Current Status of Dengue/Dengue Haemorrhagic Fever in WHO South-East Asia Region

By
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Abstract
Dengue fever/dengue haemorrhagic fever (DF/DHF) is the most important emerging viral disease affecting nearly half of the world’s population. It is estimated that there are between 50 to 100 million cases of DF and about 500 000 cases of DHF which require hospitalization every year.

In the WHO South-East Asia Region, over the past 15 years, DF/DHF has become a leading cause of hospitalization and death among children. The annual incidence of DF cases is estimated to be between 20–30 million and of DHF between 200 000 and 400 000 cases with 10 000 deaths. During 1996–1998, an increasing trend in morbidity associated with DF/DHF has been observed in India, Indonesia, Maldives, Myanmar, Sri Lanka and Thailand. There are formal DF/DHF control programmes in most of the countries except India and Maldives. The DF/DHF control strategy relies mainly on two aspects: (1) efficient disease management in hospitals to reduce case fatality rates, and (2) vector control through the integration of chemical, biological and environmental methods of control. Source reduction programmes are largely community-based, particularly utilizing schoolchildren. This presentation also details the role of the WHO
Introduction

The global pandemic of dengue/dengue haemorrhagic fever (DF/DHF) has re-intensified greatly over the past 15 years. More than 2.5 billion people are at risk of the infection in over 100 countries worldwide (1). There is an estimated incidence of tens of millions of dengue cases each year and at least 500 000 cases of DHF with a mortality of about 5% in most countries; the vast majority of these cases, at least 95%, are among children less than 15 years of age.

The South-East Asia Region of WHO comprises 10 countries, namely, Bangladesh, Bhutan, India, Indonesia, Democratic People’s Republic of Korea, Maldives, Myanmar, Nepal, Sri Lanka and Thailand, with a total population of 1.45 billion.

Ever since the recognition of DF/DHF as a disease entity in Manila in 1950, the disease has spread to many countries in South-East Asia. Notably among them was Thailand which recorded a severe outbreak in 1958, followed by Indonesia in 1968, and Myanmar in 1970. The disease has now become endemic in seven countries of the Region, except Bhutan and Nepal, and the occurrence of outbreaks has become a regular feature.

Since 1994, there has been a growing proportion of cases with haemorrhagic manifestations, particularly in Sri Lanka and India, which has contributed to an increasing trend in the case fatality rates in the Region (2).
DF/DHF situation in countries of the SEA Region

Bangladesh

For the time being, DHF is not considered to be a public health problem in Bangladesh though an outbreak apparently occurred in 1964 at the same time as it occurred in Calcutta, India. DF is endemic and a serological survey has shown antibodies to DEN-3 and, to a lesser extent, to DEN-1 and DEN-2, among a high percentage of the population in Dhaka and Chittagong. *Ae. aegypti* is common in the country but is least present in Dhaka. Densities are relatively low as water is not commonly stored for household use. Nevertheless, the presence of this vector and three serotypes of dengue virus implies that the country is at some risk and must be alert to any epidemic outbreak.

India

Though DF has been known to be in existence in India for a long time, DHF was first reported in an outbreak which occurred in Calcutta in 1963. It appears that the proportion of DHF or DF cases with haemorrhagic manifestations has increased in the last 5–6 years; all the states, excepting those in the north-east, have reported outbreaks. The disease was earlier restricted to urban centres, but is now spreading out to rural areas as well. The onset of the disease occurs immediately after the monsoon season which varies in duration from state to state, between July and November. The attack rates in the outbreaks reported have ranged from 20% to 80% of the population in affected localities. All age-groups have been affected by DF, and all the four serotypes of the virus have been isolated and are in circulation in the country; more than one serotype are commonly present during many of the outbreaks in urban areas. The seropositivity of localities affected by dengue can be quite high ranging from 8% to 91%.

The vectors, *Ae. aegypti* and *Ae. albopictus*, are widespread in India and their local densities can be quite high; however, the role of *Ae. albopictus* has not yet been established. Most of the DF/DHF outbreaks have occurred in localities where the larval house index
was more than 20%. There is no regular vector surveillance and control programme in India.

Recently, India experienced a severe outbreak of DHF in Delhi during September–October 1996, which took a toll of 423 lives with 10 252 hospitalizations, giving a case fatality rate of 4.1%\(^3\). DHF is now a notifiable disease in Delhi since 1997.

**Indonesia**

DHF was first reported in Indonesia in 1968 when haemorrhages and mortality occurred during the dengue outbreaks in Surabaya and Jakarta. Since that time, DHF has spread rapidly and its incidence has mounted. In the first outbreak in Jakarta, 53 cases of DHF and 24 deaths were recorded. Twenty years later, by 1988, a total of 44 573 cases of DHF with 1527 deaths had been reported from 201 of the total 304 districts in the country and the incidence of DHF rose to 27.1 per 100 000 population. Considerable efforts were made to control the vectors during 1988–1996; in fact, the incidence of DHF touched a low of 6.1/100 000 in 1989. Since 1989, the incidence has fluctuated: rising again to 9.7/100 000 in 1994, and even higher in 1996. In 1994, 217 regencies/municipalities reported the occurrence of DHF with the rate per 100 000 population remaining relatively as high as 9.7. Surveillance statistics for 1996 showed an increasing trend with 44 650 reported cases and 1192 deaths. However, during 1997, the number of cases decreased to 30 730 with 681 deaths.

The Government accords a high priority to the surveillance of the disease and the control of its vector, *Ae. aegypti*. The species is very widespread throughout Indonesia and house indices are often quite high. It is felt that mass larviciding, the application of thermal fogs and ultra low volume (ULV) insecticide concentrates along with an intensive programme of health education with the active participation of the community have had a reasonable success in reducing the incidence of DHF. The larval surveys carried out in 1992 showed that the vector premise index in schools was 32.40% and that the incidence of dengue among schoolchildren 5–14 years old was 46.40% in 1993 and 40.40% in 1994.
Because of these very high rates, special efforts have been made to achieve source reduction in and around schools by enlisting the active cooperation of both teachers and students. There are about 42,689,700 students in schools in Indonesia. A school health programme has been established and a national seminar has recommended source reduction through this programme. Schoolchildren are actively participating in source reduction activities.

### Maldives

The first reported outbreak of DF occurred in Maldives in 1979. Investigations showed that both DEN-1 and DEN-2 serotypes were circulating and that some 71% of the country’s population was seropositive. Outbreaks were again reported in 1980. In 1988, a very severe outbreak of dengue occurred in the capital, Male, which affected a large proportion of the population of children under ten years of age; nine deaths from DHF were reported. The last outbreak reported in 1998 with 1778 reported cases and no death reported.

Surveys of the mosquito population show that *Ae. aegypti* and *Ae. albopictus* are common in Male and are present in all the islands of the country; they have been found to breed in roof-top water tanks, rain water harvesting tanks, a large variety of small containers, particularly in plastic trays kept below flower pots, and in empty coconut shells and tree holes.

### Myanmar

The first major epidemic of the disease syndrome occurred in the Capital, Yangon, in 1970. Since then, epidemics have continued to occur in a cyclic pattern and the disease has spread from Yangon to most parts of the country. Between 1970 and 1995, there were 83,381 cases of DHF with 3,243 deaths, a case fatality rate of 3.88%. Probably, the actual number of DHF cases is considerably larger as only the hospitalized cases are reported. About 90% of the DHF cases in Myanmar occur in the 5–8-year-old age-group.

During the first five years in which DHF was known to occur in the country, almost all the cases were
confined to the Yangon division. By 1975, the disease syndrome had begun to spread and, in that year, 31% of the DHF cases occurred in Mandalay and only 29% in Yangon. However, Yangon still remains the most serious focus of DHF. In 1994, 11,647 cases and 461 deaths from DHF were reported from the country as a whole.

DF and particularly DHF/DSS are increasingly becoming serious public health problems in Myanmar, especially among the 5–10 and 11–15-year-old age-groups and, as noted above, a vast majority of the cases occur in the 5–8-year-old age-group. The syndrome continues to spread geographically within the country accounting, in part, for the increased number of cases. The surveillance of DF/DHF is limited by the fact that only two laboratories can carry out the laboratory diagnosis, viz. the Department of Medical Research and the National Health Laboratory, both in Yangon.

*Ae. aegypti* and *Ae. albopictus* are found throughout Myanmar in high densities. *Ae. aegypti* is the main vector and *Ae. albopictus* has only a secondary role. Furthermore, the spread of *Ae. aegypti* within the country is increasing with the species being found in areas where it has not been previously reported. An increasing effort is being made to control the vector through community participation by reducing the larval habitats, but densities still remain very high. The country is preparing contingency plans for dengue vector control based on a better mapping of the distribution and population densities of aquatic stages. More efforts are, however, required to improve the surveillance of dengue infections and case management.

**Nepal**

There is no recorded transmission of DF/DHF in Nepal. While there have been no clinical cases of DF/DHF, the serological specimens taken near the border with India in 1980 and 1981 were seropositive for both DEN–2 and DEN–4. Although its origin is uncertain, a high percentage of the sera tested was positive which implies that surveillance for the infection must be maintained. Although *Ae. aegypti* has not been recorded in Nepal, *Ae. albopictus* is present. More surveys are needed in urban areas to verify...
this situation, especially in towns bordering India.

**Sri Lanka**

Dengue was known to be endemic in Sri Lanka from the beginning of the century but its first epidemic outbreak which was serologically confirmed was in 1965. Though most of the towns throughout the country were affected during this epidemic outbreak, the western coastal belt was the most affected. Colombo recorded the highest number of cases and the first two cases of DHF also occurred at that time. There were 13 cases of DHF with five deaths in 1966; 29 cases and eight deaths in 1967, and seven cases with two deaths in 1968. Up to 1972, there were only a few scattered cases with no cases reported between 1973 and 1976; very few DHF cases were reported until 1989. Surveys, however, showed that more than one serotype were circulating. In 1989, there was a sudden outbreak of DHF with 203 clinically diagnosed cases and 20 deaths [a case fatality rate (CFR) of 9.8%]. In 1990, the number of cases rose sharply to 1350 of which 345 were serologically confirmed; DHF cases were also reported from outside Colombo. Several hundred cases have been reported annually from 1991 to 1997 with a CFR ranging from 1.2 to 4.16. The age distribution shows that 70% of the cases were related to those less than 15 years of age with the peak being seven years; more men (57%) than women (43%) were affected.

DHF is a notifiable disease in Sri Lanka. At places where DHF cases have been reported, control measures include health education, particularly in schools, and community participation in cleaning campaigns. Vector surveillance shows that though *Ae. aegypti* is more common than *Ae. albopictus*, the latter is quite common in the outskirts of Colombo.

**Thailand**

The first epidemic outbreak occurred in 1958 with 2706 cases and 296 deaths, resulting in a morbidity rate of 10.6/100 000. DHF has persisted since 1958 with the first cases outside of Bangkok being reported for the first time in 1964. Subsequently, it had spread gradually throughout the country by 1978 and now occurs in
In 1987, a major epidemic occurred with the highest incidence to date of 174,285 cases and 1,007 deaths. The year 1990 was another serious year when 92,002 cases and 414 deaths were reported. In 1993, there were 67,017 cases and 222 deaths and in 1997, 99,150 cases and 227 deaths.

Every year, beginning February, there is a gradual increase in the incidence of DHF cases in Thailand which peaks in July and August, with the monthly number of cases declining thereafter. All the four serotypes of dengue are circulating in Thailand though the proportion of each serotype varies from year to year. The trend of the incidence of the disease has continued to increase in a cyclic pattern. The disease mainly affects the younger age-groups of less than 15 years with the highest proportion of cases occurring in the age-group 5–9 years, followed by the age-group 10–14 years. As can be expected, DHF is the main cause of paediatric hospitalization in the country. Despite the increased number of cases, the CFR has declined as physicians have gained experience in the treatment of young patients: the CFR decreased from more than 10% in 1958 to 0.27% in 1994 and 0.29% in 1996. It was further reduced to 0.23% in 1997.

The main vector of DHF in Thailand, as elsewhere in the Region, is *Ae. aegypti*. *Ae. albopictus* is uncommon in Bangkok but its distribution and population begins to increase in the suburbs and is particularly high in rural areas. *Ae. aegypti* was initially found mainly in urban areas but in the last decade it increased steadily in rural areas as well.

An increasing amount of effort and funding is being devoted to the control of *Ae. aegypti*. Much of the effort revolves around the education of teachers and students in schools throughout Thailand as well as enlisting the cooperation of the community in the prevention of vector breeding. So far the control efforts have had only a limited impact on vector population densities. However, as more experience is gained, it is hoped that vector densities will
Municipalities continue to use thermal fogs and, to a lesser extent, ultra low volume (ULV) insecticide applications. As these applications, as also the use of temephos sand granules, are only sporadic, they have little impact on vector densities. Much more effort needs to be made to gain effective participation by the community in applying the environmental measures for reducing vector breeding before any real impact can be effected on vector densities. It is also essential that a greater use should be made of entomological evaluation to assess the effects of control measures and alter them appropriately whenever necessary.

In summary, out of the seven endemic countries in the South-East Asia Region, only four countries, i.e. Indonesia, Myanmar, Sri Lanka and Thailand, have DHF as a reportable/notifiable disease. It shows a high endemicity in Indonesia, Thailand and Myanmar while it is moderate in India and Sri Lanka. Bangladesh and Maldives experienced outbreaks and the presence of dengue antibodies in a high percentage of the population implies high receptivity to DF/DHF outbreaks. The number of the reported cases and fatality rates of DF/DHF by country for the years 1985-1997 is given in Figure 1.

