SNAKEBITES AT MAHARAT NAKHON RATCHASIMA REGIONAL HOSPITAL

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Abstract. One hundred and ninety-nine victims of snakebite hospitalized at Maharat Nakhon Ratchasima Hospital between 1898 and 1991 were studied. The male: female ratio was 1.9:1 and their mean age (± SD) was 30.0 ± 18.6 years. The most common of victims were farmers and laborers. Dead snakes were identified as follows: 72 were *Trimeresurus* sp. (36.2%), 36 were *Naja kaouthia* (17.6%), 4 were *Bungarus fasciatus* (2.0%), 1 were *Colloselasma rhodostoma* (0.5%) and 1 was *Vipera russelli* (0.5%). No death was noted among the victims bitten by *Trimeresurus* sp, *C. rhodostoma* and *V. russelli*. Fifty-eight victims exhibited complications, constituting 29.1%. Four cases died from the bite of *N. kaouthia*, 2 from *B. fasciatus* and 1 from unidentified snake. A total death rate was 3.5% (7 in 199 cases). The mean duration in the hospital for patients bitten by *Trimeresurus* sp. and *N. kaouthia* were 2.3 days and 2.0 days, respectively.

In order to decrease the morbidity and mortality of snakebite victims in Nakhon Ratchasima Province, prevention and control of this entity should be emphasized in health education of local people, training programs on appropriate management of snakebites for the medical and paramedical personel working in the remote rural district hospitals and health centers. In addition, antivenoms and other necessary medical supplies should be adequately provided.

INTRODUCTION

Snake bite is one of the most important public health problems of tropical countries including Thailand. According to a previous study on the epidemiology of venomous snakes throughout the country conducted by Viravan *et al* (1990) during the years 1983 to 1986, it was found that snakes responsible for bites in the northeast of Thailand were as follows: green pit viper (*Trimeresurus* sp), spitting cobra (*Naja sputatrix*), common cobra (*Naja kaouthia*), banded krait (*Bungarus fasciatus*), Malayan krait (*Bungarus candidus*) and Malayan pit viper (*Calloselasma rhodostoma*).

During past years, a large number of cases presented to the Emergency Room of Maharat Nakhon Ratchasima Regional Hospital (MNRH), the largest regional hospital in Northeast Thailand, with problems arising from snake bite. Some of these victims came directly to hospital shortly after the bite while the others were referred from remote rural district hospitals or rural health centers located within the province. Some of these patients developed complications or died. The data of these cases have not been previously documented.

The aim of this study was to determine the magnitude of snake bite problems at MNRH in terms of incidence, diagnosis, complications and management in order to develop improved strategies for coping with such problems in Nakhon Ratchasima Province.

MATERIALS AND METHODS

In Maharat Nakhon Ratchasima Regional Hospital, during the three years period January 1989 to December 1991, patients were admitted to the study if they claimed to have been bitten by venomous snakes or if they were referred from other health centers or hospitals with the diagnosis of snake bite or suspected snake bite, and gave written informed consent for admission, investigation and treatment.

The diagnosis was made in most cases by identifying the dead snake they brought to hospital. For those who failed to do so, the diagnosis was based initially on the patients' description of the snake, together with the epidemiological evidence of snakes responsible for bites in the corresponding area, as well as the clinical manifestations of

the patients.

A data base was established recording age, sex, occupation, type of snake, site of bite, time of bite, location of bite, month of bite, clinical features of snake envenomation, laboratory study reports, use of antivenom and eventual outcome.

RESULTS

During the study period, 296 cases of snake bite presented to MNRH. Of these 296 patients, 199 were hospitalized for the study. Fifty-four of these 199 victims were children under 15 years old who were admitted to pediatric wards (27.1%), and the remaining 145 cases were admitted to medical wards (72.9%) (Table 1). The incidence of snake bite admission per 1,000 total admissions per year were 4.2 and 10.6 for pediatric and medical wards, respectively.

The patients' ages ranged from 1 to 86 years (mean 30.0, SD 18.6). The male : female ratio was 1.9 : 1. The most common victims were farmers and laborers; 74.4% of the victims were bitten in rural areas and 25.6% in urban areas. Ninety-two cases (46.2%) were referred from other health institutions; these included rural health centers, district hospitals and surrounding nearby government and private hospitals and clinics.

Sixty-eight percent of bites occurred during the night, 21.1% during the afternoon and only 10.6% during the morning. All bites, except two occurred on the extremities. In 78.4% of the patients the bite was on the lower leg and in 20.6% it was on an upper limb. In one case the bite was on the neck and another one received venom in the eye from a spitting cobra. Little seasonal snake bite variation in our study was noted; a relatively low incidence occurred in the first three months of the year.

