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Clinical and laboratory studies on haemorrhagic fever in Burma, 1970–72*

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This three-year serologic study of 2 060 children with a clinical diagnosis of haemorrhagic fever, who were admitted to the Children's Hospital and other hospitals in Rangoon, has shown that the etiology of the illness was multiple. Of all these patients, 347 (16.8%) had a dengue infection (96 with primary and 251 with secondary dengue infections), 510 (24.7%) had chikungunya infections, 55 (2.7%) had simultaneous chikungunya and dengue, 263 (12.8%) had influenza A infections, 62 (3.0%) had influenza B, 12 (0.6%) had measles, and there were 811 (39.4%) for whom no etiology could be established. Epidemiological and clinical features and laboratory findings are discussed. Evidence is presented for human infections with all four types of denguevirus in Rangoon.

A programme for the surveillance of haemorrhagic fever was started in Rangoon in 1964. Blood samples were taken from patients with suspected haemorrhagic fever in the acute and convalescent stages at the Children's Hospital, Rangoon General Hospital, and the Defence Services' General Hospital in Rangoon. Since laboratory facilities in diagnostic virology were not available in Burma till 1969, the sera were sent with assistance from the World Health Organization to the Bangkok Virus Research Institute for serologic testing. A few dengue infections were thus confirmed. A premonsoon age-stratified serologic survey of different socioeconomic subpopulations in Rangoon, conducted in 1968 by the Central Epidemiology Unit (CEU), Department of Health, Rangoon, provided evidence for the high prevalence of antibodies to both dengue and chikungunya viruses, although antibodies to the latter virus were found only in children over the age of 5 years (CEU, unpublished data, 1968).

Beginning in June 1970, an unusually large number of patients were admitted to the Children's Hospital with high fever, convulsions, vomiting, haematemesis, melaena, and ecchymoses at the site of injections. By the end of that year, 1 654 patients had been hospitalized in Rangoon, of whom 81 died (CEU, unpublished data, 1971). Virologic tests carried out at the Virus Research Institute in Bangkok and at the Department of Tropical Medicine and Medical Microbiology, School of Medicine, Honolulu, Hawaii, indicated that both dengue and chikungunya viruses were involved.

In 1971 and 1972, the surveillance of haemorrhagic fever was continued at the Children's Hospital and was extended to other hospitals in the Irrawaddy and Salween deltas.

This paper describes the results of laboratory tests for the 3 years 1970–72 carried out by two of the authors (C. K. M. and S. T.) at the Department of Tropical Medicine and Medical Microbiology, School of Medicine, University of Hawaii, as part of their training under WHO fellowships; also included are data from serologic tests, carried out by the same virologic techniques, in Bangkok and at the National Health Laboratory in Rangoon.

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MATERIALS AND METHODS

Clinical study

On admission, all patients with suspected haemorrhagic fever had their gastric contents aspirated via a naso-gastric tube in order to detect or confirm the presence of gastrointestinal bleeding. Altered blood was identified by the occult blood (Orthotolidine) test. The clinical course of each patient was carefully recorded on a special form by a CEU medical officer assigned to the haemorrhagic fever ward. A tourniquet test, as decribed by Nimmannitya et al. (4), was performed on most of these patients. Of the 2 016 serologically investigated patients admitted to the Children's Hospital, Rangoon, a complete clinical study was carried out on 1 650. Clinical studies were not undertaken on the 34 patients in the other hospitals in Rangoon and on the 10 patients in the district hospitals. There were thus 2 060 patients in all.

Serum collections

Sera were collected from patients with suspected haemorrhagic fever in the Rangoon Children's Hospital and the Infectious Diseases Hospital, Rangoon, by CEU staff during the CEU surveillance programme on haemorrhagic fever. Sera from the district hospitals were sent directly to the National Health Laboratory, Rangoon. Blood samples were taken from patients in the acute stage within 5 days of the onset of the illness and in the convalescent stage 14 days later. Paired sera from 2 046 patients and single serum samples from the 14 fatal cases were collected between July 1970 and December 1972. After separation of the red blood cells, the sera were stored at −20°C or −70°C until appropriate tests were carried out.