![Figure 1. Number of Reported Cases and Case Fatality Rate of DF/DHF in the South-East Asia Region, 1985-1998](image-url)
The WHO programme for the prevention and control of DF/DHF is being implemented at the global level at WHO headquarters, the regional offices and at country level. The current programme is based on a resolution of the Forty-sixth World Health Assembly in 1993 on dengue prevention and control which urged Member States to strengthen national and local programmes for the development of strategies for the prevention and control of DF/DHF and its vectors. To achieve this it is necessary to ensure that DHF and DSS are made reportable diseases in each endemic country. The surveillance capabilities of the endemic countries in respect of the disease and its vectors must be strengthened in order to obtain accurate data on the incidence and distribution of DHF. Dynamics of the disease transmission and the bionomics of the vectors will enable the vector and disease control programmes to be strengthened at local, municipal, national and regional levels. Assistance has also been provided to identify resources to broaden laboratory capacity for the diagnosis and improvement of the treatment of DHF and DSS cases.

Improvement of vector control operations and the ability to deal with emergencies caused by epidemic outbreaks can be achieved by such technical inputs and the provision of additional extrabudgetary resources.

Technical Advisory Committee

In 1964, the South-East Asia (SEA) and the Western Pacific (WP) regions of WHO organized the first Interregional Seminar on Mosquito-borne Haemorrhagic Fevers in Bangkok, Thailand. Since then, the Organization has been actively involved in assisting Member countries in the planning, development and implementation of control measures.

In 1974, the SEA and WP regions established a Technical Advisory Committee (TAC) on DHF. In view of the increasing occurrence of epidemics in the countries of the two regions it was felt that a guide for the diagnosis, treatment and control of dengue infection would be of value to physicians and health authorities faced with the growing risk of epidemics. The first version of this guide entitled "Technical Guide for Diagnosis, Surveillance, Prevention and Control of Dengue Haemorrhagic Fever" was published in 1975.
Dengue Newsletter/Dengue Bulletin

The SEA and WP Regional Offices have been jointly publishing annually, since 1975, a Dengue Newsletter for dissemination to Member countries of the knowledge about DF/DHF incidence and its control. The severity of the disease and the high case fatality rate has triggered off global research interest. These efforts have now culminated in the building up of sensitive diagnostic techniques for the management of cases and vector control strategies. For the dissemination of more scientific knowledge, the Dengue Newsletter was renamed as Dengue Bulletin to better reflect its content and scope.

Standardization of epidemiological research

In order to get comparable results in the countries of the SEA Region, the Research Study Group on DHF in SEAR designed a common protocol in 1979 which was made available to Member countries to serve as the basis for undertaking epidemiological research studies. Initially, Indonesia, Sri Lanka and Thailand were supported by SEARO in conducting five-year research studies on the epidemiology of DHF. Myanmar joined this group in 1984. These multicentre epidemiological studies yielded both broad information on the epidemiology of dengue and also information of practical importance on the development of a tetravalent dengue vaccine. One important accomplishment of this study was the development of laboratory competence to work with dengue viruses in the four participating national laboratories.

Revised guidelines

The South-East Asia Advisory Committee on Medical Research, established in 1976, identified DHF as one of the research priorities in the Region. As the CFR from DHF/DSS was very high in the first outbreaks, WHO supported research studies on pathophysiology, clinical and laboratory diagnosis, and case management during the period 1976–1983. On the basis of these studies, revised guidelines on DHF were issued by the Technical Advisory Group in 1980 and 1986, which incorporated changes in
the criteria for the diagnosis and recommended treatment.

Community-oriented DHF vector control

Following the 1983 and 1986 WHO/SEAR intercountry meetings on DHF, community-oriented DHF vector control studies have been undertaken in Indonesia, Myanmar and Thailand. As an outcome of these studies, Indonesia and Thailand developed national DF/DHF control programmes using community approaches, which have been in operation since 1990.

Monograph on dengue/DHF prevention and control

Extensive research on different aspects of vector control and the cumulative knowledge built up in the Region on the feasibility and practicability of the community-based control programme culminated in the publication in 1993\(^4\) of a monograph on DF/DHF prevention and control. It contains available information on the prevention and control of the infection. This publication was well received and has been reprinted twice. It is proposed to bring out a similar publication in the Regional Office in the near future.

Brainstorming on dengue in India

WHO and the Rockefeller Foundation supported an international conference on DHF and a national "brainstorming" session on dengue in India in 1994\(^5\). The conference recommended inclusion of DHF in the list of notifiable diseases and established control activities in India.

WHO regional strategy for prevention and control of DEN/DHF

A global strategy for dengue vector control was developed as an outcome of the consultative meeting on key issues in dengue vector control towards the operationalization of the Global Strategy in June 1995 in Geneva. Following this meeting, the SEA regional consultative meeting was held in October 1995\(^6\) in New Delhi to review the guidelines for the prevention and control of DF/DHF and to develop a control strategy applicable to the countries of the Region.
Guidelines for management of DEN/DHF epidemic

Following a severe outbreak of DHF in New Delhi in September–October 1996, WHO/SEARO organized a technical meeting on the management of DF/DHF epidemic in November 1996\(^7\). Guidelines for control operations and the management of epidemics were developed for use by Member countries.

Collaborative effort with WHO/WPRO

In view of the alarming trend of DF/DHF in countries of the South-East Asia and Western Pacific regions, the two regional offices organized a bi-regional meeting in Manila in June 1997 with the objective of sharing and exchanging information and preparing collaborative activities to improve control activities between the two regions.

Development of dengue vaccine

The most important progress made in the South-East Asia Region is the development of a tetravalent live attenuated dengue vaccine at Mahidol University, Thailand, with technical and financial support from WHO. The activities of this project, which started in 1980, have been reviewed in Bangkok every year by a Peer Review Group since 1983. The last 12th Peer Review Meeting on Dengue Vaccine Development was held in August 1994. The results of the clinical trials of this new vaccine in adult volunteers have shown that it is safe and its immunological response is encouraging. The Phase I and II trials of the tetravalent dengue vaccine in children are currently under way.

Current control strategies

As there is no specific treatment nor a curative drug or vaccine currently available, prevention and control of dengue transmission must be carried out through comprehensive programmes for the control of the vector. The recently-adopted global strategy for the prevention and control of the DF/DHF vector recommended five broad areas for action: (1) selective integrated mosquito control with community and intersectoral participation; (2) active surveillance based on a strong health system; (3)
emergency preparedness; (4) capacity–building, and (5) vector control research.

Capacity–building

The reduction in the CFR has been identified by Member countries and WHO as a priority area. For this purpose, WHO/SEARO has undertaken the following activities:

- Trained 46 physicians working in the established dengue training/curative wards and teaching/referral/major hospitals in the endemic countries of the Region, at the WHO Collaborating Centre in Bangkok, Thailand.

- Supported the establishment of 15 dengue training/curative wards in six endemic countries of the Region and provided basic minimum equipment.

- Developed “Guidelines for treatment of DF/DHF in small hospitals”.

- Supported the development and production, in collaboration with the WHO Collaborating Centre, of a teaching video film on the management of DHF.

- Provided technical support to Member countries in the control of dengue epidemics.

- Developed and published comprehensive regional guidelines on the prevention and control of dengue/dengue haemorrhagic fever.

As part of capacity–building for the prevention and control of dengue infection, WHO provided long-term training in epidemiology, surveillance methods, and vector control for dengue infection to three epidemiologists from India, Myanmar and Sri Lanka at the Dengue Branch of the CDC at San Juan, Puerto Rico. WHO expects that the services of the staff so trained will be optimally utilized for the implementation of respective national dengue control programmes. Also, long–term training has been provided to two laboratory technicians from the Medical Research Institute, Colombo, in the virological/serological diagnosis of dengue infection at the CDC. During 1994–1999, WHO continued to support the development of live attenuated and recombinant dengue vaccines at the WHO Collaborating Centre for Vaccine Development at the Institute of Sciences and Technology for Development, Mahidol University at Salaya, Thailand.
References


Summary of Dengue Situation in WHO Western Pacific Region

By
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Abstract
In the WHO Western Pacific Region, dengue/dengue haemorrhagic fever (DF/DHF) is a serious public health problem in many tropical countries. Every year, approximately 15 countries/areas report cases of the disease. The most regular reporting countries are: Cambodia, Lao People’s Democratic Republic, Malaysia, the Philippines, Singapore, Viet Nam and several Pacific Island countries and areas.

In recent years, the dengue incidence has been increasing steadily throughout the Region. In 1998, a total of 151,124 cases with 787 deaths were reported, which was the highest number of cases recorded since 1991. Although the case fatality rate (CFR) for the Region has declined to less than 1% due to a better understanding of the pathogenesis and improvement in case management, the CFR still exceeds 4% in some parts of the countries due to late admission to hospitals. This paper briefly reviews the recent epidemiological situation of dengue in the Western Pacific Region, including several outbreaks that were reported throughout 1998 in countries such as Cambodia, the Philippines and Viet Nam. The paper also describes WHO’s role and activities in the prevention and control of dengue in the Region.

Keywords: Dengue fever, Dengue haemorrhagic fever, Dengue shock syndrome (DSS), Western Pacific, Aedes aegypti, and case fatality rate (CFR).

Introduction
In recent years, dengue has become a major international public health concern. Many countries and areas in Asia as well as in Latin America have been experiencing unusually high levels of dengue/dengue haemorrhagic fever activity.

In the Western Pacific Region, DF/DHF continues to be a serious public health concern. Over the past two decades, 33 out of the 36 countries and areas in the Region have reported cases of DF/DHF. The disease has been reported almost annually by 15 countries, including Cambodia, China, Lao People's Democratic Republic (Lao PDR), Malaysia, the Philippines, Singapore, Viet Nam and several Pacific Island countries and area. Table 1.

Table 1. Number of Reported DF/DHF Cases and Deaths in the Western Pacific Region, 1991–97

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During 1993–1997, a total of 552,088 cases were reported from the Region. Of these, 70% were reported from Viet Nam alone. Over the last two decades, the case fatality rate (CFR) has been declining in most of the endemic countries in the Region due to a better understanding of the pathogenesis and improvement in case management. The overall CFR in the Region is now less than 1% (Figure 1). However, in some countries, the CFR still exceeds 4% due to factors such as late admission to hospitals.
In newly-industrialized countries such as Malaysia and Singapore where the dengue incidence had declined due to successful vector control programmes, a resurgence in cases has been reported since 1994. In the Pacific Island countries and areas, the reappearance of DEN-2 was confirmed in 1996 for the first time since the 1980s.

The occurrence of DF/DHF dengue cases in most countries in the Western Pacific Region reaches its peak during the period June–November each year. The level of activity in 1998 was considerably higher than in previous years. A major contributing factor to this increased activity may be changes in weather patterns such as the El Nino phenomenon.

**Current epidemiological situation of dengue in selected countries/areas**

**Australia**

Dengue along with other mosquito-borne diseases such as Japanese encephalitis, Murray Valley encephalitis and Ross River fever, are causing significant human diseases in Australia. Over the past two decades, epidemic activity has been restricted

![Figure 1. Number of Reported DF/DHF Cases and CFR in WPR, 1991–1998](image-url)
to north Queensland. In 1996–1997, an outbreak occurred in the Torres Strait during which approximately 210 laboratory-confirmed cases of DEN–2 were reported.

According to the National Centre for Disease Control in Australia, a total of 500 dengue cases were reported in the country in 1998 as of 8 December, which was more than double the number of cases reported during the same period in 1997 (207 cases). Commencing December 1997, an outbreak of DEN–3 was reported in Cairns, Queensland, and 165 confirmed cases were reported as of 25 May 1998. One case of DHF and the first case of dengue encephalabopathy in the country were also reported. By June 1998, the outbreak had subsided due to control activities undertaken by the Tropical Public Health Unit of the Queensland Department of Health.

Cambodia

Dengue was first recognized in Cambodia in 1960 and, since then, the disease has become a serious public health problem with dengue epidemics occurring every two to three years in the country. In 1990 and 1995, major epidemics occurred, and 7241 cases (331 deaths) and 10 208 cases (424 deaths) respectively were reported. Like in all dengue-endemic countries, the major vector is Aedes aegypti, but A.albopictus also plays an important role in dengue transmission in rural areas.

In 1998, a large DHF outbreak occurred throughout the country\(^2\). From January to March, an unprecedented dry-season DHF outbreak occurred in Phnom Penh, with the number of cases exceeding the epidemic threshold more than five fold. In June, a sharp increase of DHF cases was observed, this time with the virus spreading to 18 of Cambodia's 22 provinces as compared to only six during the 1995 epidemic. Two provinces (Koh Kong and Kratie) reported DHF for the first time. By the end of 1998, a total of 16 216 DHF cases with 475 deaths were reported in the country (CFR=2.9%), which was the worst year for dengue on record. In response to the outbreak, the National Dengue Control Programme of the Ministry of Health, in collaboration with WHO and other agencies, established a nationwide action plan under which various prevention and control activities were
implemented. These included insecticide spraying and the distribution of the larvicide Abate to households across the country. In addition, health education was provided on television, radio and in the form of leaflets to encourage people to store water in regularly cleaned, covered containers. WHO and USAID provided spraying equipment and 38 tonnes of Abate in response to the outbreak.