According to the type of snake (Table 2), 72 were bitten by green pit viper (36.2%), 35 by common cobra (17.6%), 4 by banded krait (2.0%), 1 by Malayan pit viper (0.5%), 1 by Russell's viper (*Vipera russelli*) (0.5%) and 86 by unindentified snakes (43.2%).

Table 1

General features of hospitalized snake bite patients.

	Number of cases	%
Total cases	199	100.00
Sex		
male	131	65.8
female	68	34.2
Age		
< 15 year	54	27.1
≥ 15 year	145	72.9
Site of bite		
foot, ankle, leg	156	78.4
hand, wrist, forearm	41	20.6
head, neck	2	1.0
Time of bite		
morning	21	10.6
afternoon	42	21.1
night	136	68.3
Place of bite		
habitat	31	15.6
farmers, paddy fields, others	168	84.4
Location of bite		
urban	51	25.6
rural	148	74.4

Table 2

Distribution by type of snake.

Species	Method of identification		Total	%
	Identification of dead snake	Patient's description, epidemiologic evidence, clinical features		
Trimeresurus sp	22	50	72	36.2
N. kaouthia	10	24	34	17.1
N. sputatrix	-	1	1	0.5
B. fasciatus	-	4	4	2.0
C. rhodostoma	1	-	1	0.5
V. russelli	-	1	1	0.5
Unidentified	-	86	86	43.2
Total	33	166	199	100.0
N. kaouthia:Trimeresurus sp	1:2.2	1:2		

Table 3

Clinical presentation of green pit viper bite patients.

	No. of cases	%
Total cases	72	100.0
Only fang marks	9	12.5
Only local manifestations	52	72.2
Systemic manifestations	11	15.2
Abnormal coagulation studies	17	23.6
Thrombocytopenia	8	11.1
Total complications	14	19.4
spontaneous systemic bleeding	7	9.2
ecchymosis/petichial hemorrhage	4	5.5
wound infection	4	5.5
compartment syndrome	1	1.4
gangrene	1	1.4
Death	-	-

Mean duration of hospital stay (day) 2.3 (range 6 hours-8 days)

Of the 72 victims bitten by green pit vipers, 22 patients brought to hospital a dead snake (30.5%). Sixty percent of them had the obvious one or more fang marks at the bite sites. Fifty-two cases developed only pain, marked swelling and ecchymosis of the affected limbs without any signs and symptoms of systemic envenoming; blood coagulopathy profiles and platelet count were within normal limits (72.2%) (Table 3). Coagulopathies were encountered in 25 victims (34.7%), 7 of these 25 showed clinical evidence of spontaneous systemic bleeding, such as bleeding per gum, hematemesis or hematuria, while 4 exhibited ecchymosis with petichial hemorrhage over the entire body,

Table 4

Clinical presentation of cobra bite patients.

	No. of cases	%
Total cases	35	100.0
Local manifestations	35	100.0
Systemic manifestations	16	45.7
Total complications	22	62.8
respiratory failure	9	25.7
wound infection	19	54.2
pneumonia	1	2.8
sepsis	4	11.4
compartment syndrome	1	2.8
Death	4	11.4

Mean duration of hospital stay (day) 2.0 (range 12 hours-54 days)

and 2 developed both bleeding tendency and generallized petechii. All of these systemic manifestations were restored to normal after the administration of antivenoms intravenously within 5 to 6 hours. Besides the complications mentioned above, 7 cases acquired wound infection (9.2%), 1 developed compartment syndrome and 1 suffered from gangrene. No death was noted among these victims. The mean duration of hospital stay was 2.3 days (range 6 hours to 8 days).

Ten of 35 cobra bite victims brought the dead snakes to hospital (28.6%). One or two fang marks were obviously seen in 82.8% of the cases. All patients developed signs and symptoms of local envenoming, these included pain, swelling and necrosis at the site of bites (Table 4). One case who received venom in the eye from a spitting cobra exhibited corneal abrasion. Sixteen of 35 victims (45.7%) manifested systemic envenoming. No patient showed signs of systemic effects without ptosis and drowsiness, and all of these cases were treated with antivenom intravenously. Nine of these 16 patients (25.7%) developed respiratory failure and required artificial ventilation. Four of these 9 cases died (11.4%), 1 from respiratory failure, 2 from sepsis and another one from pneumonia with sepsis. Wound infection at the bite site occurred in 19 cases (54.2%). Four cases developed septicemia, one patient suffered from pneumonia upon the use of a ventilator, and one case showed clinical evidence of the compartment syndrome. The mean duration of hospital stay of cobra bite victims was 2 days with a range of 12 hours to 54 days.