Of the paired and single serum samples, 195 were sent to the Virus Research Institute, Bangkok, and 1 118 to the laboratory in Hawaii where serologic tests were carried out. The remaining 747 paired serum samples were tested in the National Health Laboratory, Rangoon.

Virologic studies

Dengue and chikungunya. The following antigens for both the haemagglutination inhibition (HI) and complement fixation (CF) tests were prepared from infected suckling mouse brains by sucrose–acetone extraction (2): Dengue 1 (Haw)— 131 suckling mouse passages (smp); Dengue 2 (NGC)— 25 smp; Dengue 3 (H-87)— 25 smp; Dengue 4 (H-241)— 28 smp; and chikungunya (AFR)— 181 smp.

The haemagglutination inhibition tests were performed according to the method of Clarke and Casals (2) but with microtitre equipment,[a] and 4–8 haemagglutinating (HA) units of D_1, D_2, D_3, D_4, and chikungunyavirus antigens were used. Appropriate controls were always included in each test, and preliminary and back titrations of antigens were carried out to ascertain the number of units used. Sera were tested at serial twofold dilutions from 1 : 10 to 1 : 10 240; the highest dilution of serum, which gave complete inhibition of haemagglutination, was taken as the HI titre.

The complement fixation tests were performed by standard methods (1) on only those sera which were suggestive of dengue infection by the HI test. Each serum sample was tested at serial twofold dilutions from 1 : 8 to 1 : 256.

The interpretation of serologic results was based on the criteria of Nimmannitya et al. (4). Since serum samples were tested with all 4 dengue antigens, aberrant responses could be readily detected and the HI test would be repeated on these particular serum samples until the results were consistent and reproducible. In all tests in which the control titrations of antigen showed that 16 or 4 HA units had been used, the serum titres were corrected to 8 HA units, since a regular reciprocal relationship exists in this range between antigen units and HI titres (2).

The LLC-MK_2 (rhesus monkey kidney continuous cell line) plaque reduction neutralization test (PRNT) was carried out, as previously described (3), with the following dengue strains: Dengue 1 (16007), Leahi TC6; Dengue 2 (16681), Leahi TC5; Dengue 3 (16562), Leahi TC7; and Dengue 4 (4328-S), Leahi TC3.

Influenza. Antigens were obtained by growing influenza A and influenza B viruses in the allantoic cavities of 10–11-day-old embryonated eggs. Influenza A2/HK/8/68(MK2-E6 passage) and influenza B/Massachusetts/3/66(passage E10) strains were used as seed viruses. The eggs were incubated for 2–4 days at 33°C and the allantoic fluid was harvested after chilling the eggs at 4°C overnight. For the presence of haemagglutinins, the allantoic fluids were titrated in duplicate with 0.5% chicken erythrocytes.

In the haemagglutination inhibition test, non-specific inhibitors were removed from the sera by treating 1 volume of serum with 4 volumes of receptor-destroying enzyme (100 units per ml). For perform-

[a] Linbro, New Haven, Connecticut, USA.

Table 1. Number of patients admitted to hospital in Rangoon with haemorrhagic fever by etiology, 1970–72

Year	Chikungunya	Dengue	Dengue and chikungunya	Influenza A	Influenza B	Measles	Unknown etiology	Total
1970	451	52	36	—	—	—	352	891
1971	43	78	8	164	0	12	117	422
1972	16	217	11	99	62	—	342	747
total	510	347	55	263	62	12	811	2060

ing the HI test, microtitre equipment was used with 0.5% chicken erythrocytes and 4 HA units of antigen. Serial twofold dilutions of serum from 1 : 10 to 1 : 640 were tested. Known antisera to influenza A and B viruses were included in all the tests.

