

A STUDY OF STONEFISH (*SYNANCEJA*) STINGS IN SINGAPORE WITH A REVIEW OF THE VENOMOUS FISHES OF MALAYSIA

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INTRODUCTION

It is well known that there are certain species of fishes in Malaysia which are equipped with venom organs and are capable of inflicting painful and sometimes fatal wounds (Buddle, 1930; Gimlette and Thomson, 1939; Tweedie, 1941; Le Mare, 1952; Scott, 1959). There have also been several papers on the biological and pharmacological aspects of stonefish stings in other parts of the world. There has not been, however, any large series of documented cases in the medical literature. As a consequence, the knowledge of the clinical manifestations of stonefish stings has been fragmentary and controversial.

The present paper seeks to record and discuss eighty-one cases of stings by stonefishes (genus *Synanceja*) encountered over the course of four years in the Pulau Bukom Hospital, Singapore. These cases probably represent the total incidence of such stings in that period of time in a population of about seven thousand living on Pulau Bukom, an island south of Singapore, and the few other small islands adjacent to it.

TERMINOLOGY

The term "venomous fishes" is used to describe fishes which produce injurious effects by injecting their venom by means of spines. Venomous fishes are distinct from "poisonous fishes" which cause various gastro-intestinal and neurological disturbances when their flesh is ingested. Since most authors use the general term "ichthyotoxism" to include both forms of intoxication, Halstead (1953) has proposed the term "ichthyosarcotoxism" to designate intoxication from poisonous fishes and "ichthyoacanthotoxism" for intoxication from the stings by venomous fishes. The corresponding terms

for the poisons involved would be "ichthyosarcotoxins" and "ichthyoacanthotoxins".

Careless use of terms relating to the anatomy of the venom apparatus of the different groups of venomous fishes has also resulted in ambiguity. The most satisfactory terminology is given by Halstead *et al.* (1953), Halstead *et al.* (1955), and Ocampo *et al.* (1953).

The terms in common parlance for fishes of the genus *Synanceja* include "Goblinfish" and "Rockfish" as well as "Stonefish". The local Malay names can be found in Table 1.

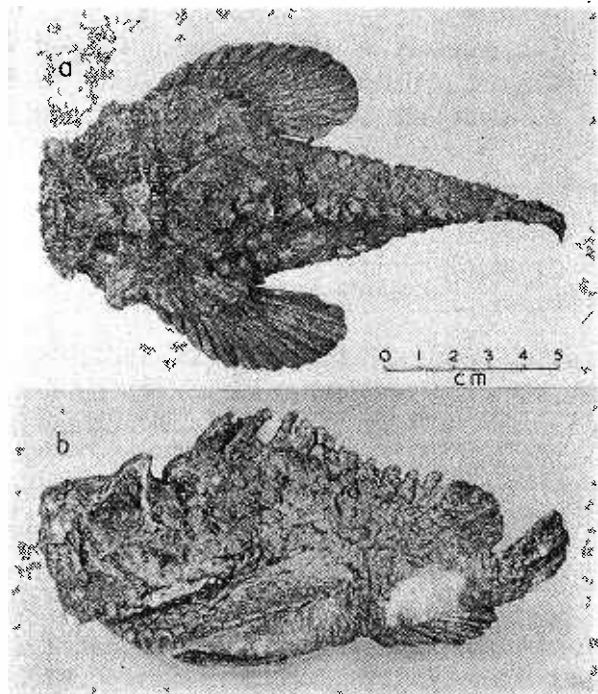


Fig. 1. *Synanceja horrida* (Linne), Punggol, Singapore, 5th September, 1963, (a) dorsal, and (b) lateral view.

THE STONEFISHES

The fishes of the family Synanceidae are represented by nine species in Malaysian waters (de Beaufort, 1962). All are reported to be dangerous. The two best known species are

Synanceja horrida (L.) and *Synanceja verrucosa* Bl. Schn., both of which are widely distributed in the shallow waters of the tropical Indo-Pacific region. In Singapore, *S. horrida* is common on the reef flats of the small islands to the south of Singapore. The species has a grotesque appearance, with a large hideous head and a warty skin (Fig.1). It has 12-14 dorsal spines, 3 anal spines and 2 pelvic spines, and their associated venom glands. It often lies motionless for long periods. Because of its camouflaged appearance, it frequently looks like a seaweed encrusted stone, and is often unnoticed until trod upon.

CLINICAL FEATURES

16 of the stings were incurred in the sea around Pulau Bukom Besar, while the rest were incurred around the neighbouring islands of Bukom Kechil, Seking, Semakau and Sudong. Not all the cases came into hospital accompanied by the offending fish. However, as all the inhabitants of this region are very familiar with the stonefish, it can be assumed that their witness is quite reliable.