Fiji
In 1989–90, a dengue outbreak with at least 3500 suspected cases including roughly 40 deaths, was reported. In December 1997, a large DEN-2 outbreak began in Fiji, and by the time the outbreak subsided in May 1998, a total of 24 780 suspected cases with 13 deaths had been reported. The areas affected were primarily the urban and peri-urban areas of Suva and Lautoka, the two largest cities. The Ministry of Health in Fiji quickly established an outbreak response team which met regularly to guide activities in the areas of surveillance, information dissemination, vector control and case management. A major community campaign was also initiated in the country. WHO collaborated with the MOH from the outset in activities such as developing case management guidelines and sending insecticides and equipment from WHO’s regional stockpile in Suva to be used for spraying campaigns for the epidemic. Support to the MOH was also provided by the Pacific Community through their AusAID-funded vector-borne disease control programme, the Government of Japan, and other international, regional and bilateral partners. The lower case fatality rate for the 1998 outbreak has been attributed to improved case management based on guidelines introduced early in the epidemic.

Malaysia
Since 1994, the incidence of dengue has been on the rise in Malaysia. According to the WHO Collaborating Centre for Arbovirus Reference and Research in Kuala Lumpur, the 1997 dengue season has been the most severe to date, with a total of 19 544 cases, including 806 DHF cases and 50 deaths reported. This was 37.1% higher than the total number of cases reported in 1996 (14 255 cases) and
the worst year for dengue on record. Cases were reported throughout the year but peaked in July. All the states in the country were affected, but high incidence was recognized in urban areas with a high population density. The virus strains were DEN–1 and DEN–2. Both played equally important roles in causing severe dengue infections.

In 1998, as of 16 May, a total of 5598 dengue cases with 5 deaths had been reported. This is similar to the number of cases reported during the same period last year (5600 cases) but the case fatality rate is 31% lower. Although most states have reported an increase in cases, the Federal Territory, followed by Selangor and Johor, have reported the highest number. The National Dengue Control Programme has been involved in disease surveillance, vector control, health education, community participation programmes, and research.

New Caledonia

In 1995–96, a dengue outbreak occurred in New Caledonia and 1820 cases were reported due to DEN–3. This was followed by a total of 154 dengue cases reported in 1997. However, in the first half of 1998, a DEN–2 outbreak occurred and by mid-July, a total of 2443 dengue cases had been reported – nearly 15 times more than the number of cases notified for the same period in 1997. Cases were concentrated primarily in and around Noumea. Vector control measures were undertaken by the Department of Health which included insecticide spraying and reduction of mosquito breeding sites. By the end of 1998, a total of 2616 cases (1730 confirmed) with no deaths were reported.

Philippines

According to the Department of Health’s (DOH’s) Health Intelligence Service, 11 571 DF/DHF cases were reported in the Philippines in 1997. The DOH’s Field Epidemiology Training Programme (FETP) Surveillance System reported 12 811 cases with 314 deaths for 1997. In July and August 1998, outbreaks were reported in five areas in the Philippines but by September, a nationwide dengue outbreak was declared by the Department of Health (DOH) with 18 areas being declared as ‘dengue hotspots’. By 15 December 1998, a total of 31 297 cases with 493
deaths (CFR=1.6%) had been reported in the country by the FETP. According to the FETP, this has been the most severe outbreak during the last decade. Most of the cases were from Metro Manila, the Ilocos Region, Benguet and Nueva Ecija, Western Visayas, Eastern Visayas and Southern Tagalog. San Lazaro Hospital, an infectious diseases hospital in the National Capital Region, reported 5992 cases with 103 deaths (CFR=1.7%) as of 19 December 1998. A dengue alert was issued by the DOH urging the public to eliminate mosquito breeding sites. Health education campaigns were strengthened and dengue operation centres were established to function as screening and rehydration stations. WHO provided support to the DOH in the areas of health education and the development of appropriate case management protocols.

Singapore

Since 1994, dengue incidence has been rising steadily in Singapore. In 1998, a total of 5258 cases was reported. This was the highest number of cases reported over the last decade. The Ministry of Environment is responsible for DF/DHF control in the country and the control of *Ae. aegypti* and *A. albopictus* is largely through source reduction, health education and the application of public regulations.

Tonga

In February 1998, a dengue outbreak occurred in Tonga and, by 31 July, a total of 460 clinically suspected cases were reported. A total of 335 patients had undergone serology tests and 103 of these had confirmed evidence of DEN-2. There was one death of a child of six years attributed to DHF on 23 March 1998. No other deaths were reported. Between 1–15 June 1998, antibody tests were performed on 13 suspected cases with specimens collected. Of these cases, there were only two positive IgM results. Almost without exception, the confirmed cases had all been from the main island of Tongatapu. Only two confirmed cases were from the neighbouring small island of `Eua.

Vanuatu

In the first half of 1998, dengue fever activity was reported in Port Vila and the health department reported 131 clinical cases with eight serologically
confirmed cases (DEN–2) in mid-June. In December 1998, a further eight cases were serologically confirmed from Port Vila (DEN–2). The Ministry of Health has stepped up their mosquito control programme focusing on the reduction of mosquito breeding sites, chemical application in essential water containers, public health awareness campaigns and the use of insecticide-treated mosquito nets.

Viet Nam

DF/DHF is considered to be a major public health problem in Viet Nam, as it is a leading cause of hospitalization and death. In 1997, a large number of dengue cases were reported – a total of 108,000 cases with 245 deaths. In 1998, a total of 143,179 cases with 313 deaths were reported as of 30 November. This has been the highest number of cases ever known since 1991. Provinces in the southern region of Viet Nam were provided with materials for surveillance and testing and all provincial and district hospitals in the southern region were supplied with haematocrit equipment for the case management of DHF.

WHO’s activities in prevention and control of dengue in WPR

Since the early 1970s, WHO has been actively involved in the development and promotion of strategies for the treatment and control of dengue. In 1993, the Forty-sixth World Health Assembly confirmed that dengue prevention and control should be among the priorities of the Organization. Since then, global and regional strategies emphasizing the need for effective prevention, active surveillance and outbreak preparedness have been developed.

In Cambodia, Lao PDR, the Philippines, Viet Nam, and the Pacific Island countries/areas, dengue control programmes have been established in collaboration with WHO to promote vector surveillance and control, public education and case management. In these programmes, vector control through community participation is emphasized. WHO’s Western Pacific Regional Office (WPRO) is also involved in emergency disease intervention activities for outbreaks that occur in the Region. For example, when the dengue outbreak occurred in Cambodia in 1995, the government began intensive dengue intervention activities in collaboration with WPRO,
USAID, other governmental agencies and non-governmental organizations. WHO experts were sent to the country to provide technical support for these activities, and WHO also provided supplies and equipment. After proper control measures had been taken, the number of cases quickly decreased and the case fatality rate declined.

**Outbreak Response Task Force**

In April 1996, the Outbreak Response Task Force (ORTF) was established in WPRO in response to an increasing potential of the life-threatening outbreaks due to new, emerging, and re-emerging communicable diseases. The ORTF is involved in areas of surveillance, emergency preparedness, training, and research on emerging and other communicable diseases, including dengue, in the Region.

**Regional stockpiles**

To ensure rapid mobilization of supplies and equipment during an emergency, the Regional Office established regional stockpiles for vector-borne diseases, including dengue, in Cambodia and Fiji in 1996. The effectiveness of the regional stockpile was demonstrated during the dengue outbreaks that occurred in Lao PDR in 1996, Cooks Islands in 1997 and, most recently, Fiji and Tonga in January 1998 and Cambodia in June 1998, when supplies were quickly sent to the countries.

**Information exchange**

In the area of information exchange, PACNET (the Pacific Health Surveillance Network), an Internet-based information network, was developed in 1996 which serves as a tool to quickly disseminate information to various countries and organizations on common public health issues that occur in the Pacific Islands, such as dengue outbreaks. The network was developed by UNICEF, the Pacific Community, WHO and other organizations. Also, WHO/WPRO has been publishing the annual *Dengue Bulletin* in collaboration with the South-East Asia Regional Office (SEARO) which provides information on various achievements in dengue control activities. In July 1997, a WHO WPR/SEAR Bi-Regional Meeting on the Prevention and Control of Dengue was held in Manila to exchange information on dengue and also strengthen international and inter-
regional collaboration to tackle the disease. Topics discussed in the meeting included disease surveillance; vector surveillance and control; laboratory diagnosis; case management; vaccine development; and information exchange, and conclusions were made to strengthen activities in these areas.

WHO collaborating centres
In the Western Pacific Region, there are three WHO collaborating centres on dengue virus which are located in Australia, Japan and Malaysia. In the laboratories of these centres, rapid serological and DNA diagnostic methods have been developed by using IgM-ELISA and PCR techniques in the past. Also, various dengue vector control methods have been evaluated, such as permethrin-treated nets and the use of copepods.

Conclusion
Since 1994, the incidence of dengue has been increasing in the Western Pacific Region. However, the case fatality rate has been kept low at less than 1% due to improvement in case management and possibly due to improved public recognition of the serious clinical signs of the disease, leading to early access to health services. For countries where dengue is endemic, it is important that appropriate plans be established to properly respond to dengue outbreaks. Disease surveillance should especially be maintained at high levels in such countries to detect any increase in dengue cases and trigger early intervention.

References
Clinical Profile of Dengue Haemorrhagic Fever in Adults during 1996 – Outbreak in Delhi, India

By


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Abstract

An epidemic of dengue fever occurred in Delhi which started in the middle of August 1996. Virus serotype DEN-2 was found to be responsible for this outbreak. During this epidemic, 98 adult patients diagnosed to have dengue haemorrhagic fever (DHF) (n=75) and dengue shock syndrome (DS) (n=23) were admitted to one of the medical units of the Department of Medicine at the AIIMS hospital, New Delhi. Fever (100%), body aches (45.9%), abdominal pain (38.3%), purpura (33.8%), epistaxis (32.6%), melaena (26.5%), haematemesis (22.4%) and ecchymoses (20%) were commonly present symptoms. Mu capture ELISA IgM antibodies for serodiagnosis of dengue virus infection was positive in 23 of the 27 patients tested. At the time of admission, 94 patients had a platelet count below 100,000/mm³. Four patients with haemorrhagic manifestations had an initial platelet count of >100,000/mm³. Severe thrombocytopenia (platelet count <20,000/mm³) was present in 43.8% of the patients. The ultrasound tests showed pleural effusion in 10...
of the 12 patients and ascites in five patients tested when they were not clinically evident. Eight patients died. Logistic regression analysis revealed that patients who died had a lower haematocrit, higher respiratory rate, and extensive ecchymoses and were often in shock at the time of presentation. There was poor correlation between thrombocytopenia and ecchymoses. No correlation was found between platelet count and the outcome of multivariate analysis.

**Key words:** Dengue haemorrhagic fever, Dengue shock syndrome, India.

**Introduction**

Dengue fever has been known for more than a century in the tropical areas of the South-East Asia and Western Pacific regions\(^1\). The haemorrhagic form was, however, first recognized in the Philippines in 1953\(^2\). In India, the first epidemic of dengue haemorrhagic fever was reported in Calcutta (DEN-2) in 1963\(^3\). Delhi witnessed dengue epidemics in 1967 (DEN-2), 1970 (DEN-1 and 3), 1982 (DEN-1 and 2)\(^2\), 1988 (DEN-2)\(^4,5\) and 1991\(^6\). An epidemic of dengue fever occurred in Delhi starting in the middle of August 1996. Virus serotype DEN-2 was found to be responsible for this outbreak. In this paper, we describe clinical manifestations and laboratory investigations and outcome in 98 patients with DHF. Various prognostic factors affecting survival are also described.

**Material and methods**

During the 1996 dengue epidemic, 721 adults and children were hospitalized at the All India Institute of Medical Sciences (AIIMS) hospital, New Delhi, India. Of these, 98 adult patients diagnosed to have DHF were admitted to one of the medical units (unit II) of the Department of Medicine and form the basis of this presentation.

Medical records of these 98 adult patients were analysed. The criteria used for diagnosing DHF included: an acute febrile illness of less than 10 days’ duration with purpuric spots or mucosal bleeding, hepatomegaly, and shock (any two), plus thrombocytopenia or raised haematocrit (any one). For the diagnosis of dengue shock syndrome (DSS), in addition to the previously mentioned criteria, the presence of
hypotension or narrow pulse pressure was required. Of these 98 patients, 23 satisfied the criteria for the diagnosis of DSS.

In all patients, a detailed history was taken and clinical examination was done at admission and subsequently during the stay in the hospital. In all the patients, the platelet count was estimated daily. Platelet function and platelet antibody tests were performed in six and three patients respectively. Haematocrit was estimated at admission in 71 patients and it was serially estimated in 49 patients on a daily basis until the time patients became afebrile for 1-2 days. Prothrombin time and activated partial thromboplastin time were estimated in seven patients. Serum biochemistry, chest radiograph, and ultrasound of chest and abdomen were done whenever it was feasible. IgM antibodies to dengue specific virus were tested using Mu capture ELISA in the acute phase serum samples in 27 patients (reagents kindly gifted by Dr D.J. Gubler, Centers for Disease Control (CDC), Atlanta, USA).