Measles. Antigen was obtained from a commercial source prepared from African green monkey kidneys infected with the Edmonston strain of measlesvirus.[a]

The HI test was performed according to the method of Rosen (5) with microtitre equipment. In each test, 4 HA units of antigen in 0.025 ml were used and the sera were tested in serial twofold dilutions from 1 : 10 to 1 : 640.

RESULTS

The distribution of 2 060 patients (with a clinical diagnosis of haemorrhagic fever) by serologically confirmed diagnoses during the period 1970–72 is shown in Table 1. In 1970, the majority of hospitalized patients (451 of 891) were found to have chikungunya infections; there were also 52 patients with dengue, 36 with dengue and chikungunya, and 352 on whom no etiologic diagnosis could be established. Unexpectedly, in 1971, influenza A was predominant and accounted for 164 of 422 hospitalized patients; there were also 78 patients with dengue, 43 with chikungunya, 8 with simultaneous chikungunya and dengue infections, 12 with measles, and 117 with no etiologic diagnosis. In 1972, both influenza A and B infections led to the admission of patients to hospital with a diagnosis of haemorrhagic fever, and the proportion of confirmed dengue cases increased. Of the 747 patients, there were 217 with dengue, 16 with chikungunya, 11 with dengue and chikungunya, 99 with influenza A, 62 with influenza B, and 342 with no etiologic diagnosis.

In Fig. 1–3 are shown the numbers of patients admitted to hospital each month during 1970–72 and their serologically confirmed diagnoses. Perhaps owing to delayed recognition or seasonal factors, the incidence of dengue and chikungunya reached

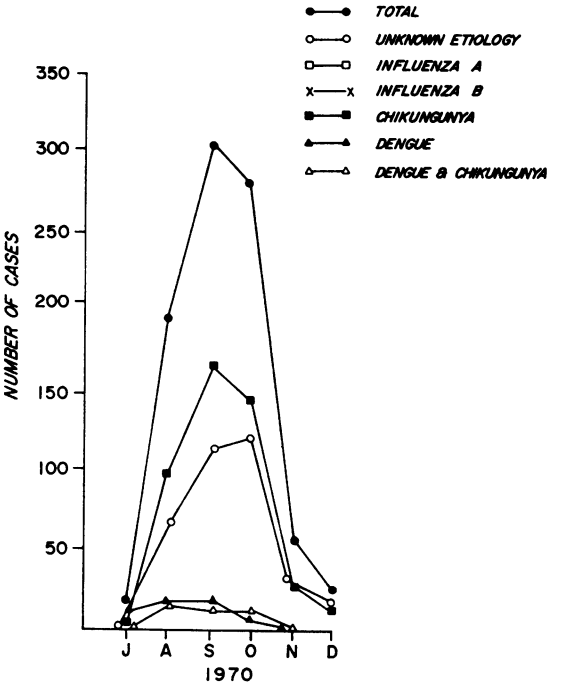

Fig. 1. Etiology and monthly distribution of 891 patients hospitalized with haemorrhagic fever in Rangoon, Burma, 1970 (from July till December).

[a] Measles antigen, Flow Laboratories, Rockville, Maryland, USA.

