the poisonous snake is a rarity, whereas in the southern area the majority of snakes are poisonous.

This paper describes the commoner snakes found, with a view to their easier identification; the pathological and clinical features of snake bite are discussed and the different forms of treatment reviewed. Only 18 of the 42 or more species found in the area are mentioned; these include all the poisonous species and those of the non-poisonous species which are most frequently found.

IDENTIFICATION

Snakes cannot be fully identified by colour or superficial markings as these vary from area to area. Note therefore should be taken of the shape of the head; the distribution of shields on the head, especially those behind the eye (postocular and temporal); the number of shields under the body (ventral) and under the tail (subcaudal); and the shape of the pupil.

The Colubridae and Viperidae may be distinguished by a number of characteristics. The Colubridae have a head which is continuous with the body and which is covered with large plates; the pupil is generally circular and the tail is long.

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and slender. The Elapidae are related to the Colubridae, but form a separate family. They have large head plates like the Colubridae and poison fangs which are partially canalised and situated in the anterior part of the jaw. In the Viperidae the head is distinct from its neck and is generally heart-shaped covered with small shields or scales; the pupil is vertical and the tail short and dumpy. All vipers are poisonous and have a pair of large anterior canaliculated poison fangs supported by mobile maxillary, palatine and pterygoid bones.

Snakes of the Northern Area

Colubridae

The Colubridae are divided into the Aglyphae, in which the teeth are solid and which do not secrete venom, and the Opisthoglyphae, which have one or more of the posterior maxillary teeth grooved and which secrete a mildly toxic venom. This venom is poisonous to lizards and other small animals but not to man. Among the Aglyphae are the water snakes Natrix natrix and Natrix tessellatus. Coluber jugularis and Coluber nummifer are other Aglyphae commonly seen in this area. Malpolon monspessulanus and Telescopus fallax are the common Opisthoglyphae.

Natrix natrix has a wide distribution occurring throughout Europe, Asia Minor and Cyprus. It may reach a length of nearly seven feet. The coloration is olive, olive grey or brown with black spots, and with a white or yellow collar.

Natrix tessellatus is found in Syria, Israel and the Nile delta as well as in Europe and Asia Minor, but does not occur in Cyprus. It rarely grows longer than three feet. It is generally more brightly coloured than Natrix natrix, its spots are in three longitudinal rows with a more or less regular chess pattern, and it has a distinct V-shaped dark band dorsally at the junction of the body and the head.

Coluber jugularis has a wide distribution occurring in Asia Minor, Syria and Israel; it is one of the commonest snakes found in Cyprus, where it is known as the black rat snake, owing to its habit of catching small rodents by constricting them. Small specimens up to three and a half feet long are pale olive with numerous black spots which in the very young may be tinged with orange. The adult, which may grow up to eight feet, is bluish black in colour with a cream coloured underside.

Coluber nummifer is also very common in Cyprus and Israel and is usually found in built-up areas. It is sandy coloured with three to five alternating series of dark brown, black-edged spots. The median series of these are large and rhomboidal. This pattern superficially resembles that often found in Vipera palestina, but the shape of the head and the large head shields of the Colubridae should make the difference obvious. This snake may grow up to eight feet in length.

Malpolon monspessulanus is widely distributed throughout the Mediterranean and is common in Cyprus, Israel, Jordan and Egypt. It is dark brown in colour
with small dark or black spots accompanied by yellowish or white streaks. The head markings are white and consist mainly of V-shaped marks over the parietal head shields. It may reach up to six and a half feet in length.

_Teleidoscopus fallax_ is a small snake, reaching a maximum of two and a half feet in length. It is very common in Cyprus and also occurs in Asia Minor. It has a grey coloration with brown or black spots or bars on the body. It has a pair of enlarged grooved fangs situated below the posterior border of the eye. It is a nocturnal creature and, unlike most Colubridae, its pupil is vertical. It is known as the cat snake because of the way in which it stalks its prey.

**Viperidae**

_Vipera lebetina_ is the only poisonous snake found in Cyprus and it also occurs over a wide area, including the Greek isles, Turkey, the Lebanon, Syria, Iraq and North Africa. Its head is heart-shaped and it has a distinct neck. Its tail is small—generally a tenth of its total body length. Its head is covered with small scales which are keeled like those on its body, while its pupil is vertical. These snakes may reach a length of four and a half feet. In Cyprus, where it is known as "Kufi" it is grey, greyish buff or brown with two dorsal series of darker spots or orange bars which may however be indistinct.