**Treatment**

Intravenous fluids, platelet–rich plasma (PRP), fresh whole blood and fresh frozen plasma were infused as and when considered necessary. In patients with isotonic dehydration, 5% dextrose, Ringer’s lactate, and normal saline were used. Bicarbonate-containing solutions were given to patients having persistent fluid losses due to diarrhoea. We did not administer PRP unless the patient was actively bleeding or was in shock or had a platelet count below 20,000/mm³. Fresh whole-blood transfusion was given when patients had either massive haemorrhage or a falling PCV. Nasogastric suction was avoided wherever possible. Paracetamol was given as an antipyretic agent when temperature was higher than 39°C, and no more than six doses were administered in 24 hours. Combinations of paracetamol, ibuprofen, salicylates and intramuscular injections were avoided.

**Statistical analysis**

Modified students t–test applicable to two groups with unequal variances was applied to study the association
between a numerical variable and the outcome. Univariate and multivariate logistic regression analyses were carried out for predicting survival.

**Results**

The patients’ mean age was 26.3 (SD 10) years. There were 74 males. The mean duration of symptoms was 5.6 (SD 2.6) days. The mean duration of fever was 4.88 days (range 3 to 8 days) in patients who died, whereas its mean duration was 5.53 days in survivors.

Other clinical features at initial presentation are outlined in Tables 1 and 2. The haemorrhagic manifestations included erythematous macular skin rash (36.7%) and extensive ecchymoses (19.4%). Haematemesis occurred in 22.4% and melaena occurred in 26.5% of the patients. In 10.2% of the patients both haematemesis and melaena occurred. Epistaxis was noted in 32.6% of the patients. Haematuria, haemoptysis and bleeding from other sites such as gums, rectum, and vagina occurred in 51 patients (52%) (Table 1).

**Table 1. Clinical presentation in 98 patients with DHF/DSS**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Number (%)</th>
</tr>
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<tbody>
<tr>
<td>Body aches</td>
<td>45 (45.9)</td>
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<tr>
<td>Rash</td>
<td>36 (36.7)</td>
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<tr>
<td>Purpura</td>
<td>33 (33.6)</td>
</tr>
<tr>
<td>Ecchymoses</td>
<td>19 (19.4)</td>
</tr>
<tr>
<td>Bleeding from other sites*</td>
<td>51 (52.0)</td>
</tr>
<tr>
<td>Abdominal pain</td>
<td>38 (38.7)</td>
</tr>
<tr>
<td>Haematemesis</td>
<td>22 (22.4)</td>
</tr>
<tr>
<td>Melaena</td>
<td>26 (26.5)</td>
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<tr>
<td>Epistaxis</td>
<td>32 (32.6)</td>
</tr>
<tr>
<td>Impaired consciousness</td>
<td>05 (05.1)</td>
</tr>
<tr>
<td>Shock</td>
<td>23 (23.5)</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>03 (03.1)</td>
</tr>
<tr>
<td>Hepatomegaly</td>
<td>20 (20.4)</td>
</tr>
<tr>
<td>Splenomegaly</td>
<td>08 (08.2)</td>
</tr>
<tr>
<td>Jaundice</td>
<td>01 (01.0)</td>
</tr>
<tr>
<td>Renal failure</td>
<td>01 (01.0)</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>08 (08.2)</td>
</tr>
<tr>
<td>ARDS</td>
<td>01 (01.0)</td>
</tr>
</tbody>
</table>

* Haemoptysis, conjunctival haemorrhage, haematuria, rectal and vaginal bleeding

ARDS = Acute respiratory distress syndrome

Clinical examination revealed a mean pulse rate of 93.1 per minute (SD 14.2). Mean systolic blood pressure was 106.6 mm Hg (SD 17.0) and mean diastolic blood pressure was 70.2 mm Hg (SD 12.2). Shock was present in 23.5% of the patients. The mean respiratory rate at presentation was 16.3 per minute (SD 6.6). Tachypnoea (respiratory rate >18) was present in
17 of the 63 patients. All the patients who died had tachypnoea. Renal failure and acute respiratory distress syndrome (ARDS) were present in one patient each. Hepatomegaly (20.4%), splenomegaly (8.2%), and lymphadenopathy (3.1%) were also found.

Dengue virus–specific IgM Mu capture ELISA was positive in 23 of the 27 patients (85.1%). All these patients had fever for five or more days. The haematological and biochemical parameters are shown in Table 2.

### Table 2. Laboratory parameters in 98 patients with DHF/DSS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
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</thead>
<tbody>
<tr>
<td>Haemoglobin g/dl [n=88]</td>
<td>11.6 (2.9)</td>
</tr>
<tr>
<td>Haematocrit % [n=71]</td>
<td>39.0 (8.6)</td>
</tr>
<tr>
<td>Total leukocyte count /mm³ [n=73]</td>
<td>7163 (10365)</td>
</tr>
<tr>
<td>Platelet count /mm³ [n=98]</td>
<td>30000 (25000)</td>
</tr>
<tr>
<td>Serum bilirubin mg/dl [n=34]</td>
<td>0.9 (0.6)</td>
</tr>
<tr>
<td>AST (IU/l) [n=43]</td>
<td>274 (634)</td>
</tr>
<tr>
<td>ALT (IU/l) [n=43]</td>
<td>143 (242)</td>
</tr>
<tr>
<td>Serum alkaline phosphatase (IU/l) [n=29]</td>
<td>196 (155)</td>
</tr>
</tbody>
</table>

The mean haemoglobin and haematocrit were normal in a majority of patients. Raised haematocrit (>48 %) was observed in 6 of the 71 patients tested. Fourteen of the 49 patients demonstrated >20% increase in haematocrit over the lowest value recorded, thus fulfilling the criteria for the diagnosis of DHF as per the WHO definition. Leukopenia (<4000/ mm³) was observed in 22 of the 73 patients for whom the total leukocyte count was available. At the time of initial presentation, 94 patients had a platelet count below 100,000/mm³. In four patients, the platelet count was >100,000/mm³. Severe thrombocytopenia (platelet count <20,000/mm³) was present in 43.8% of the patients. There was no correlation between the platelet counts and the presence of ecchymoses. Platelet function was studied in those six patients with haemorrhagic manifestations who had platelet count in the normal range. Of these six patients, a reduced platelet aggregation was found with adrenaline in five patients and with adenosine diphosphate (ADP) in three patients respectively. One patient showed normal platelet aggregation with adrenaline and ADP. In another three patients, antiplatelet antibodies were demonstrable. Coagulation profile
(n=7) was normal in all the patients tested.

Serum bilirubin was elevated in three of the 34 patients in whom it was tested. Serum aspartate aminotransferase (AST) (n= 43) and alanine aminotransferase (ALT) (n= 43) were elevated in 88.4% and 76.7% of the patients respectively. Serum alkaline phosphatase was elevated in three of the 29 patients in whom it was tested. One patient had a raised level of blood urea and serum creatinine at initial presentation. After haemodialysis the values became normal.

Twelve patients were studied for the presence of pleural effusion using chest radiograph and ultrasound examination. Chest radiograph revealed pleural effusion in three patients and consolidation in one. Pleural effusion was detected by ultrasound in 10 of these 12 patients (83%). The pleural effusion was right-sided and was bilateral in two patients. Unilateral left-sided pleural effusion was not found in any of the patients. Unilateral left-sided pleural effusion was not found in any of the patients. Ultrasound examination of the abdomen revealed ascites (n=5), perihepatic collection of fluid (n=1), gall bladder wall thickening (n=5) and sludge in the gall bladder (n=1). None of these patients had any clinical evidence of pleural effusion or ascites. Collection of fluid in the pelvic cavity was not observed in any of the patients studied ultrasonographically.

Univariate analysis (Table 3) revealed that the respiratory rate, platelet count, haematocrit, and haemoglobin were significant predictors of outcome. Logistic regression analysis for the predictors of survival showed that tachpnoea, ecchymoses and shock were of significance in predicting the survival of patients (Table 4).

Table 3. Predictors of survival in 98 patients with DHF/DSS [Univariate analysis]

<table>
<thead>
<tr>
<th>Variable</th>
<th>Alive (n=90)</th>
<th>Dead (n=8)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate/minute*</td>
<td>15.5 (4.5)</td>
<td>27.5 (4.5)</td>
<td>p=0.05</td>
</tr>
<tr>
<td>Platelet count (× 100 000 /mm³)*</td>
<td>1.12 (0.9)</td>
<td>0.56 (0.48)</td>
<td>p=0.01</td>
</tr>
<tr>
<td>Haemoglobin g/dl*</td>
<td>12.9 (2.8)</td>
<td>10.0 (3.5)</td>
<td>p=0.05</td>
</tr>
<tr>
<td>Haematocrit %*</td>
<td>36.5 (8.6)</td>
<td>25.6 (1.3)</td>
<td>p=0.03</td>
</tr>
<tr>
<td>Ecchymoses</td>
<td>14/76</td>
<td>5/8</td>
<td>RR=6.93 [1.81–26.49]</td>
</tr>
<tr>
<td>Purpura</td>
<td>28/62</td>
<td>5/8</td>
<td>RR=3.28 [0.84–12.9]</td>
</tr>
<tr>
<td>Shock</td>
<td>18/72</td>
<td>5/8</td>
<td>RR=5.43</td>
</tr>
</tbody>
</table>
Clinical Profile of Dengue Haemorrhagic Fever in Adults during 1996 – Outbreak in Delhi

Table 4. Logistic regression analysis for predictors of survival in 98 patients with DHF/DSS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Coefficient</th>
<th>OR</th>
<th>95% Confidence Interval</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>7.20</td>
<td>0.84</td>
<td>0.73-0.96</td>
<td>0.01</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>-0.17</td>
<td>0.84</td>
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<td>0.14</td>
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No. of observations = 98; Pseudo $r^2 = 0.43$; AU ROC = 0.92

Discussion

This presentation describes the clinical profile of DHF in adult patients. Most of these patients were young adults. A similar trend was reported in studies from Singapore (7,8) and Malaysia (9). This may be due to the fact that adults are not immune to all strains of the dengue virus. In Singapore where vector control measures are being carried out since 1973, the mean age of occurrence of DHF had increased from 14 years in 1973 to 28 in 1994. Similarly, in Malaysia also, dengue fever occurs in young adults. Further, increased mortality from this disease has also occurred in young adults in both countries (7,9).

Studies from Thailand indicate that the mortality from DHF occurs as a result of hypovolaemic shock which, in turn, results from increased capillary permeability (1,10) leading to raised haematocrit. Therefore, WHO has included raised haematocrit as one of the important criteria for the diagnosis of DHF. Ideally, serial estimation of haematocrit should be done in patients with suspected DHF. However, in the present epidemic, haematocrit was not estimated in all the patients because of the tremendous workload on the laboratory. In the present study, haematocrit was >48% in six of the 71 patients in whom it was tested; and only 14 cases demonstrated >20% increase in haematocrit over the lowest value recorded. This may be due to the fact that haemoglobin in most of the patients was low (possibly due to severe haemorrhage or chronic anaemia). This could also have been due to the fact that most of the patients received intravenous fluids before they sought treatment at the...
AIIMS hospital. Other studies from Jakarta, Indonesia\(^{(10)}\), had also shown that one-third of the confirmed fatal cases of dengue with massive gastrointestinal haemorrhage did not manifest haemoconcentration. Reports from the Philippines and Kuala Lumpur \(^{(11,12)}\) also showed significant haemoconcentration in only 39.5% and 22% of the patients respectively.

Bleeding from various sites was found in 70 of the 98 patients. The cause of bleeding could have been thrombocytopenia, consumption coagulopathy, capillary fragility\(^{(12)}\) or platelet dysfunction \(^{(13)}\). Although thrombocytopenia was a constant finding, there was poor correlation between thrombocytopenia and bleeding diathesis. No correlation was found between platelet count and ecchymoses, indicating thereby that the abnormal platelet aggregation rather than reduction in absolute numbers was the cause of bleeding diathesis. However, one patient with normal platelet count and normal platelet function presented with bleeding. Demonstration of anti-platelet antibodies in three patients indicates that platelet destruction could also be immunogenic. Rapid fluctuation in daily platelet count was also seen in some of our patients, and the possible explanation for this could be that the platelets align themselves onto the ‘leaky endothelial cells’ which are lining the blood vessels damaged by the virus, and with the recovery, these platelets return to circulation \(^{(12)}\).

We did not encounter any abnormality in the coagulation profile in our patients. This finding is in agreement with the observation that coagulation abnormalities are uncommon in DHF.

Hepatomegaly was observed in 20.4% of the patients in the present study. Hepatomegaly has been described in 16.8% patients in Vishakapatnam \(^{(14)}\), in 22.2% patients in Calcutta \(^{(3)}\) and in 13.5% patients in the Philippines \(^{(11)}\). Most of the patients in the present study in whom liver functions were tested had raised ALT and AST levels. In the study in Malaysia, five of the 9 cases where liver profile was done showed significant liver enzyme abnormalities \(^{(12)}\). Dengue virus–induced damage to the hepatocytes, hypoxia, shock or associated liver disease have all been postulated to be the pathogenetic mechanisms for the occurrence of transaminits in patients with DHF\(^{(12)}\). Splenomegaly was found in 8.2% of
our cases whereas in Calcutta, it was observed in 9.3% of the cases (3).