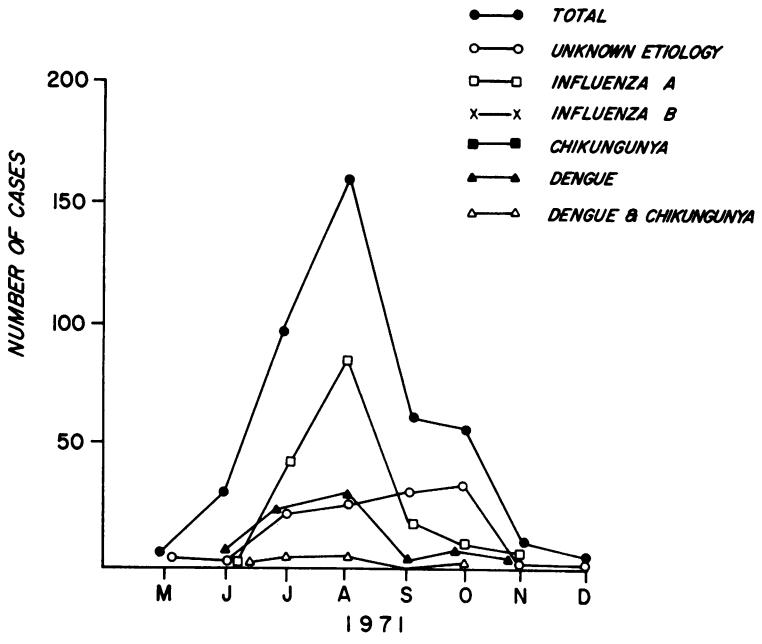

Fig. 2. Etiology and monthly distribution of 422 patients hospitalized with haemorrhagic fever in Rangoon, Burma, 1971 (from May till December).

Table 2. Distribution of patients with haemorrhagic fever in Rangoon by e tiology and by age and sex, 1970–72

Age group (years)	Primary dengue		Secondary dengue		Chikun-gunya		Dengue & chikun-gunya		Influenza A		Influenza B		Measles		Unknown etiology		Total	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
<1	5	7		2	8	4		1		1					19	15	32	30
1	5	5	4	9	21	14	6	1	5	4	1	1			28	16	70	50
2	7	4	8	11	22	22	2	2	10	3	1	2			28	33	78	77
3	6	6	19	28	34	22	3	3	14	7	1	1	1		51	50	129	117
4	7	5	18	29	40	39	6	3	12	16	2	5	1		58	39	144	136
5	8	6	24	20	45	33	7	2	18	30	5	7	1		60	47	168	145
6	3	5	8	21	41	23	2	4	15	22	4	3	2	5	45	59	120	142
7		4	11	7	24	20	2	4	19	15	9	3	1	1	53	37	119	91
8	4	4	3	4	21	11			8	7	3	4			26	33	65	63
9		1	3	5	16	9	1		11	13	2	4			18	23	51	55
10	1	1	3	3	6	6	1	1	8	11	2	1			20	16	41	39
11+	2		6	5	12	17		4	8	6	1				17	20	46	52
total	48	48	107	144	290	220	30	25	128	135	31	31	6	6	423	388	1 063	997