_Vipera palastina_ is found in the Lebanon, Israel and Jordan. It is olive drab to reddish brown and on its back there is a dark brown zigzag or wavy band which may separate into single square or rhomboid spots. On the sides are large vertical markings with lighter centres, in the intervals of the dorsal band. Otherwise this snake resembles _Vipera lebetina_. Its habitat may extend down into the southern area, and one was received from as far south as Ma'an in Jordan.

**Other Families**

The Greek blind snake _Typhlops vermicularis_, which is non-poisonous, is quite common in Cyprus. It is a member of the family Typhlopidae and bears a superficial resemblance to an earthworm and in fact burrows into the ground. It has small lateral eyes and on close inspection is found to be scaled as a snake. _Eryx jaculus_, a small member of the boa family, is found on the mainland but not in Cyprus.

**Snakes of the Southern Area**

These are mainly sand vipers with an occasional elapid. Among the non-poisonous Colubridae found are _Natrix tesselatus_, _Malpolon monspessulanus_, and _Spalerosophis diadema_, which is red in colour with a dorsal series of brown rhomboids.

**Viperidae**

These mostly conform to the general type of viper described above, but they are all much smaller and well camouflaged, being almost invisible in the desert.

_Cerastes cerastes_, the horned viper, is a very small snake rarely reaching more than one and a half feet in length. It has characteristically a horn consisting of a
scale standing above each eye, the eyes being directed upwards. It is light sandy yellowish grey in colour with dark brown spots on its back and a dark stripe behind the eye. It moves by throwing agile loops one after the other and buries itself in the sand. Round the Dead Sea and the gulf of Aqaba, it is often found without a horn.

*Cerastes vipera* is the common sand viper of North Africa. It is very similar to the horned viper and is also sand-coloured. It is shorter and stouter and does not have horns. It is found in Egypt but does not extend into Asia.

*Echis colorata* is a small snake rarely reaching more than one and a half feet in length. It is related to *Echis carinatus*, which is widely distributed throughout North Africa, Iraq, Persia and India. *Echis colorata* itself is found in limited areas around the gulf of Aqaba, the Red Sea and Southern Arabia. Its head is distinct from its neck and is roughly triangular. The tail is a little under a quarter of the length of its whole body. It is a sandy grey colour with a row of whitish spots with dark brown edges on the back and two to three rows of irregularly placed dark spots on the sides. Though a small snake, *Echis colorata* is very poisonous. It buries itself in the sand and therefore may easily be trodden upon or kicked.

*Pseudocerastes fieldii* is a rare form of horned viper and is usually only one and a half feet in length when fully grown. Its head is roughly triangular and is covered with small scales, which cover a broadly pointed horn above each eye. It is usually pale yellowish grey in colour with indistinct markings. It is found in a limited area around the gulf of Aqaba.

*Atractaspis engaddensis* is a highly poisonous viper which has the superficial appearance of a colubrid with large head shields. It is blue-black in colour and has recently been described in the Sinai and Negev (Haas, 1951).

**Elapidae**

*Naja haje*, the Egyptian cobra, is a large snake reaching up to six and a half feet in length. It forms a hood by spreading its anterior ribs and thus widening its neck. This hood is narrower than that of the Indian cobra and spreads farther down its body. Its colour varies from uniform yellow grey to brown and its scales are dull. It is highly poisonous.

*Walterinnesia egypti* is similar to *Naja haje* but is black and does not have a hood. Superficially it may be mistaken for *Coluber jugularis*, but the latter has a more slender neck and is rarely found in sandy terrain. *Walterinnesia egypti* occurs mainly in Egypt but also has been described in southern Israel (Haas, 1951).

**Nature and Action of Snake Venom**

Snake venom is a clear, colourless fluid which consists mainly of proteins, peptones and polypeptides. It also contains enzymes such as hyaluronidase (Duran-Reynals, 1939), proteases, fibrinolysins, cytolysins and agglutinins. The proteins of cobra venom have a molecular weight of between 2,500 and
4,000. It is absorbed by way of the blood-stream and has a very quick action. Viper venom proteins have a molecular weight of about 20,000. It spreads by the lymphatics and has a relatively slow action. It has been shown that if the lymph flow to a limb is obstructed, viper venom is not absorbed (Barnes & Trueta, 1941).