Erythematous, morbilliform macular or maculo–papular rash was found in 36.7% of the patients, whereas Krishnamurty et al. (14) found it in 27.1% of the patients in Visakhapatnam. In the series of haemorrhagic fever cases from Calcutta (3), 40% of the patients had diffuse erythematous flush. Lymphadanopathy was found in only 3% of our patients compared to 10.6% reported in the study from the Philippines (11).

Impaired consciousness was found in 5 of the 98 (5.1%) patients in the present study. In a study from Thailand (15), altered sensorium had been reported and no evidence of encephalitis was found on autopsy. The possible explanation for these neurological symptoms could be metabolic acidosis, severe disseminated intravascular coagulation, gross haemorrhage or oedema in brain, or hepatic dysfunction leading to encephalopathy (15). One patient in the present study developed ARDS and succumbed to the illness. Diffuse pulmonary involvement due to the virus, aspiration of gastric contents, or Gram–negative sepsis could have been the causes of ARDS in this patient. One patient developed acute renal failure, and after haemodialysis this patient made complete recovery. Prolonged shock would be the possible cause of renal failure in this patient.

Pleural effusion or ascites demonstrable by ultrasonography in DHF patients with no clinical evidence of these findings has been reported earlier in paediatric patients with DHF (16). In the present study, ultrasound picked up pleural effusion in 10 of the 12 patients tested and has been found to be more sensitive than chest radiograph in demonstrating this finding. Gall bladder wall thickening and perihepatic fluid collection have been found to predict the development of shock (17). These findings have been postulated to have developed because of plasma leakage and haemorrhage. In the present study, one of the five patients in whom gall bladder wall thickening occurred developed shock. The presence of these findings might suggest the diagnosis of DHF in the appropriate clinical setting.

Dengue virus specific IgM Mu capture ELISA was positive in 23 of the
27 patients in whom it was tested. All samples, with a duration of fever of five or more days, were tested by ELISA. The four negative samples had a duration of fever of 5–6 days and may not have seroconverted by this time. A study using Mu capture ELISA in patients with confirmed dengue fever (18) showed that 96% of the 76 blood samples drawn between 7 and 20 days after the onset of the illness were positive. In a study in Thailand, the sensitivity of this test was shown to be 97% in convalescent samples while none of the samples from the two control groups was positive (19).

Eight of the 98 patients died. These patients had lower haemoglobin and haematocrit levels. The low haematocrit could have been due to chronic anaemia and/or bleeding. Further, they also had faster respiratory rate, extensive ecchymoses, and presented with shock as compared to the survivors. Tachypnoea could have been due to bleeding, fluid overload, infection or shock.

References


Seasonal Prevalence of *Aedes aegypti* in Five Localities of Delhi, India

By

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(Indian Council of Medical Research)
20, Madhuban, Delhi-110092, India

Abstract

Studies were carried out in selected localities of Delhi to detect the presence of *Aedes aegypti*, the principal vector of dengue and dengue haemorrhagic fever (DF/DHF) and seasonal fluctuations in immature and adult densities. Results revealed that the breeding index was very high in surveyed localities ranging from 5.3 to 6.9 during the month of September. The highest breeding index (6.9) was recorded in Malaviya Nagar and the lowest in Khelgaon. Similarly, the adult density ranged from 10.7 to 15.2 per man hour during the post-monsoon period and showed positive correlation with immature densities. The occurrence of breeding and adult density throughout the year, particularly in Sadiq Nagar and Malaviya Nagar, revealed that the antilarval measures adapted in the Urban Malaria Scheme were ineffective to check the build-up of the density of *Aedes aegypti*.

Key words: *Aedes aegypti*, dengue, dengue haemorrhagic fever (DHF), seasonal prevalence, breeding index.

Introduction

Consequent upon the occurrence of the first DF/DHF outbreak in Calcutta in 1963(1), an *Aedes aegypti* survey was undertaken in Delhi in 1964 to
Seasonal Prevalence of Aedes aegypti in Five Localities of Delhi

assess the potential threat of DF/DHF. Studies revealed that Aedes aegypti populations were restricted to the walled city (old parts of Delhi) and the peripheral areas recorded only the presence of Aedes albopictus and Aedes vittatus. Subsequent studies revealed that the Aedes aegypti population in Delhi depicted a phenomenon of “annual pulsation”, i.e. the species remained confined to the “mother foci” in humid and cooler parts of the central city and spread to outer areas during the rainy season by establishing a secondary foci. Following the occurrence of the first outbreak of DHF during 1963, a comprehensive study on the seasonal prevalence and the relative importance of domestic containers in supporting the perennial breeding of Aedes aegypti was undertaken in one of the identified mother foci. The present study was carried out in newly-developed peripheral posh colonies of Delhi which had come into existence after the first survey in 1964 to detect the presence of Aedes aegypti and its seasonal prevalence. The study areas included five localities in New Delhi, i.e. Sadiq Nagar, Malaviya Nagar, Ayurvigyan Nagar, Andrews Ganj, and Khelgaon, and the survey was carried out from October 1996 to February 1998.

Material and methods

The pipette method in tyre dumps and a small stainless steel dipper with iron handle were used for the sampling of Aedes larvae from evaporation coolers and large water bodies. Adults were sampled with the help of an aspirator and flash torch. The samples of larvae from different habitats were brought to the laboratory and the larvae were reared in enamel trays at a temperature of 29±1°C and 70–80% relative humidity for a reconfirmation of species identity. The House index (HI), Container index (CI) and Breteau index (BI) were calculated as per WHO standard procedures. The sampling of larvae and adults was carried out weekly to observe the seasonal changes in both larval and adult densities. The average monthly container indices and adult index were then estimated. Meteorological data was collected from the Safdarjang station located in the south zone of the Municipal Corporation of Delhi. The mean maximum and minimum temperatures and the relative
humidity were correlated with *Aedes* and adult indices.

**Results**

The monthly average of HI, CI, BI and man-hour density are presented in Table 1.

![Figure 1: Trend of Domestic & Peri-domestic breeding of *Aedes aegypti* in five localities of Delhi.](image1)

![Figure 2: Seasonal prevalence of *Aedes aegypti* in five localities of Delhi (1996-98).](image2)

The results revealed that the breeding of *Aedes aegypti* occurred throughout the year in Sadiq Nagar and Malaviya Nagar. Similarly, adult density was also observed in these localities throughout the year. This is contrary to the reports that the breeding was only confined to the extreme cold months (January-February) in all the localities surveyed. The proportion of the domestic and peridomestic breeding of *Aedes aegypti* is presented in the Figure 1. However, peridomestic breeding sites such as discarded containers, flower vessels, tyre dumps and water meter chambers supported the maximum breeding in both dry and wet seasons.

![Graph showing seasonal prevalence of *Aedes aegypti*.](image3)
### Table 1. Larval indices and man hour densities of *Aedes aegypti* in five localities of Delhi during 1996–98

<table>
<thead>
<tr>
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### Seasonal Prevalence of *Aedes aegypti* in Five Localities of Delhi

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<td>1.1</td>
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</table>

HI = House Index (%), CI = Container Index (%), BI = Breteau Index (per 100 houses) MHD = Man-Hour density
A comparison of the meteorological data revealed that the *Aedes* breeding was reduced to a very low level when the average temperature varied between 10° and 50°C and the relative humidity ranged between 30% and 40%. The average minimum temperature of about 28°C and 70–80% relative humidity were quite ideal for the proliferation of the breeding of this species.

**Discussion**

During the present survey *Aedes aegypti* was the only species which was encountered. This may be due to the fact that the survey was confined to well-developed urban localities. This is in conformity with the earlier observations that *Aedes aegypti* is considered a domestic species and is common in urban situations, while *Aedes albopictus* occurs in either transitional areas or rural situations\(^2\). The breeding index was very high in the surveyed localities ranging from 5.3 to 6.9 during the month of September. The highest container index (6.9) was recorded in Malaviya Nagar and the lowest (5.3) in Khelgaon. Similarly, the adult density ranged from 10.7 to 15.2 [highest (15.2) in Malaviya Nagar and lowest (10.7) in Khelgaon]. The occurrence of breeding and adult density throughout the year, particularly in Sadiq Nagar and Malaviya Nagar, revealed that antilarval measures adapted in the Urban Malaria Scheme were ineffective to check the build-up of the density of *Aedes aegypti*. Since *Aedes aegypti* breeds in domestic water containers, emphasis should be placed on species sanitation which can also be supplemented by stringent legislative measures. These measures can also be integrated with synthetic pyrethroid–treated curtains as demonstrated by Majori et al.\(^5\) and Ansari et al.\(^6\) (1998) in selected localities in Delhi.

**References**

4. Rakesh Katyal, Kuldip Singh and Kausal Kumar. Seasonal variations in *Aedes aegypti*


Prevalence of *Aedes aegypti* in DHF Outbreak Areas in Panipat City, Haryana State, India

By Rakesh Katyal, Mohan Bhardwaj, Sushil Kumar Sharma, Kuldip Singh Gill, and Kaushal Kumar

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22 Shamnath Marg, Delhi–110 054

Abstract

Entomological investigations carried out in DHF-affected localities in Panipat city revealed widespread prevalence of *Aedes aegypti* mosquito, the vector of dengue/DHF. The breeding of *Aedes* mosquito was mainly found in cement tanks, clay jars, drums, coolers, ornamental plant bottles, etc. The cement tanks was found to be the most preferred container for *Aedes* breeding. The proportional positivity rates of various types of containers calculated were: cement tanks 50%, followed by drums 20.5%, clay jars 14.7%, coolers 11.7% and ornamental plant bottles 2.9%. An analysis of data revealed that the larval house, containers and breteau indices in the three localities surveyed were estimated at 42.8%, 33.6% and 53.9% respectively. The adult *Aedes aegypti* indoor resting density in one of the affected localities was found to be appreciably high, i.e. 16.0 per man/hour.

Keywords: *Aedes aegypti*, dengue fever, dengue haemorrhagic fever, Panipat, Haryana, India.

Introduction
In India, dengue/dengue haemorrhagic fever (DF/DHF) has been restricted to urban and semi-urban areas of the country\(^1,2\). However, over the years, large-scale development activities, viz. rapid growth of the transport system through networks of railways and roads, industrial and building activities, provision of safe piped drinking water, electricity, overall improvement in civic amenities and socioeconomic conditions of rural masses, have resulted in the establishment and proliferation of *Aedes aegypti* mosquito in urban and rural areas alike\(^3,4\). During 1996, large-scale outbreaks of dengue/DHF were reported in the capital city of Delhi and in Faridabad and Hissar districts of Haryana State and Ludhiana city in Punjab State\(^5,6\).

During September 1997, a number of cases of fever showing the characteristic signs of DHF, i.e. high fever, abdominal pain, headache, rash in a few cases accompanied by bleeding in vomits, stools or from gums, were detected. Serological tests using Immunoblot and HI tests detected IgM and IgG antibodies to dengue virus. To supplement these findings, an entomological survey was organized in three affected localities to detect the extent and intensity of *Aedes aegypti* breeding and to institute control measures.

**Methodology**

Panipat is an upcoming industrial town in Haryana State and is well-known for its textile industry and handicrafts. The city is having a scarce and intermittent piped water supply, forcing the inhabitants to resort to water storage practices for use in the textile and other industries and for household purposes.

Entomological surveillance was carried out in three affected localities (Pop. 30 000) in Panipat city during September 1997, viz. Ward No.8, Jain Mohalla, and Sethi Chowk. House-to-house searches were made in order to detect *Ae. aegypti* breeding in all containers in domestic/peridomestic areas of dwelling units by standard (WHO) entomological techniques. Besides, adult *Ae. aegypti* mosquitoes were also collected from indoors in Jain Mohalla, using the aspirator tube and torch, and per man/hour density was recorded.
Results and discussions

During the survey, a total of 63 houses/premises and 101 containers were searched for *Aedes* breeding in the affected localities (Tables 1 and 2).

**Table 1.** Locality-wise House, Container and Breteau indices of *Aedes aegypti* recorded in Panipat city during September 1997

<table>
<thead>
<tr>
<th>Name of Locality</th>
<th>House Index (%)</th>
<th>Container Index (%)</th>
<th>Breteau Index (%)</th>
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<tr>
<td>1. Ward No. 8</td>
<td>50.0</td>
<td>37.8</td>
<td>63.6</td>
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<td>2. Jain Mohalla</td>
<td>37.8</td>
<td>33.3</td>
<td>50.0</td>
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<td>3. Sethi Chowk</td>
<td>33.3</td>
<td>29.4</td>
<td>47.6</td>
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**Table 2.** Infestation of *Aedes aegypti* by containers

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<th>Types of container</th>
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<tr>
<td>Metal drum</td>
<td>16</td>
<td>43.7</td>
<td>20.5</td>
</tr>
<tr>
<td>Clay jar</td>
<td>22</td>
<td>22.7</td>
<td>14.7</td>
</tr>
<tr>
<td>Desert (evaporation)</td>
<td>17</td>
<td>23.5</td>
<td>11.7</td>
</tr>
<tr>
<td>cooler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ornamental plant bottle</td>
<td>2</td>
<td>50.0</td>
<td>2.9</td>
</tr>
</tbody>
</table>

The average larval House Index, Container Index and Breteau Index calculated in respect of the three localities surveyed ranged from 33.3% to 50%, 29.4% to 37.8% and 47.6% to 63.6% respectively, which was much higher than the critical index reported for causing the outbreaks of dengue/DHF\(^7\). Maximum House, Container and Breteau indices were recorded in ward No. 8, i.e., 50.0%, 37.8% and 63.6%, followed by Jain Mohalla – 37.8%, 33.3% and 50.0%, and Sethi Chowk – 33.3%, 29.4% and 47.6% respectively. Rapid building–up of the *Ae. aegypti* population during the wet season in north India, including Panipat city, has earlier been reported\(^8\).