Three of 4 victims of banded krait were bitten at night. All of these patients developed respiratory failure and only one case responded to banded krait antivenom. One of 2 who died showed local swelling at the bite site. The one that was bitten in the morning revealed local pain and swelling without any other complications.

The single victim of Malayan pit viper brought the dead snake to hospital. He was bitten on his foot and manifested clinical evidence of local envenoming 4 hours after the bite: pain and swelling of the affected part extended to the lower half of his shin. All of his coagulation parameters and platelet count were within normal limits. He was discharged after two days hospitalization.

The patient who claimed to be bitten by Russell's viper was brought to hospital without the dead snake. He was bitten while he was fishing in the paddy field. One hour after the bite he developed bleeding problems, including local ecchymosis, oozing from the bite wound and systemic hemorrhage: hematuria, hematemesis and generalized petechial hemorrhage. The whole blood clotting time was more than 30 minutes and the platelet count revealed thrombocytopenia. The bleeding tendency seemed to subside after 50 ml of Russell's viper antivenom were administered together with transfusion of fresh frozen plasma. On day 2 he exhibited another episode of bleeding per gum,

hematuria and hematemesis but renal function tests were still of within normal limits. He was given another 50 ml of antivenom intravenously. On the next day bleeding diathesis disappeared and normal blood coagulation was restored on day 4.

Among the victims of unidentified snakes, 75% developed only local effects such as pain and swelling at the affected parts. Abnormal coagulation studies were detected in 12 of these 86 patients (13.9%), 4 of 12 showed spontaneous systemic bleeding. Nine cases had thrombocytopenia, 4 of 9 developed generalized petechii. In no case of the unidentified snake victims manifested neurotoxic signs and symptoms. All patients but one survived. The only one who died was a 3-year-old boy claiming to be bitten by the snake at the night while he was playing on the ground. Immediately after the bite his parent applied some kind of ground herbal tree leaves to the bite wound. Three hours later he developed clinical evidence of nausea, vomiting, diarrhea and convulsions and was admitted to MNRH at the fifteenth hour. Physical examination upon arrival revealed 2 fang marks in his right foot with local swelling and ecchymosis surrounding the bite wound. Blood clot quality test showed normal results while the platelet count revealed thrombocytopenia. He developed wound infection and unfortunately died from subsequent sepsis with pneumonia on day 17 of hospitalization.

DISCUSSION

The incidence of patients with snakebites admitted to MNRH of 4.2 and 10.6 admissions per 1,000 total admissions per year in Pediatric and Medical wards, respectively were high, with the high complication rate of 29.1% and mortality rate of 3.5% posing public problems in Nakhon Ratchasima Province. The mortality rate of 3.5% was greater than the national mortality rate (2.8%) (Looareesuwan *et al*, 1989). However, the national mortality rate is thought to be underreported because those who died during transportation to hospital were not taken into consideration. The trend of incidence of this entity has not yet declined. The wide range of age distribution of the patients may reflect the chance of all age groups to be bitten by snakes. But the most common victims are young and active and the morbidity and mortality which they suffered represents a considerable loss of productivity. That males had twice the bite rate of females probably reflects the greater involvement of men in working or spending time outdoors. The predominance of nocturnal bites related to the time at which snakes seek out for their prey. The majority of snakebites occurred in remote rural areas resulting, to some degree, in delays in initiating appropriate treatment, though there are health facilities available at almost all subdistrict and district levels throughtout the country. Because of the shortages of medical supplies, particulary antivenom, and equipment as well as of health personal who can provide an appropriate medical care for such patients, nearly half of them (46.2%) had to be referred to MNRH for proper management.

One of the mainstays of initial therapy for snake bite victims, paticulary those suffering from moderate to severe systemic envenomation, is the administration of intravenous specific antivenom. Therefore a correct diagnosis is of utmost importance. Misdiagnosis and incorrect treatment may result in patients suffering severe morbidity and possibly death. Thus the dead snake needs to be brought to hospital for proper identification, since the patient's descriptions are not always reliable.