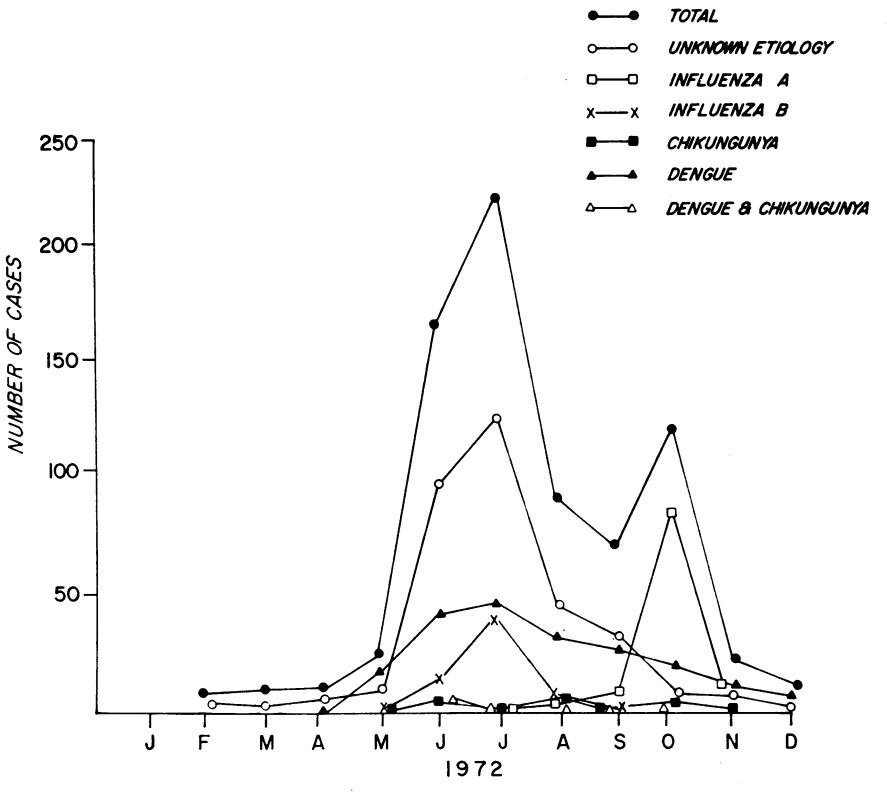

Fig. 3. Etiology and monthly distribution of 734 patients hospitalized with haemorrhagic fever in Rangoon, Burma, 1972.

a peak later in 1970 (September) than in 1971 or 1972 (August and July, respectively). The peaks of the curves for the numbers of hospitalized patients showed that infections of unknown etiology paralleled dengue and chikungunya in 1970 and 1972, but occurred somewhat later in 1971. Interestingly, the influenza A and B outbreaks in 1971 and 1972, respectively, coincided precisely with the period when patients were hospitalized with arbovirus infections. In 1972, however, the peak of the influenza A outbreak occurred several months after the modal period for dengue infection. This late influenza A outbreak thus led to a bimodal curve for the total number of patients admitted to hospital with " haemorrhagic fever " in 1972. The measles cases, which occurred in 1971 during the later half of the rainy season (the rainy season extends from May till November), are not shown in Fig. 2. No virological tests for influenza and measles were performed in 1970, nor were any sera tested for measles in 1972.

The day of hospitalization of patients with haemorrhagic fever in 1971 according to confirmed etiologies was also investigated. It indicates the day from the onset of the fever when the parents or the physician believed the child was ill enough to be hospitalized. Patients with chikungunya infections were admitted to hospital earlier than those with dengue. More than 50% of chikungunya-infected patients were hospitalized less than 48 hours after the onset of the illness. The average duration of the stay in hospital lasted from 4.2 to 4.8 days and did not vary in the different infections.

The age and sex distribution of haemorrhagic fever cases by etiology is shown in Table 2. There were 48 males and 48 females infected with primary dengue (M : F = 1 : 1), 107 males and 144 females with secondary dengue (M : F = 1 : 1.3), and 290 males and 220 females with chikungunya (M : F = 1.3 : 1). Both sexes were equally affected in the remaining etiologic categories. Children aged 4 or

Table 3. Distribution of patients with haemorrhagic fever in Rangoon by etiology and by clinical signs, 1970–72 [a]

Clinical signs	Dengue		Chikungunya	Influenza A and B	Measles	Unknown etiology
	primary	secondary				
Total no. of patients examined	79	186	359	220	12	794
coffee-ground gastric aspirate	25 (31.6)	50 (26.8)	60 (16.7)	52 (23.6)	2 (16.6)	147 (18.5)
haematamesis	60 (75.9)	149 (80.1)	271 (75.5)	203 (92.3)	6 (50.0)	446 (56.1)
epistaxis	27 (34.1)	26 (19.3)	53 (14.7)	62 (28.1)		91 (11.5)
bleeding gum	2 (2.5)	2 (1.1)	1 (0.2)	6 (2.7)		10 (1.2)
melaena	4 (5.1)	26 (13.9)	22 (6.1)	17 (7.7)		43 (5.4)
petechial haemorrhage	6 (7.6)	24 (12.9)	8 (2.2)	7 (3.1)		26 (3.2)
convulsion	7 (8.8)	14 (7.5)	1 (0.2)	7 (3.1)		20 (2.5)
positive tourniquet test	40 (57.1)	82 (50.0)	73 (22.8)	105 (53.0)	9 (75.0)	174 (24.1)
haematuria	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.9)		1 (0.1)
shock	4 (5.1)	80 (43.0)	6 (1.6)	7 (3.1)		13 (1.6)
rash	18 (22.7)	32 (17.2)	68 (18.9)	20 (9.1)	9 (75.0)	75 (9.4)
lymphadenopathy	18 (22.7)	50 (26.8)	130 (36.2)	60 (27.2)		122 (15.3)
vomiting	42 (63.1)	127 (68.2)	290 (80.7)	168 (76.3)		340 (42.8)
enlarged liver	13 (16.4)	63 (33.8)	81 (22.5)	69 (31.3)	6 (50.0)	155 (19.5)
enlarged spleen	0 (0.0)	1 (0.5)	1 (0.2)	2 (0.9)		9 (1.1)