Cement tanks were found to be the primary containers for *Aedes* breeding because water in these containers was never emptied and was replenished periodically, making them the perennial breeding sites. Besides, other containers like clay jars, drums, coolers and ornamental plant bottles were also found to be positive for *Aedes* breeding.
The adult *Ae. aegypti* collected in Jain Mohalla yielded a density of 16.0 per man/hour. In view of the appreciably high larval House, Container and Breteau indices and adult density of *Ae. aegypti* in Panipat, it is felt that there is a need for regular entomological surveillance in the city to keep the vector density below the critical level in order to contain any future outbreak of DHF and its spread to adjoining areas, especially during July–September, which is the period when vector breeding is the highest.

**Acknowledgement**

The authors are grateful to Director, National Institute of Communicable Diseases (NICD), Delhi, for providing the opportunity and the necessary facilities for carrying out entomological investigations. The cooperation extended by the Civil Surgeon and the District Malaria officer, Panipat, and their staff is gratefully acknowledged. Thanks are also due to Mr N.A. Khan and Mr F.W. Walter, Technicians at the NICD, for their technical assistance.

**References**

Entomological Investigations of DF/DHF Outbreak in Rural Areas of Hissar District, Haryana, India

By

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Abstract

Entomological investigations were carried out in six out of 18 villages which reported DF/DHF outbreaks and in four randomly-selected non-affected villages of Hissar district in Haryana State during August 1996. The investigations revealed the establishment of the breeding of vector species, Aedes aegypti, in artificial containers in domestic and peri-domestic situations due to water storage practices. Earthen pots, cement tanks, plastic containers, and desert coolers were found to be the main sources of Ae. aegypti breeding. In the fever-affected villages, the House, Container and Breteau indices ranged from 40.00 to 81.81, 11.50 to 35.10 and 51.10 to 150.00 respectively. However, in the randomly-selected non-affected villages, the House, Container and Breteau indices varied from 0.0 to 44.44, 0.0 to 14.86 and 0.0 to 55.5 respectively, indicating thereby the high receptivity of the area to DF/DHF transmission. The spread of DF/DHF to rural areas is a matter of great concern to public health authorities and needs immediate attention to gear up vector surveillance and timely preventive and intervention measures.

Keywords: Aedes aegypti; dengue fever; dengue haemorrhagic fever; Breteau Index; Hissar, India.
Introduction
Dengue/dengue haemorrhagic fever (DF/DHF) is endemic in many countries in South–East Asia and has been declared as one of the most fast spreading vector–borne diseases. During 1995, the estimated number of DHF cases in seven countries of the WHO South–East Asia Region was about 160,000 cases with 4000 deaths(1). In India, dengue fever was recognized as a classical disease with a high morbidity but no mortality and being mainly restricted to urban areas of the country(2,3,4). However, during the past few years the frequency of DHF outbreaks has increased(5,6). Earlier, the disease was mainly restricted to urban and semi–urban areas of the country because of the availability of favourable breeding sites of the mosquito vector species, Aedes aegypti, and rural areas were reported to be largely free of the vector species(7). However, over the years, the vector species has made inroads into rural areas of the country due to the introduction of safe drinking water supply schemes which have resulted in water storage practices. This has led to the establishment and proliferation of Aedes aegypti mosquito(8,9). These developments have resulted in frequent outbreaks of dengue/DHF in rural areas of the country as well(10,11).

During 1996, Delhi, the capital city, experienced one of the most severe outbreaks of dengue/DHF, when 10,252 cases with 423 deaths were reported(6). Concurrently, during July 1996, outbreaks of DF/DHF with a few deaths were also reported from a few villages of Hissar district in Haryana State. Signs and symptoms of the disease and the isolation of DEN–2 virus from the blood sera samples collected from the inhabitants of the fever–affected villages confirmed the dengue aetiology of the diseases(6). The present communication deals with the entomological investigations carried out by the National Institute of Communicable Diseases, Delhi, in August 1996 during the period of the outbreak.

Material and methods
Entomological surveillance was carried out in six affected and four randomly–selected non–affected villages wherein a total of 136 houses in affected
villages and 68 houses in non-affected villages were searched for the breeding of *Ae. aegypti* and House, Container and Breteau indices were calculated. In addition, the landing/biting rate of *Ae. aegypti* and the total catch of adult mosquitoes by pyrethrum space spray was also undertaken in one of the worst affected villages.

**Results and discussions**

(i) Larval surveys

On the basis of the larval surveys carried out in fever-affected and non-fever-affected villages, the House Index, Container Index and Breteau Index in fever-affected villages ranged from 40.00 to 81.8, 11.50 to 35.10, and 51.10 to 150.0 respectively, whereas in non-affected villages, the House Index ranged from 0.00 to 44.44, the Container Index from 0.00 to 14.86 and the Breteau Index from 0.00 to 55.50. (Table 1 A&B). Mixed breeding of *Ae. aegypti* and *Anopheles stephensi*, the vector of malaria, was also detected in some of the earthen pots and desert coolers. Besides the breeding of *Ae. albopictus*, another important vector species was also detected in one of the discarded earthen pots lying in an outdoor situation in Bagla village.

(ii) Adult surveys

The adult *Ae. aegypti* surveys were undertaken in village Bagla which reported the maximum number of fever cases. In the village, it was observed that the localities inhabited by poor socioeconomic groups having mud houses with high dampness, less light and less ventilation revealed a high density of adult *Ae. aegypti* population.

<table>
<thead>
<tr>
<th>Name of location and Population</th>
<th>House Index (%)</th>
<th>Container Index (%)</th>
<th>Breteau Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladwa/Ladwa (7616)</td>
<td>55.55</td>
<td>25.80</td>
<td>88.8</td>
</tr>
<tr>
<td>Dhobi/Mohabatpur (4000)</td>
<td>63.15</td>
<td>19.71</td>
<td>147.3</td>
</tr>
<tr>
<td>Bagla/Bagla (2776)</td>
<td>76.92</td>
<td>22.50</td>
<td>138.4</td>
</tr>
<tr>
<td>Landhri/Landhri (5503)</td>
<td>78.94</td>
<td>26.96</td>
<td>126.3</td>
</tr>
</tbody>
</table>

*Table 1. A Larval survey results of Aedes aegypti in affected and non-affected villages of Hissar during August 1996*
### Some of the areas surveyed included those which had reported high incidence of malaria during 1995. As these areas were covered with focal spray of HCH as per National Anti Malaria Programme norms, an extremely low density of adult *Ae. aegypti* mosquito was recorded, indicating thereby the effectiveness of HCH spray in controlling the dengue vectors. However, the use of HCH has been banned in the country since April 1997.

### Conclusions

The large-scale development activities in rural areas of the country, including Haryana state, though have contributed a great deal to the economic development of rural areas, the changes in cultural practices such as storage of water due to shortage of water supply for various household purposes, use of coolers, etc., have resulted in the spread and establishment of *Ae. aegypti* in rural areas and transmission of DF/DHF.

In Haryana, piped drinking water supply is available in most of the rural areas since 1980. However, as the supply of tap water is very erratic,
irregular and is provided for an extremely short period of 30–40 minutes a day with no fixed timings, the villagers have resorted to storing the tap water in earthen pots, cement tanks, plastic containers, drums, etc., with a capacity of 10 to 2000 litres. The large water containers were found to be the main source of *Ae. aegypti* breeding as these containers were never emptied completely and the water was replenished periodically as and when piped water supply was restored.

In view of the above, the spread of dengue to rural areas should be a matter of great concern to public health authorities, and there is an urgent need to create awareness among the rural population about the penetration of the disease into their areas. They should be imparted necessary education about the threat and their cooperation should be elicited in the early detection and elimination of *Ae. aegypti* breeding by undertaking source reduction, environmental management and personal protection measures.

### Acknowledgements

The author is grateful to Director, National Institute of Communicable Diseases, New Delhi, for providing him the opportunity and necessary facilities to undertake outbreak investigations. The cooperation extended by the Civil Surgeon, Hissar, and his staff is gratefully acknowledged.

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Investigation of *Aedes aegypti* breeding during dengue fever outbreak in villages of Dharmapuri district, Tamil Nadu, India

By

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Abstract

Consequent upon the reports of the incidence of dengue fever (DF) in some villages in Dharmapuri district, Tamil Nadu (India) in 1997, a house-to-house survey was conducted in Bikkanapalli (village 1) and Maniyampadi (village 2) and a hamlet, Thandramedu (village 3). The studies revealed widespread breeding of *Ae. aegypti* in a variety of storage vessels and unprotected containers. The predominant level of breeding of *Ae. aegypti* was noticed in non-potable water. The most preferred containers were drums and cement tanks in villages 1 and 2 respectively. A sustainable approach, which should include mass education and community participation along with the provision of adequate water supply and an anticipatory weekly larvicidal application three months prior to the expected transmission period, is considered a viable proposition for the prevention of DF/DHF epidemics.

Keyword: *Aedes aegypti*, dengue fever, dengue haemorrhagic fever, Container Index, Dharmapuri, Tamil Nadu.
Introduction

Outbreaks of dengue (DF) in India have commonly occurred in large towns and cities where the mosquito vector, *Aedes aegypti*, is prevalent\(^{(1)}\). Recently, DF/DHF epidemics have been reported from villages in the states of Kerala\(^{(2)}\), Maharashtra\(^{(3)}\), and Gujarat\(^{(1)}\). The socioeconomic practice of storing piped water in a wide variety of unprotected containers has led to the proliferation of places suitable for *Ae. aegypti* breeding\(^{(4)}\). During 1996, a village (pop. 2429), which is located 12 km from Krishnagiri, Dist. Dharmapuri, Tamil Nadu, reported for the first time fever cases compatible to dengue fever in a rural setting\(^{(5)}\). The cases were later confirmed by serological tests as that of dengue. Entomological investigations revealed over 40% of the water storage containers as positive for *Ae. aegypti*. During July 1997, suspected cases of dengue with typical clinical symptoms were reported in Bikkanapalli (31), Maniyampadi (324) villages and a hamlet, Thandramedu (1), in the same district. The present investigations were carried out in these affected villages to elucidate entomological factors which had culminated in the transmission of the disease.

Study area

Dharmapuri district (12° 30N and 78° 10E) borders Karnataka and Andhra Pradesh states in the north, Salem district in the south, Thiruvannamalai district in the east and a part of Karnataka state in the west. The study area receives rainfall both during the south-west monsoon (June to September) and north-east monsoon (mid-October to mid-December). Bikkanapalli (study village 1), with a population of 1176, receives intermittent supply of piped water. There are about 10 pottery units in the village and most of the inhabitants store water in mud pots. Maniyampadi, another study village (village 2) is a neighbouring village of Bikkanapalli and has a population of 568. This village receives protected water supply. Thandramedu, a hamlet (village 3) which is close to Bikkanapalli village, is an isolated pocket of houses with a small population of 25. The inhabitants get their water from a hand pump.
Materials and methods

Larval and adult mosquito collections were made in the study villages according to the methods described in earlier studies. The larval prevalence of *Ae. aegypti* was estimated by Breteau Index (BI = Number of containers with *Ae. aegypti* breeding per 100 houses searched), House Index (HI = Percentage of houses positive for *Ae. aegypti* larvae) and Container Index (CI = Percentage of water-holding containers infested with *Ae. aegypti* larvae). Chi-square ($X^2$) test was performed to find out any significant difference in the water storage practices and *Ae. aegypti* breeding in the study villages.

Results

Breeding and distribution of *Ae. aegypti*

Of the total 368 premises in the three study villages, 142 premises were surveyed randomly for *Aedes* breeding. The number of premises surveyed varied from 7 in village 3 to 103 in village 1. Villages 1 and 2 only showed the breeding of *Ae. aegypti* (Table 1).

<table>
<thead>
<tr>
<th>Village/ Hamlet</th>
<th>No. of houses</th>
<th>No. of containers</th>
<th><em>Ae. aegypti</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>HI</td>
<td>CI</td>
</tr>
<tr>
<td>1</td>
<td>103</td>
<td>269</td>
<td>37.5</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>94</td>
<td>18.8</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

No water storage containers breeding *Ae. aegypti* were detected in village 3. Larval indices, i.e. HI, CI and BI, for village 1 were 37.5, 26.8 and 69.9 while for village 2 these were 18.8, 10.6 and 31.3 respectively.

Incidence in indoor and outdoor breeding

Of the containers examined, 139 containers in village 1 and 65 containers in village 2 constituted domestic (indoor) breeding sources, of which 20.1% and 9.5% respectively were found to be positive for *Ae. aegypti* breeding. Similarly, a total of 130 and 29 containers constituted the peri-domestic (outdoor) breeding sources, of which 33% and 13.7% were found to be positive for immatures of *Ae. aegypti* in village 1 and village 2.
respectively. The domestic and peri-domestic container indices (CI) did not differ significantly ($X^2=0.42; p >0.1$). Although the immature stages of *Ae. aegypti* were collected in both potable and non-potable water containers, the magnitude was significantly higher in non-potable containers ($X^2 = 19.41; p<0.001$).