Viper and cobra venoms have different actions. Viper venom acts mainly on the vascular system whereas cobra venom acts mainly upon the nervous system bringing about respiratory collapse. Viper venom spreads by the lymphatics and local signs usually develop within an hour; the first sign is bruising round the site of entry, which may generally be seen as two small puncture marks. Blisters filled with sero-sanguineous fluid also appear round the bite. Swelling of the whole limb develops, and it may also become covered with ecchymoses. It may be three to four days before the swelling reaches its maximum, and the affected limb may become twice its original diameter. At autopsy this is found to be due to hæmorrhage into the subcutaneous fat and underlying muscle. On incision of the skin, sero-sanguineous fluid exudes freely. The regional lymph nodes are invariably swollen and hæmorrhagic. In bites of the lower limb, hæmorrhage may be seen spreading up the psoas major muscle and in the retroperitoneal tissue on the side of the bite. If the bite is in the upper limb the whole of the chest wall and the side of the neck on the affected side may also be involved in the hæmorrhagic process. In fatal cases autopsy shows a severe hæmorrhagic state of the internal organs. There is often a blood-stained peritoneal exudate, and massive hæmorrhage into the mesentery. Hæmorrhage into the gastric mucosa may be very severe. When the intestines are involved, the hæmorrhage is mainly into the muscle coats. The kidneys are congested and there may be hæmorrhage into the lumen of Bowman's capsule. There may be large ecchymoses in the endocardium of the left ventricle, but this is no more than that seen sometimes as a result of shock or in violent deaths. Lymphocytic infiltration of the suprarenals has been described (Efrati & Reif, 1953).

**CLINICAL COURSE**

**Cobra bite**

The local symptoms produced by an injection of cobra venom may be slight. There may be some œdema, inflammation or loss of sensation in the limb. Nausea and vomiting supervene rapidly. After an hour the patient becomes dull and apathetic. Paralysis begins from the extremities, then passes up to the thorax so that respiratory distress becomes apparent. The patient may eventually die from asphyxia due to acute respiratory failure. Death may occur within four hours. Should the patient survive, recovery is rapid.

**Viper bite**

The local findings as a result of viper bite have been described above. Viper bite may also give rise to a generalised constitutional upset. The rapidity with which this develops has a serious bearing on the prognosis. It may develop as early as half an hour after the bite. The first sign is severe vomiting, which may
be followed by intense diarrhoea. The diarrhoea is probably related to the massive intestinal and mesenteric haemorrhage which occurs. Shock may rapidly supervene. The blood pressure may fall below 70 mm. of mercury and there may be profound anaemia, associated with the passage of blood and tissue fluid into the affected limb. On admission to hospital, the patient may at first be found to have a haemoconcentration in which the haemoglobin level may rise to 20 g. per cent. There is at first loss of plasma into the affected limb and later of red cells as the damage increases, and the patient will be found anaemic after twenty-four hours. Haemolysis does not occur as a result of the bite of any of the vipers in this region, and the anaemia is always due to a loss of blood into the affected limb or a result of haemorrhage elsewhere. There is generally a leucocytosis which may be as high as 20,000-30,000 white cells per c. mm. In cases which survive these constitutional changes there is a risk of renal failure developing after seven days.

**INCIDENCE AND PROGNOSIS**

Amongst troops in the Suez Canal zone snake bite was almost unknown. In Cyprus, viper bite is rare and when it occurs is mild, generalised symptoms do not develop, and in most cases there are only local symptoms in the affected limb. The incidence is only four or five cases a year in the whole island, and the only fatal case in ten years was in a two-year-old child.

In Israel, where viper bite is mainly from *Vipera palestina*, cases are more common and the effects more profound. Out of 300 cases recorded between 1931 and 1953 there were 21 fatalities, giving a 7 per cent mortality (Theodor, 1954). The incidence of constitutional disturbance was also much higher. Out of 65 cases described by Efrati & Reif (1953), shock developed in 40 per cent. Fatalities are recorded as a result of the bite of *Echis colorata* (Theodor, 1954).