The majority of the victims in this series were adults. Most of them were between 16 to 45 years of age. There were 76 men and 5 women. The ethnological distribution was as follows:—

Malays or Indonesians	-	-	72
Chinese	-	-	8
Eurasian	-	-	1

The numbers of Malays or Indonesians affected are out of proportion to their numbers in the general population of the islands named above. This could be accounted for by the fact that most of the fishermen who fish by wading in shallow waters are Malays or Indonesians.

The usual circumstances in which the stings occurred were that the victim was either stepping barefoot on or off a rowing boat or pushing the boat in shallow water, or wading in search of fish, shells or corals. Hence the vast majority of the stings were sustained on a toe or sole of the foot. Only in four cases were they sustained on the hand or a finger.

After the sting, there was pain at the site within a few minutes. This became more severe within the next few hours. The pain was usually excruciating. Hardened fishermen were

often reduced to tears and weeping. Inflammation of the site occurred slightly later. Most cases had tenderness, warmth and reddening within an hour. The inflammation gradually extended centripetally. None of the series had any broken spine lodged in the wound. Usually the wound consisted of a puncture of merely skin depth or an abrasion. A minority of the cases had more than one sting wound. The area just around the wound became cyanosed in a few cases.

The swelling usually became worse during the next twenty-four hours. In cases of stings on the sole or on a toe, the majority showed swelling up to about the mid-leg level. In a few cases, the swelling extended up to the groin. Usually there was reddening and warmth over the swelling, but at the stage of maximum swelling, there was usually little or no pain or tenderness. The swelling in most cases subsided within the next few days.

None of the cases in our series showed significant systemic signs. Many cases had a slight tachycardia when first examined, but it was not disproportionate to the degree of pain. Several cases had their blood pressure checked at frequent intervals during the first few hours after the sting. No significant hypotension was noted.

COMPLICATIONS

The following complications were observed:—

Femoral adenitis	-	-	2 cases
Pyogenic infection of the sting wound	-	-	1 case
Transitory numbness of affected leg	-	-	1 case
Transitory pain of knee of affected leg	-	-	1 case

All these complications occurred within a few days after the stings. None was severe nor persistent. All responded readily to treatment with antibiotic or analgesic drugs. In addition to the above, there was one patient who received a sting on his palm. He developed swelling and pain of his forearm, which subsided completely after a few days. He resumed work as a manual labourer. Within a few hours of resumption

of duty, he developed a recurrence of the swelling and pain. This permanently subsided after a further short period of rest.

No adverse effect on the general health of the patient was noted.

MANAGEMENT

A tourniquet was applied at once between the site of the sting and the rest of the body. As most of our cases sustained the sting on the foot, this meant that the tourniquet was usually applied at the ankle. The tourniquet was applied at the wrist when the sting was on the hand or fingers. It was applied for two to three hours, with periodic releases.

A systemic analgesic was administered. Most of the cases were given 2 ml. of di-hydrohydroxy codeinone ("Proladone") by subcutaneous injection. Three cases were each given an injection of 100 mgm. of pethidine.

After the patient had settled down, the wound was cleansed with sterile saline, and then carefully explored for any broken spine or other foreign bodies. An antiseptic sterile dressing was then applied.

The patient was usually observed in hospital for three or four hours. Special attention was paid to his general level of consciousness, pulse rate, blood pressure, respiratory rate, and the severity of the pain. There was no occasion to repeat the injection of di-hydrohydroxycodeinone because of unrelieved pain. One of the cases given injection pethidine, however, required a second dose. Throughout the period of observation, the patient was kept warm and lying in bed.

The patient was sent home at the end of the period, after his condition was satisfactory, with paracetamol or other analgesic tablets.

An antibiotic cover was given for grossly contaminated cases. An injection of antitetanus serum or tetanus toxoid (depending on the previous immunity status of the patients) was also given for such cases.

Corticosteroids, in the form of hydrocortisone injections or oral prednisolone, were administered in seventeen cases in an attempt to limit the exudation and swelling. Although no controlled trial of their use was carried out, our impression is that there was no significant difference in progress and complications between cases in which corticosteroids were used and those in which they were not. In a few of

the seventeen cases the corticosteroids were not used from the onset but only when the swelling took more than a few days to subside.

Antihistamine drugs were used systemically in some of the earlier cases, but no special benefit was noted.

The patients were asked to come back the next day, and were usually seen at daily intervals until all symptoms and signs had disappeared.