**Control measures**

“Search, locate and destroy campaigns” were carried out with the help of village youths to stop the *Aedes* breeding in discarded containers like tins, broken pots, split coconut pods, etc. The unwanted pots in the pottery units were destroyed and the unused pots were turned upside down. The unprotected containers (domestic) were covered with pieces of cloth or a lid.

During the “Search, locate and destroy campaigns”, the inhabitants were demonstrated the *Aedes* breeding habitats and the immature stages of *Aedes* mosquitoes. The community was also educated to scrub and clean the containers once a week before refilling them with water. The *Ae. aegypti* populations were evaluated after the institution of control measures.

Two rounds of thermal fogging at four weeks interval using pyrethrum extract 2.0% were carried out between 1600 and 1800 hours*. All the cement tanks (constructed) and buried mud pots were similarly treated with Temephos 0.025%.

**Evaluation**

Of the 103 and 32 households in villages 1 and 2, a total of 98 and 29 houses respectively were examined after the institution of control measures. In village 1, the CI was found to have been reduced from 26.82 to 9.6 and in village 2 from 10.6 to 4.3. The HI was reduced from 37.5 to 7.5 in village 1 and from 18.8 to 6.9 in village 2. The BI was also found to have gone down from 69.9 to 3.3 in village 1 and from 31.3 to 13.8 in village 2 (Table 2). During the second visit, omissions in the larvicidal (Temephos) application were noticed and unprotected containers were also found.

*Control intervention at 4 weeks interval and dosages used for temephos are not up to the standard – Editor*
Table 2. *Ae. aegypti* larval and adult indices in study villages in Dharmapuri before and after institution of control measures

<table>
<thead>
<tr>
<th>Name of village</th>
<th>HI</th>
<th>CI</th>
<th>BI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bikkanapalli</td>
<td>37.5</td>
<td>26.8</td>
<td>69.9</td>
</tr>
<tr>
<td><em>(Before)</em></td>
<td>7.1</td>
<td>9.6</td>
<td>13.3</td>
</tr>
<tr>
<td><em>(After)</em></td>
<td>18.8</td>
<td>10.6</td>
<td>31.3</td>
</tr>
<tr>
<td>Maniyampadi</td>
<td>6.9</td>
<td>4.3</td>
<td>13.8</td>
</tr>
</tbody>
</table>

Discussion

*Ae. aegypti* mosquito has successfully adapted itself to human dwellings where water is stored both inside and outside the premises. The abundance of breeding sites found in both the surveyed villages contributed to the high density of *Ae. aegypti* infestation and the dengue fever cases. On the other hand, the hamlet, Thandramedu, reported only one dengue fever case despite the fact that there was no *Ae. aegypti* breeding. However, it was found that the particular patient was a mason who worked in village 1 during the day.

The level of *Ae. aegypti* breeding was high in peri-domestic (outdoor) containers indicating that these were more conducive for breeding than the indoor containers. This could be due to the fact that non-potable water was kept without any protective cover which favoured the deposition of eggs by *Ae. aegypti*, while the indoor containers were kept covered.

There was a delay in the notification of the disease by the primary health centres. Control measures were initiated soon after the receipt of the notification from the medical officers concerned but they did not seem to be as effective as expected. These were attributed to (i) lack of cooperation from the villagers by their refusal to allow the field workers to check their houses and apply Temephos, (ii) Community participation was lacking, and (iii) many of the houses were locked since both husband and wife had left to work in the fields.

The growing number of water containers kept in the villages contributed to the density of *Ae. aegypti* infestation. Since the need for water storage was the greatest in village 1, the highest number of
dengue fever cases was reported from there. Our experience therefore suggests that the *Ae. aegypti* infestation cannot be successfully controlled without the involvement and co-operation of the community. Therefore, a sustainable approach should include mass education and community participation, with a regular provision of adequate water supply to communities, which will help in the containment of the disease transmission.

**Acknowledgements**

The authors gratefully acknowledge the help given by Dr A.M. Venkatakumar, the then Deputy Director of Health Services, Krishnagiri, and the field staff. The authors also thank Dr T. John Victor, Entomologist of this Institute, for his valuable suggestions during this study. The assistance of Mrs V. Devabharathi, Statistician, in conducting statistical analyses is also acknowledged.

**References**


Dengue Haemorrhagic Fever Outbreaks in Indonesia 1997–1998

By

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Abstract

Since the last three decades, dengue haemorrhagic fever (DHF) has been endemic in Indonesia. The DHF incidence fluctuates monthly and reaches its peak in December–January every year except in big cities such as Jakarta, Bandung and Surabaya, where the highest incidence occurs in April–May. During the period November 1997–May 1998, DHF outbreaks occurred in 18 districts/municipalities of 11 provinces in Indonesia. The total number of DHF cases reported were 16 005 with 250 deaths (CFR 1.5%). The highest number of cases in 1998 were reported in April when the peak was reached in Jakarta. Control measures were carried out by each regency/municipality which were supported from provincial and central levels. The activities included: health education to communities through the mass media, and Ae. aegypti larval source reduction through community participation and mass larvaciding. In addition, insecticide ULV fogging was applied in areas with a high concentration of DHF cases.

Keywords: Dengue fever, Aedes aegypti, outbreak, Indonesia.

Introduction

The appearance of DHF cases in Indonesia was first reported from Jakarta(1) and Surabaya in 1968(2). At that time, only two districts (0.6% of the total number of districts) were affected by the disease and the
number of cases reported was 53 with 24 deaths (CFR=45.3%). Since then, the areas affected have enlarged and the DHF incidence has increased from year to year. Up to 1997, the disease had spread to 240 districts (78.9% of the total number of districts) and 31,784 cases with 705 deaths (CFR=2.2%) had been reported.

The DHF incidence fluctuates annually due to the occurrence of DHF outbreaks every year in different aras of Indonesia. During the 30-year period from 1968 to 1998(3), there were four significant DHF outbreaks, which occurred in 1973, 1983, 1988 and 1998. The number of DHF cases in Indonesia usually increases during December-January every year (Fig.1).

However, in big cities such as Jakarta, Bandung and Surabaya, the incidence reaches its peak in April-May. *Ae. aegypti*, the main vector of DF/DHF, is widely distributed in houses and public places. The average house index (HI) estimated for *A. aegypti* larvae in different provinces of Indonesia in 1997 was 20.8%.

**DHF outbreaks in 1997–**
1998

During the period November 1997–May 1998, DHF outbreaks were reported from 18 districts/municipalities in 11 provinces in Indonesia. The total number of cases was 16,005 with 250 deaths (Table 1).

All the outbreak areas were urban, which were either the headquarters of districts/ municipalities or the capital cities of provinces. The total population of the affected areas was 13,441,009 of which Jakarta accounted for 10,621,814 people (79%).

Period of outbreaks

The outbreak started during November 1997 in Jambi, South Sumatera, and Lampung (western part of Indonesia) and lasted till January–February 1998. Subsequently, the outbreaks occurred in the eastern part of Indonesia (all provinces in Sulawesi island and the provinces of West Nusatenggara and East Timor) which started from December 1997, followed by the outbreak in Ambon, the capital of Maluku province, in February 1998. In Jakarta the outbreak began in March 1998. The period of the DHF outbreaks ranged from 2 to 3 months.

Table 1. Number of DHF cases reported by Provincial District from November 1997 – May 1998

<table>
<thead>
<tr>
<th>Province</th>
<th>District</th>
<th>Population (000)</th>
<th>Period</th>
<th>Cases</th>
<th>Deaths</th>
<th>CFR (%)</th>
<th>AR (0/00) **</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>Palembang</td>
<td>1264</td>
<td>Nov.97-Feb 98</td>
<td>2094</td>
<td>73</td>
<td>3.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Sumatera</td>
<td>Muaraenim</td>
<td>690</td>
<td>Nov.97-Feb.98</td>
<td>140</td>
<td>9</td>
<td>6.4</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Banyuasin</td>
<td>1355</td>
<td>Nov.97-Feb.98</td>
<td>114</td>
<td>3</td>
<td>2.6</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>Musirawas</td>
<td>564</td>
<td>Nov.97-Feb.98</td>
<td>249</td>
<td>10</td>
<td>4.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Location</td>
<td>Total Cases</td>
<td>Year</td>
<td>Start-End</td>
<td>Cases</td>
<td>Deaths</td>
<td>Case Fatality Rate</td>
<td>Attack Rate</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------</td>
<td>------</td>
<td>-----------</td>
<td>-------</td>
<td>--------</td>
<td>--------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Jambi</td>
<td>3873</td>
<td>1997-1998</td>
<td>Nov.97-Jan.98</td>
<td>514</td>
<td>13</td>
<td>2.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Lampung</td>
<td>255</td>
<td>Dec.97-Jan.98</td>
<td>129</td>
<td>3</td>
<td>2.3</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>DKI Jakarta</td>
<td>1371</td>
<td>Mar.98-May 98</td>
<td>1679</td>
<td>12</td>
<td>0.7</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>East Jakarta</td>
<td>2643</td>
<td>Mar.98-May 98</td>
<td>3169</td>
<td>20</td>
<td>0.6</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>S.Jakarta</td>
<td>2389</td>
<td>Mar.98-May 98</td>
<td>2397</td>
<td>16</td>
<td>0.6</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>W.Jakarta</td>
<td>2376</td>
<td>Mar.98-May 98</td>
<td>2377</td>
<td>25</td>
<td>1.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>N.Jakarta</td>
<td>1843</td>
<td>Mar.98-May 98</td>
<td>2667</td>
<td>30</td>
<td>1.1</td>
<td>1.4</td>
<td></td>
</tr>
<tr>
<td>South Sulawesi</td>
<td>262</td>
<td>Jan.97-Feb.98</td>
<td>69</td>
<td>2</td>
<td>2.8</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Central Sulawesi</td>
<td>227</td>
<td>Jan.98-Feb.98</td>
<td>57</td>
<td>2</td>
<td>3.5</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>North Sulawesi</td>
<td>362</td>
<td>Jan.98-Feb.98</td>
<td>80</td>
<td>2</td>
<td>2.5</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>Southeast Sulawesi</td>
<td>429</td>
<td>Jan.98-Feb.98</td>
<td>120</td>
<td>12</td>
<td>10.0</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>NTB</td>
<td>472</td>
<td>Jan.98-Apr.98</td>
<td>172</td>
<td>16</td>
<td>9.3</td>
<td>0.4</td>
<td></td>
</tr>
<tr>
<td>East Timor</td>
<td>154</td>
<td>Jan.98-Apr.98</td>
<td>44</td>
<td>1</td>
<td>2.3</td>
<td>0.3</td>
<td></td>
</tr>
<tr>
<td>Maluku</td>
<td>302</td>
<td>Feb.98-Apr.98</td>
<td>14</td>
<td>1</td>
<td>7.1</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>13441</td>
<td></td>
<td></td>
<td>16005</td>
<td>250</td>
<td>1.5</td>
<td>1.2</td>
</tr>
</tbody>
</table>

*CFR=Case fatality rate ** AR=Attack rate

The number of cases reported from the outbreak areas totalled 16,005, of which 12,289 cases (76.7%) were from Jakarta alone. The average attack rate (AR) was 1.2 per 1000 population. The districts and municipalities with an attack rate of more than 1.0 per 1000 population were: Jambi, Palembang, Central Jakarta, North Jakarta, East Jakarta, South Jakarta and West Jakarta.

The highest attack rate occurred in Palembang (1.6 per 1000 pop.), Jambi (1.4 per 1000 pop.) and North Jakarta (1.4 per 1000 pop.).

The average case fatality rate (CFR) during the outbreaks was 1.5%. The districts and municipalities with the case fatality rate of more than 2.5% were: Palembang, Muaraenim, Banyuasin, Musirawas, Palu, Maros,
Buton, Bima and Ambon. The highest CFR was reported from: Buton (10.0%), Bima (9.3%), Ambon (7.1%), and Muaraenim (6.4%). Factors influencing the high CFR in these four towns included: (1) the first time occurrence of DHF cases/outbreaks in the areas (Bima and Buton) had led to a poor understanding of the disease by the community as well as health providers, and (2) shortage of resources including laboratory facilities, especially in small towns which resulted in poor case management in hospitals.

Control of outbreaks
The control of DHF outbreaks was carried out by each regency or municipality and their efforts were supported by provincial and Central governments and the private sector\(^4\). The Central government, together with provincial authorities, provided technical guidance, insecticides and additional equipment including the infuse sets and operational funds. A campaign to control *Ae. aegypti* larvae was announced at the Central level by the Minister of Health in April 1998 which called for the community to empty and refill water tanks regularly and to cover water containers and all other possible articles conducive for *Ae. aegypti* breeding. In Jakarta and other provinces, the Governors instructed all Mayors and district chiefs to personally supervise the control activities, including the campaign for source reduction, to control *Ae. aegypti* larvae. Mass larviciding was largely implemented by trained personnel who were supervised by health centres. In addition, insecticide fogging was applied by district or municipal health offices in areas which had a high concentration of DHF cases. *Ae. aegypti* larval source reduction was carried out by schoolchildren under the direction of teachers. Education to the community was conducted through TV, radio and other branches of mass media. Communication and information activities on DHF prevention to mothers were carried out by cadres and PKK (Family Welfare Foster) through group education and house visits.