[a] Figures within parentheses are percentages.

[b] Total number of patients examined with primary dengue was 70, secondary dengue 164, chikungunya 320, influenza A and B 198, and in the unknown etiology group 721.

5 years were admitted most frequently compared with other age groups. There was no significant difference in the age distribution of patients in the different etiologic groups.

The clinical signs observed at the Children's Hospital are shown in Table 3. Statistical tests of significance were carried out on paired comparisons of the frequencies of all the results in each etiologic group. The signs, whose incidence differed significantly when the patients with primary and secondary dengue infections were compared, were: epistaxis ($p<0.01$), melaena ($p=0.05$), shock ($p<0.01$), and enlarged liver ($p<0.01$). The frequency of clinical signs in chikungunya and primary dengue infections were similar, except for epistaxis ($p<0.01$), convulsions ($p<0.01$), positive tourniquet test ($p<0.01$), and lymphadenopathy ($p<0.01$); chikungunya and secondary dengue infections differed in the frequency of melaena ($p<0.01$), petechial haemorrhages ($p<0.01$), convulsions ($p<0.01$), a positive tourniquet test ($p<0.01$), shock ($p<0.001$), lymphadenopathy ($p=0.05$), vomiting ($p=0.05$), and hepatomegaly ($p<0.01$).

The findings in patients with influenza were of interest, since haematemesis was more frequent among them than in the other groups ($p<0.01$) and epistaxis was also more frequent except for those with primary dengue ($p<0.01$). Petechial haemorrhages, rashes, and convulsions were, however, less frequent in influenza than in patients with dengue ($p<0.05$).

As individuals, the patients in the " unknown etiology " group closely resembled those with dengue, chikungunya, or influenza, but as a group, most of the clinical signs were found to occur with a significantly lower frequency compared with the other groups: haematemesis ($p<0.01$), epistaxis ($p<0.01$) (except for secondary dengue and chikungunya), melaena ($p<0.05$) (secondary dengue only), convulsions and petechial haemorrhages ($p<0.01$) (dengue infections only), positive tourniquet test ($p<0.01$) (except chikungunya), shock ($p<0.001$) (secondary

Table 4. Serologic studies on primary dengue in fections in children in Rangoon, 1971

Patient	Age/sex	Day of illness when serum was taken	Titres against the indicated antigen												Interpretation
			HI				CF				PRNT				
			d1	d2	d3	d4	d1	d2	d3	d4	d1	d2	d3	d4	
7123	8 years/M	4	<10	<10	<10	10	<4	<4	<4	<4	<20	<20	<20	20	primary dengue 1
		17	40	40	40	40	16	4	4	4	60	<20	<20	<20	
7081	11 months/F	4	<10	<10	<10	<10	<4	<4	<4	<4	<20	<20	<20	<20	primary dengue 2
		18	40	160	160	320	16	64	16	16	45	740	26	200	
7295	5 years/M	3	<10	<10	<10	40	<4	<4	<4	<4	<20	<20	<20	<20	primary dengue 3
		23	80	80	640	160	32	32	64	32	40	130	960	50	
7275	3 years/M	3	<10	<10	<10	40	<4	<4	4	4	<20	<20	<20	<20	primary dengue 4
		23	160	160	160	320	16	16	32	128	125	250	220	>1 280	

dengue only), rashes ($p<0.01$) (except influenza), vomiting ($p\leq0.05$), and enlarged liver ($p<0.01$) (except primary dengue and chikungunya). No significant differences were noted in the incidence of other clinical signs between the groups.