Among the fatal presumed banded krait victims, the first case who claimed to be bitten by a banded krait while he was sleeping in the bedroom did not respond to banded krait antivenom intravenously. Based on the history and physical finding of no local reaction and the time of bite, it is possible that he was not bitten by a banded krait but by Malayan krait *(B. candidus)*. This species belongs to the same genus of banded krait and both produce the same kind of neurotoxin, causing similar clinical features. Unfortunately, banded krait antivenom can not neutralize the toxin of Malayan krait, and there is no antivenom for the Malayan krait available in Thailand at this time. However, the use of artificial ventilation and anticholinesterase administration in such a case bitten by a Malayan krait may produce a dramatic improvement for respiratory failure as observed by some investigators (Warrel *et al*, 1983). Another fatal case was a child who claimed to be bitten by a banded krait on his neck at night; he developed local swelling at the bite site, later developed respiratory failure but there was no improvement after banded krait

antivenom was given. Diagnosis of this case was based also on the clinical finding of local swelling, so it is unlikely that he was bitten by banded krait, since the banded krait and Malayan krait do not produce cytotoxic toxin, so there is no local reaction. Based on epidemiologic data, it is most likely that he was bitten by a cobra, the most common snake causing neurotoxic effects found in Thailand and Nakhon Ratchasima Province. So this case should have been given cobra antivenom in stead of banded krait antivenom.

All cobra bite victims developed local envenoming; as many as 46.0% had systemic neurotoxic envenomation and 26.0% (9) exhibited respiratory failure requiring artificial ventilation. In spite of cobra antivenom administration in every case of those developing respiratory failure, 4 cases died, because of the delays in treatment and of septicemia subsequent to the use of ventilator. The delay in treatment arose from the long duration of transportation and improper diagnosis in the first place based on the patient's description. Only 28.5% of these victims brought the dead snake to hospital for identification. Though the venom antigen of *N. kaouthia,* a major cause of cobra bite throughout Thailand, can be detected in the serum of the victim by ELISA technique (Vivaran *et al,* 1986), it is costly, time-consuming and available only in some institutions. It has been reported by some investigators that in a case who develops respiratory failure due to cobra bite it is not necessary to give cobra antivenom, that artificial ventilation with symptomatic and supportive treatment plus close observation is adequate to save the life of the patient (Limthongkul *et al,* 1987). But we do not encourage the application of this principle in provincial rural health settings where the lack of health personel and medical supplies prevail. Though the victims can be saved from the respiratory failure, they still have the risk of secondary infections stemming from the use of ventilators and may eventually die from pneumonia or sepsis.

Most of the victims of green pit viper bites had no serious systemic symptoms except for local pain and swelling of the affected parts. Only 9.7% of the patients developed severe spontaneous systemic bleeding and 5.5% mainfested generalized petechial hemorrhages with ecchymosis. These victims were most likely to be bitten by *T. albolabris,* the white-lipped green pit viper that causes the most severe envenoming found in Thailand (Hutton *et al,* 1990). Although, green pit viper toxin per se may not cause death, its bite may result in other severe complications such as wound infection at the bite site, due to direct cytotoxic effects of the toxin with or without secondary bacterial infection. According to bacteriological studies of the venom, mouth cavities and the bite wound of venomous snakes in Thailand, it has been found that most of them showed a mixture of aerobic and anaerobic organisms. These include *Enterobacter, Pseudomonas* sp, *Proteus vulgaris, E. coli, Morganella morganii, Providencia, Staphylococcus aureus,* non-hemolytic *Streptococci, Peptostreptococci, Propionebacterium* and *Clostridium* sp. (Pongprasit *et al,* 1988; Theakston *et al,* 1990). In addition, cytotoxicity of toxin may cause severe local swelling resulting in compartment syndrome or gangrene.

The victim of Russell's viper bite did not bring the dead snake to hospital for identification. However the clinical signs and symptoms of were consistent with systemic hematotoxic envenoming similar to that observed in Russell's viper envenomation and the response to Russell's viper antivenom confirmed the diagnosis. This finding contrasts with the report of Viravan *et al* (1990) that there is no Russell's viper found in the Northeast of Thailand.

In the case of the one fatal case bitten by an unidentified snake, he should not have died if he had not acquired secondary infection, probably due to contamination of the herbal tree leaves applied to the bite wound, leading to subsequent sepsis.

From our experience, it is suggested that in order to decrease the morbidity and mortality due to snake bite, preventive measures should be emphasized in health education of rural people on the awareness of snake bite during work in the paddy fields, farms and gardens or spending time outdoors by the wearing of appropriate clothes. The use of traditional remedies should be discouraged and appropriate first aid should be practiced. Training programs on appropriate first aid and management of snake bite should be conducted for medical and paramedical personel working in remote rural district hospitals and health centers. In addition, the necessary medical supplies, particulary antivenoms corresponding to the venomous snake found in each particular area and equipment including ventilators should be supplied to these

hospitals and centers.

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