OTHER VENOMOUS FISHES

Details of the various forms of ichthyosarcotoxism are outside the scope of this paper. However, it suffices to say that the problem is an exceedingly complex one and it is not exactly known how several valuable Malaysian food fishes (*vide* in Scott, 1959), are considered highly poisonous in other areas (Halstead and Lively, 1954; Halstead, 1959). Several interesting theories have been put forward on the causes of ichthyosarcotoxism and a few are discussed briefly by Halstead (1953). For more details on this aspect of ichthyotoxism the reader is referred to the bibliography provided by Whitley and Halstead (1955).

At least eleven families of fishes are represented by venomous species in the Malaysian area. These are listed in Table I with their respective vernacular names and with the literature citations by which the local species may be identified. However, Scott (1959) will serve to identify provisionally the families and some common species. With the exception of the Stingrays of the family Dasyatidae, of which a single species is reported far inland in fresh water (Alfred, 1962), all are marine. The Dasyatidae, Plotosidae, and Ariidae, are also often abundant in river estuaries and other brackish localities. Reports of venomous stings from certain local fresh-water catfishes of the families Clariidae, Bagridae and Siluridae, have not been satisfactorily authenticated.

The clinical characteristics of Stingray wounds and their treatment are discussed by Halstead and Buncker (1953), who also give details of the habits, stinging action, and structure of the venom apparatus of the Dasyatidae, Gymnuridae and Myliobatidae. Of the Chimæridae, little is known except for the presence of a venom apparatus (Halstead, 1959), and although there are no published records of these fishes from the Malaysian area, we have included them since Fowler (1941) lists at least two

TABLE I
Families of venomous Malaysian Fishes

Family	English Name	Malay Name	Literature
1. Dasyatidae	Stingrays	Pari, Pari pasir	Fowler, 1941:396-449
2. Gymnuridae	Butterfly Rays	Pari, Pari tembikar, Pari kelawar	Fowler, 1941:449-557
3. Myliobatidae	Eagle Rays	Pari, Pari lang	Fowler, 1941:457-478
4. Chimaeridae	Chimaeroids	—	Fowler, 1941:487-503
5. Plotosidae	Catfishes	Sembilang, Unsat	Weber & de Beaufort, 1913:223-231
6. Ariidae	Catfishes	Duri, Pedukang	Weber & de Beaufort, 1913-271-316
7. Uranoscopidae	Star Gazers	Keratok, Kertang	de Beaufort, 1951:40-50
8. Siganidae	Rabbitfish	Denkis, Debam	de Beaufort, 1951:95-125
9. Acanthuridae	Surgeonfish	Denkis gebang, Debam	de Beaufort, 1951:127-128
10. Scorpaenidae	Scorpionfish	Lepu, Depu, Gedempu	de Beaufort, 1962:2-90
11. Synanceidae	Stonefish, Goblinfish, Rockfish	Lepu, Depu, Gedempu Semaram karang	de Beaufort, 1962:93-113

species from the Philippines and it is not inconceivable that they may occur locally. Medical aspects of Catfish stings are briefly discussed by Halstead *et al.* (1953). There does not appear to be any information on the clinical characteristics of wounds caused by Uranoscopidae (Halstead, 1959), and furthermore it is only recently that these fishes have been discovered in Malaya (Scott, 1959). The Acanthuridae are mentioned by Halstead (1959) as "likely to inflict a deep and painful wound" but "as to whether or not surgeonfishes' spines are venomous, this has not as yet been determined." The fishes of the family Siganidae are also known to inflict painful wounds (Scott, 1959) and we are able to substantiate this from casual observations on one case in Singapore, where the species responsible was *Siganus oramin* (Bloch and Schneider) which is often sold in local fish-markets. The literature on the Scorpaenidae is reviewed by Halstead *et al.* (1955), while Saunders and Lifton (1960) give a detailed report on a case of severe envenomation from one of these fishes.

Our own experience on Pulau Bukom with stings from other fishes is strictly limited. During the period under discussion in this paper

the following list represents the incidence of other cases of fish stings seen at the Pulau Bukom Hospital—

Rays	-	-	-	5 cases
Catfishes	-	-	-	1 case
Unidentified fishes			-	5 cases

One of the above cases of rayfish stings was that of a detainee on the prison island of Pulau Senang, who suffered excruciating pain after being stung on the sole of the foot, despite his wearing a thick pair of leather boots at the time. The above list indicates that of all fishstings, only stings by stonefishes are of numerical significance in the area around Pulau Bukom.

DISCUSSION

Publications pertaining to stonefish stings in the Malaysian area in particular appear to be restricted to the accounts given by Buddle (1930), Tweedie (1941), and Le Mare (1952), and to the pharmacological and chemical studies of the venom conducted by Saunders (1959a, 1959c and 1960) in Singapore. However, actual clinical details from authenticated cases are scanty in the above-mentioned references.