Of the 14 single serum samples obtained from patients with a clinical diagnosis of haemorrhagic fever, who later in the illness died, 8 had HI antibodies against one or more dengue antigens at a titre of 1 : 1 280.

Table 4 shows the results of the HI, CF, and plaque reduction neutralization tests, which were performed on selected samples of paired sera. These data provide evidence that all four dengue types had caused human infections during the 1971 outbreak in Rangoon.

DISCUSSION

Haemorrhagic fever is a new disease in Burma and the main object of this study was to define it as an entity, based on the diagnoses made by the staff of the Children's Hospital in Rangoon. Perhaps partly owing to the lack of continuous and timely laboratory verification of cases, the etiology of clinical " haemorrhagic fever " has proved to be multiple. In the three-year study period, 1970–72, patients with either dengue or chikungunya infections, or both, or neither, had been included, especially in the 1971 and 1972 outbreaks when the situation was complicated by concurrent outbreaks of influenza. In 1970, over 80% of the patients had chikungunya infections; the proportion of these cases was smaller in 1971 and lowest in 1972. Some of the simultaneous dengue and chikungunya infections may have been artefacts resulting from the transfusion to some patients of plasma, which contained antibody, after the collection of the blood samples in the acute phase. There were three such patients in 1970 and 1971.

A survey carried out in 1969 showed that the density of *Aedes aegypti* mosquitos per man per hour in the Kemmendine area of Rangoon was highest in June, July, and August with a peak " biting frequency " in August (C. Khai Ming et al., unpublished data, 1970). Thus, cases of " haemorrhagic fever " of arbovirus etiology appear to be seasonally correlated with the activities of *A. aegypti* mosquitos.

An analysis of the clinical findings showed that a patient with haemorrhagic manifestations, whose admission to hospital was sought within 24 hours of the onset of the disease, was more likely to have a chikungunya infection. Since chikungunya is a mild disease, this differential finding may help a physician to decide whether or not to hospitalize a patient. Chikungunya infections in Thailand have been described as causing mild haemorrhagic phenomena (4) but not shock and more severe forms of bleeding, such as haematemesis. On the whole, patients with chikungunya and primary dengue infections had milder illnesses than those with secondary dengue. A high proportion of patients with chikungunya in our study were found to have occult gastrointestinal bleeding. It should be noted that

the presence of altered blood in gastric aspirates was equally common in patients in all our etiologic categories, including patients with influenza. Gastrointestinal bleeding occurred in more than half of our patients with illnesses of unknown etiology. The cause of this phenomenon is not known, but the possibility that low-grade gastrointestinal bleeding might be related to the administration of salicylates to patients before admission to hospital is under investigation.

Shock was found to be significantly correlated with secondary dengue infections, as were melaena, petechial haemorrhages, and an enlarged liver; the incidence of hepatomegaly in patients with influenza was, however, similar to that in patients with secondary dengue.

The high frequency of haemorrhagic manifestations in patients with confirmed influenza A or B infections was notable; epistaxis, melaena, a positive tourniquet test, and rashes occurred at frequencies, which generally exceeded those described in textbooks.

The patients admitted with a diagnosis of haemorrhagic fever but with no serologic evidence of dengue or chikungunya infections are of interest. There were 811 such cases of unknown etiology, nearly equal to the number of dengue and chikungunya patients combined; according to the records available, their presenting clinical signs were rather similar to those of patients with arbovirus infections. The occurrence of patients with enlarged livers, petechial haemorrhages, and shock suggests the possibility that some secondary dengue infections might have been included in this category. Patients with moderately high, fixed HI antibody titres to dengue are difficult to categorize serologically. This antibody pattern may follow a recent anamnestic response (secondary antibody) or could represent antibody of remote origin.