In both Israel and Cyprus snake bite has a definite epidemic incidence, the peak occurring in June, July and August. This is because the snakes tend to hibernate in the colder winter months.

If untreated, the bite of the Egyptian cobra may prove fatal; however, should the patient survive paralysis, recovery is rapid. Generally snake bites of the head, neck or upper limbs have a much poorer prognosis than those of the lower limbs.

**TREATMENT**

*Local treatment*

The classical local treatment is deep incision of the bite and the application of local suction, combined with a tourniquet just above venous pressure, placed round the limb, to inhibit the spread of venom from the affected limb and to encourage the collection of oedema fluid to dilute the venom and assist drainage. Cauterisation and the application of permanganate crystals should not be encouraged as they have no rationale and, moreover, predispose to infection.

Efrati & Reif (1953) doubt the effect of compression of the limb in cases of viper bite, since the venom is slowly absorbed by the lymphatics. In these cases
treatment should consist of complete immobilisation of the limb by the use of sand-bags or a split plaster. If the patient has to be conveyed over long distances, the application of a Thomas splint would appear to be indicated. Incision and drainage have not been shown to be particularly helpful in these cases.

In the cases of cobra bite where absorption of venom is rapid and through the blood-stream a tourniquet should still be applied, the usual precautions being observed.

**General treatment**

**Viper bite.** An intravenous antihistamine drug such as Benadryl (5 mg.) has been found effective in cases where symptoms may resemble those of anaphylactic shock (Efrati & Reif, 1953). Shock should be combated vigorously by transfusions as blood is the substance lost in these cases. The general principle should be to keep the systolic blood pressure above 100 mm. of mercury to prevent the development of renal failure later. Electrolyte imbalances should also be corrected. ACTH and cortisone have been tried in several cases. The rationale for their use is that they cause retention of fluids, diminish capillary permeability and diminish the effect of hyaluronidase.

**Cobra bite.** The treatment of cobra bite is the treatment of acute respiratory failure and consists of artificial respiration, oxygen and the injection of respiratory stimulants. Artificial respiration may prove life saving.

**Antivenenes**

The Institut Pasteur produces four polyvalent antisera prepared in horses hyperimmunised against snake venoms. Of these AN (Afrique Nord) is the most useful in this area, as it contains the specific antitoxins against the venoms of Cerastes and Naja. Sergent (1944) has shown that the antiserum produced against the venom of cerastes also has a marked protective effect against the venom of *Vipera lebetina*. The antiserum C (Cobra) is specific for all forms of cobra, including the Egyptian cobra. Antitoxins against *Echis carinatus* are found in the polyvalent antiserum AO (Afrique Occidentale) from the Institut Pasteur, and a specific antiserum against this snake is also produced by Behringwerke Aktiensgesellschaft. These antisera are said to be effective against *Echis colorata*. AO serum also contains antibodies against cobra venom. Specific antiserum against *Vipera paléstina* is being produced by the Institut Pasteur in Paris (Theodor, 1954).

The form of treatment recommended by the Institut Pasteur is that 10 ml. of the antiserum be injected as soon as possible after the bite, subcutaneously into the thigh or in the neighbourhood of the bite, the dosage being the same for adults and children. The serum should be administered if necessary in further 10 ml. doses, if the first has led to any improvement in the condition of the patient. In exceptional cases where the patient's condition is critical, it may be given intravenously. In this case care should be taken to see the patient does not develop an anaphylactic reaction.
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SUMMARY

Observations have been made on the snake fauna of the countries in the Eastern Mediterranean area. Emphasis has been laid on the different species occurring in the northern and southern halves of the area. The nature of the different venoms, their pathological and clinical effects, and the treatment of the different forms of snake bite encountered in the area have been discussed. Mention has also been made of the different antivenenes available.

I would like to thank Colonel W. Stewart, M.B.E., Lieut.-Colonel Mary Munro, R.A.M.C., and Dr. H. W. Parker of the British Museum for their advice and criticism; also Colonel W. A. Y. Knight, A.D.M.S., Cyprus district, Major C. C. Langford, R.A.M.C., S.M.O. Jordan and all other medical officers who sent snakes into the Command Medical Laboratory, Cyprus.

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Observations on Snakes and Snake Bite in the Eastern Mediterranean Area

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*J R Army Med Corps* 1958 104: 63-70
doi: 10.1136/jramc-104-02-02

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