In the literature from other parts of the world also, relatively few case histories have been recorded. Duhig and Jones (1928) published in detail the history of one case, and Ralph (1943) reported one case from New Guinea. Halstead *et al.* (1956), and Smith (1957), stated that profound systemic effects of an undefined nature may lead to vascular collapse and death within a short time. The same authors also described other systemic effects, including general weakness, sweating, respiratory distress and convulsions. Flecker (1956), on the other hand, believed that the dangers of the stonefish have been exaggerated. He quoted three cases, in two of which trivial symptoms were present.

The cases in our series have all been free from serious or prolonged ill effects. No case manifested any of the systemic effects mentioned above. It is very probable that cases with serious systemic effects are exceptional, though of course they would tend to figure prominently in the popular imagination and memory. This may account for the paucity of well documented cases in medical literature. Prompt treatment might also have contributed to the relatively uneventful recovery of our cases. The population amidst which this work was carried out are well-informed on the subject of stonefish stings. Very often the patient was brought in with an improvised tourniquet in position and within a very short time of the sting.

Species differences probably do not account for the clinical picture in our cases which was mild compared with some series from other parts of the world. Most of the stonefishes collected around Pulau Bukom were identified as *Synanceja horrida*, on which the work on the pharmacology of the venom of the stonefish has largely been done (Saunders, 1959a, 1959c and 1960). It is known, nevertheless, that the venom sacs are not uniformly well-developed and that in some cases no sacs may be present on individual spines (Duhig and Jones, 1928). Therefore a sting by one of these spines would produce only minor symptoms.

Bottard (1889) described 25 cases of stonefish stings. There were seven deaths in his series, in contrast to none in our eighty-one cases. It is likely that most of the cases of fatalities associated with stonefish stings were due to infection. Some victims might have succumbed so much to the severe pain as to have drowned. It is also well-known that different races have different

thresholds of pain. It is not inconceivable that better endurance of pain in our patients might have contributed towards the absence of any fatalities. Most of them were hardened fishermen or manual labourers in their prime of life.

Our cases have also been free from severe or chronic local effects. Gallagher (in Duhig and Jones, 1928) reported one case with a sloughing wound for over 4 months and total incapacity. Flecker (1956) described another case where there was dry gangrene of the thumb and weakness of the affected limb (the hand) for nearly three months. This suggests that severe or chronic effects in the vicinity of the sting do occur, although they are perhaps of uncommon occurrence.

Until an effective antivenene is available, treatment has to remain empirical and symptomatic. The various regimes of treatment advocated by different authors reflect the controversy on the subject.

There is a division of opinion on the advisability and efficacy of using a tourniquet. It seems reasonable to us to use it, on the grounds that it delays absorption of venom into the circulation and may enable the defence mechanisms of the body to come into operation. Saunders (1960) postulated that the hypotension, demonstrated in experimental animals after the injection of the venom, was primarily due to a peripheral vasodilatation. The tourniquet may prevent the sudden flooding of the circulatory system with toxin by the unprepared body.

The relief of pain is almost the only treatment which commands universal acquiescence. Although Saunders (1960) did not detect any depression of the vasomotor centres of the central nervous system by the venom in experimental animals, the prompt alleviation of the severe pain could have lessened reflex vasodilatation consequent to the pain.

The efficacy of other means of treatment, both local and general, is controversial. Halstead (1959) mentions both the immersion of the injured limb in hot and in iced water as different forms of treatment used!

Various local injections advocated include 5% solution of potassium permanganate, a local anaesthetic, antihistamine drugs, emetine hydrochloride and corticosteroids. The usefulness of suction of the wounds is doubtful, as fishes do not inject their venom in the manner employed by venomous snakes.

Prevention of stonefish stings can be effected by the use of stout footwear and the exercise of caution in the vicinity of rocks or coral reefs. Unlike the sting of rays mentioned above, the stonefish have short and friable spines which cannot pierce stout footwear. However, the expenditure incurred in the purchase of adequate footwear is probably beyond the means of many of the potential victims in the tropical areas of the world.

SUMMARY

The circumstances, clinical features, complications and progress of eighty-one cases of stonefish stings are described. There were no fatalities, few complications and no lasting ill-effects. The various forms of treatment are discussed.

The venomous fishes of Malaysia are briefly reviewed.

It is concluded that stonefish stings occur fairly frequently in this country and that they are attended by appreciable morbidity, but that fatal cases or cases with lasting ill-health are probably rare.

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