Our data emphasize the protean nature of the haemorrhagic fever syndrome, the milder forms of which are undoubtedly accompanied by several different microbial infections.

Haemorrhagic fever in Burma, as now diagnosed, is thus a syndrome of multiple etiology. This would not have been known if virological studies had not been carried out. Infections would have been classified merely as caused by " dengue ", based only on clinical diagnosis. It is fortunate that an arbovirus laboratory has now been established to distinguish between illnesses caused by dengue or chikungunya viruses and those resulting from other causes. Effective clinical, epidemiological, and preventive studies can be carried out in the future. With the laboratory support already available, a dramatic improvement in the association of clinical diagnoses of haemorrhagic fever with secondary dengue infections in 1973 is now in evidence.

There is no doubt that the surveillance studies implemented by the Central Epidemiology Unit were useful, since they assisted in the collection of samples and the analysis of clinical data, and provided laboratory support to the staff of the Children's Hospital. These services have helped clinicians improve both the diagnosis and the treatment of patients with haemorrhagic fever.

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RÉSUMÉ

ÉTUDES CLINIQUES ET DE LABORATOIRE SUR LA FIÈVRE HÉMORRAGIQUE EN BIRMANIE (1970-1972)

Un programme de surveillance de la fièvre hémorragique a été lancé à Rangoon (Birmanie) en 1964. De 1970 à 1972, une étude sérologique portant sur 2060 enfants admis dans divers hôpitaux de la ville avec le diagnostic clinique de fièvre hémorragique a fait ressortir l'étiologie multiple de l'affection: 347 cas

seulement (16,8%) étaient dus à une infection par un virus de la dengue (96 cas d'infection primaire et 251 d'infection secondaire); 510 (24,7%) à une infection récente par le virus chikungunya; 55 (2,7%) à une infection mixte dengue-chikungunya; 263 (12,8%) à une infection par le virus grippal A; 62 (3,0%) à une atteinte grippale de type B; 12 (0,6%) des malades étaient atteints de rougeole. Chez 811 patients (39,4%), l'étiologie n'a pu être précisée.

Durant les trois années de l'étude, on a posé le diagnostic clinique de fièvre hémorragique chez des malades atteints soit de dengue, soit d'infection à chikungunya, soit des deux, soit d'une autre affection. En 1970, 80% des patients étaient atteints d'infection à chikungunya; en 1971, la proportion de ces cas était moindre et elle a atteint son niveau le plus bas en 1972. En 1971 et 1972, des épidémies concomitantes de grippe sont venues compliquer la situation. On a relevé une corrélation entre la fréquence des fièvres hémorragiques dues à des infections à arbovirus et les variations saisonnières de la densité des populations d'*Aedes aegypti*. L'analyse des données cliniques a montré une fréquence élevée des hémorragies gastro-intestinales dans tous les cas de fièvre hémorragique, indépendamment de leur étiologie.

Le cas des patients hospitalisés avec le diagnostic de fièvre hémorragique, mais chez lesquels l'examen sérologique n'a mis en évidence aucune infection par les virus de la dengue ou chikungunya, est intéressant. Ces patients, au nombre de 811, présentaient des symptômes rappelant ceux provoqués par les infections à arbovirus.

La fièvre hémorragique apparaît donc comme un syndrome d'étiologie très diverse, dont les formes bénignes peuvent s'observer dans un grand nombre d'infections microbiennes. En l'absence de preuve sérologique, et au vu des seules données cliniques, les cas observés en Birmanie auraient été classés comme « dengue ». La présente étude a aussi montré que les quatre types de virus de la dengue circulaient dans la région de Rangoon.

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