References


By

Khin Mon Mon, Saw Lwin, Soe Aung and Thar Tun Kyaw
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Yangon, Myanmar

Abstract

Dengue/dengue haemorrhagic fever is endemic in seven countries of the WHO South-East Asia Region. Myanmar is one of the three countries where DHF is endemic not only in urban areas but also in rural areas. The incidence has been increasing over the last 20 years and the outbreaks are now more common. The high incidence is witnessed in the rainy season in all states and divisions, except two states which did not report any DHF case. The under-15 year age group was more affected and persons above that age were rarely affected.

Keywords: Dengue fever, dengue haemorrhagic fever, Aedes aegypti, Myanmar.

Introduction

Myanmar is situated at 92° – 102° east longitude and 10° – 28° north latitude. The population of the country is 46.4 million. Myanmar is divided into 7 states and 7 divisions for administrative purposes. The states/divisions have been subdivided into 63 districts and 324 townships. Myanmar, being located in the tropical zone, has a relatively high temperature and humidity, which are favourable conditions for the perpetuation of Ae. aegypti.
Sporadic cases of clinically-recognizable DHF were first noticed in 1969 in Yangon Children’s Hospital which was followed by the first epidemic in Yangon in 1970\(^1\). From 1970 to 1995, a total of 83 381 cases and 3242 deaths, with a case fatality rate (CFR) of 3.9%, were recorded. The incidence of DHF increased over the two decades (1970–1980) and (1981–1991). DHF spread from Yangon to other states and divisions beginning 1975 but two states (Chin and Kayah) remained unaffected up to 1997. This report covers the period 1991–1998 in which certain changes have taken place.

### Epidemiology

#### DHF incidence and trend analysis

The yearly DHF morbidity and mortality data with CFR are shown in Table 1. The trend of DHF cases is on the rise with \((b=+253)\) based upon the absolute number of cases from 1991 to 1998. The case fatality rate has shown a downward trend with \((b=-0.16)\).

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of cases</th>
<th>No. of deaths</th>
<th>Case fatality rate (percentage)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>6772</td>
<td>282</td>
<td>4.16</td>
<td>-</td>
</tr>
<tr>
<td>1992</td>
<td>1685</td>
<td>37</td>
<td>2.19</td>
<td>-</td>
</tr>
<tr>
<td>1993</td>
<td>2279</td>
<td>67</td>
<td>2.94</td>
<td>-</td>
</tr>
<tr>
<td>1994</td>
<td>11647</td>
<td>444</td>
<td>3.81</td>
<td>Epidemic</td>
</tr>
<tr>
<td>1995</td>
<td>2477</td>
<td>53</td>
<td>2.14</td>
<td>-</td>
</tr>
<tr>
<td>1996</td>
<td>1854</td>
<td>18</td>
<td>0.97</td>
<td>-</td>
</tr>
<tr>
<td>1997</td>
<td>4005</td>
<td>82</td>
<td>2.05</td>
<td>-</td>
</tr>
<tr>
<td>1998*</td>
<td>12668</td>
<td>192</td>
<td>1.51</td>
<td>Epidemic</td>
</tr>
</tbody>
</table>

* Provisional data

#### Seasonal distribution

In Yangon division, DHF transmission occurs throughout the year. But in other states and divisions the cases start to happen from May. The number rises during the rainy season, i.e. the second week of May to the second week of October. After that, the cases decline to around zero in the states and divisions and to less than 100 in Yangon division. Water storage practices in Yangon division provide year-round breeding opportunities for the vector, whereas in other states and divisions breeding sites get established in the rainy season only, which may be
the reason for the high transmission at that time.

Distribution of cases by states and divisions

According to the status report of DHF in Myanmar for 1970–1995, Yangon division contributed 47.8% of the cases while Bago, Mon, Mandalay and Magwe contributed 42.5%. A low level of contribution, i.e. 14.8%, was from Ayeyarwaddy, Kayin, Sagaing, Rakhine, Tanintharyi and Kachin. Shan State contributed the least proportion, i.e. 0.9%.

The distribution of DHF cases during 1996–1998 among different states and divisions is shown in Table 2. Kayah state reported its first DHF case in 1998. All four cases were serologically confirmed, thus Kayah joined the list of DHF endemic states. Ayeyarwaddy division joined the ‘moderate contribution’ category from the low category level in previous years. Shan state attained the ‘low contribution’ category from the ‘least contribution’ category because of epidemics in its southern parts in 1998.

Table 2. Percentage contribution of cases by states and divisions (1996–1998)

<table>
<thead>
<tr>
<th>Status of contribution</th>
<th>State/division</th>
<th>Percentage of cases contributed</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Yangon</td>
<td>46.6</td>
</tr>
<tr>
<td>Moderate</td>
<td>Bago, Mon, Mandalay, Ayeyarwaddy</td>
<td>38.6</td>
</tr>
<tr>
<td>Low</td>
<td>Tanintharyi, Kayin, Shan, Rakhine, Sagaing</td>
<td>12.9</td>
</tr>
<tr>
<td>Poor</td>
<td>Mgwe, Kachin, Kayah</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Age–group–wise distribution

The age–wise break–up of DHF cases is shown in Figure 1 and Table 3. It appears that the worst affected age–group is 5–9 years, followed by 0–4 and 10–14 years. The least affected one is 15 years and above.

Table 3. Proportion (percentage) of age–group–wise distribution of DHF morbidity, Yangon division, 1994–1998

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>44</td>
<td>40</td>
<td>50</td>
<td>52</td>
<td>43</td>
</tr>
<tr>
<td>5–9</td>
<td>45</td>
<td>47</td>
<td>37</td>
<td>37</td>
<td>46</td>
</tr>
<tr>
<td>10–14</td>
<td>10</td>
<td>13</td>
<td>13</td>
<td>11</td>
<td>10</td>
</tr>
</tbody>
</table>
According to Table 3 above, the under-5-year age-group was more affected in the non-epidemic years (1996 and 1997). Almost an equal proportion of cases occurred among the under-5-year and 5-9-year age-groups in the epidemic years (1994 and 1998). Morbidity among the 15-year-plus age-group was found in both the epidemic years.

### Discussion and conclusion

DHF is endemic in Myanmar with a 3–4 year epidemic cycle. The incidence has
been increasing over the past 20 years and the upward trend is still continuing. The provisional number of cases in 1998 was the highest ever recorded in Myanmar but the mortality was not so high as in 1994 (See Table 1).

The CFR in Myanmar is apparently higher than in other neighbouring countries such as Thailand. It may be due to the fact that the cases reported were only hospital cases which were DHF Grade II and above. Grade I cases were not admitted and were therefore not included in the case report. So the denominator of CFR is rather less than actual and it accentuates the result.

Regarding the age-group-wise distribution, the under-5 and primary school-going age-group suffered in almost the same proportion. Therefore, the National Health Committee highlighted the school health programme and the IMCI (Integrated Management of Childhood illness) strategy was also encouraged.

Reference
Control of Dengue/Dengue Haemorrhagic Fever in Sri Lanka

By
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Abstract
Dengue fever has been endemic in Sri Lanka from the beginning of the century and it was serologically confirmed in 1962. Following an outbreak of Chikungunya in 1965, there was an island-wide epidemic from 1965 to 1968. The first two cases of DHF occurred during this period. A few scattered cases were reported over the years and the largest outbreak occurred in 1990. Surveys have shown that more than one serotype was in circulation. Two peaks of the disease occur annually in association with the monsoon rains. The highest incidence occurs in the 5–9-year age-group. Aedes aegypti and Aedes albopictus are the vectors responsible for dengue transmission.

The control programme consists of disease, vector and laboratory surveillance; vector control; social mobilization; clinical management of DF/DHF and emergency response. At the national level, a multidisciplinary dengue task force has been established. Such dengue task forces are being set up at provincial and district levels as well. Training of clinicians on clinical management is being continued. It is hoped that with the implementation of this programme in collaboration with other governmental and nongovernmental organizations and with the maximum cooperation from the community, the morbidity and mortality caused by DF/DHF will be reduced in the near future.

Keywords: Dengue fever, dengue haemorrhagic fever, mortality, Sri Lanka task force, surveillance, Sri Lanka.
Introduction

Dengue is an important vector-borne disease in Sri Lanka. It affects the young and the old, the rich and the poor alike, especially among those living in densely-populated urban areas throughout the tropics.

In Sri Lanka, the following control strategies have been established: 1) Surveillance: (a) Disease surveillance; (b) Vector surveillance; and (c) Laboratory active surveillance; 2) Vector control; 3) Social mobilization; 4) Clinical management of DF/DHF cases, and 5) Emergency response.

To coordinate all these activities, a dengue task force has been established at the national levels.

Situation and trend of DHF

A clinical dengue fever-like illness has been known to be endemic in Sri Lanka from the beginning of the century, and it was serologically confirmed in 1962. Following an outbreak of Chikungunya in 1965, there was an island-wide epidemic of dengue associated with DEN type 1 and 2, with 51 cases of DHF and 15 deaths, from 1965 to 1968\(^1\).

Although most of the towns throughout the country were affected during this outbreak, the greatest impact was felt in the western coastal belt. Colombo, the capital, recorded the highest number of cases and the first two cases of DHF also occurred at this time. In 1966, 13 cases of DHF occurred with 5 deaths; in 1967, 29 cases were reported with 8 deaths; and in 1968, 7 cases occurred with 2 deaths. Up to 1972, there were only a few scattered cases with no cases reported between 1973 and 1976. Very few DHF cases were reported between 1976 and 1988. Surveys however showed that more than one serotype was circulating and, in 1989, there was a large outbreak of DHF with 203 clinically-diagnosed cases and 20 deaths, giving a case fatality rate (CFR) of 9.8%. In 1990, the number of cases rose sharply to 1350, of which 363 were serologically confirmed (Figures 1 & 2\(^2\)).

Several hundred cases were reported annually between 1991 and 1996, with the CFR ranging from 0.9% in 1993 to 4.2% in 1996.
The highest number of cases continue to be reported by the Deputy Provincial Director of Health Services, Colombo division, with a progressive spread from the city of Colombo to its suburbs and thence to major towns outside Colombo.

In 1996, a large outbreak (289 cases) was reported from the Kurunegala health division which is about 100 km from Colombo, and focal outbreaks were reported from the provincial towns of Galle, Kandy and Batticaloa.

The age-wise distribution of the cases reported between 1991 and 1996 shows that about 60% of the cases occurred among the under-15-year age-group and that the highest percentage was among children in the 5–9 year age-group. There was not much difference between the two sexes. The percentage of males affected by the disease ranged from about 50% to 59%.

Generally, the peak number of DHF cases occur in June/July and are associated with the south-western monsoon which commences in late April and results in the maximum rainfall in the year. Another peak is reached at the end of the year which is associated with the north-eastern monsoon rains which prevail from October to December (Fig. 3).
Figure 1. Dengue Fever/Dengue Haemorrhagic Fever Clinical Cases, Deaths, Sri Lanka 1989-1997

Figure 2. Dengue Fever / Dengue Haemorrhagic Fever Suspected/ Clinical Cases Positives – Sri Lanka 1989–1997
Clinical presentation

All notified cases of DF/DHF are investigated by the Epidemiological Unit and the main clinical features of 163 cases are given below.

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>No.</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>149</td>
<td>91.4</td>
</tr>
<tr>
<td>Haemorrhagic tendencies</td>
<td>90</td>
<td>55.2</td>
</tr>
<tr>
<td>Thrombocytopenia (&lt; 100,000 more or less)</td>
<td>63</td>
<td>38.7</td>
</tr>
<tr>
<td>Enlarged liver</td>
<td>51</td>
<td>31.3</td>
</tr>
<tr>
<td>Evidence of circulatory failure</td>
<td>29</td>
<td>17.8</td>
</tr>
<tr>
<td>Plasma leakage</td>
<td>14</td>
<td>8.9</td>
</tr>
</tbody>
</table>

A total of 149 (91.4%) of the patients had fever and 90 (55.2%) had haemorrhagic tendencies as evident by at least one of the following reasons: (a) positive tourniquet test; (b) petechiae; (c) ecchymoses or purpura; (d) bleeding from mucosa; and (e) gastrointestinal bleeding. Twenty-nine patients (17.8%) had evidence of circulatory failure which was manifested by: (a) rapid and weak pulse; (b) narrow pulse pressure; and (c) cold, clammy skin and an altered mental status.

Laboratory diagnosis

According to the Virologist, Medical Research Institute, Colombo, the haemagglutination inhibition (HAI) test is used routinely and a four-fold or
greater rise in titre in acute and convalescent serum samples or a titre equal to or greater than 2560 is considered as diagnostic. Ninety-eight per cent of the DHF cases had a titre of 2560, indicating a secondary infection\(^3\).

**Dengue vectors**

*Aedes aegypti* and *Aedes albopictus* which are important dengue-transmitting vectors in most countries are present in Sri Lanka\(^4\). Vector surveillance shows that though overall *Ae. aegypti* is more common than *Ae. albopictus*, the latter is quite common in the outskirts of Colombo\(^5\). According to the studies done by a WHO consultant\(^6\) collections of adult *Ae. aegypti* indicated that breeding was mainly outdoors and the container preference of *Ae. aegypti* appeared to be rubber tyres throughout the study area\(^7\).

**DF/DHF situation in 1997**

In 1997, 980 cases of DF/DHF were reported from government institutions with 17 deaths, giving a CFR of 1.7%. The number of DF/DHF cases and deaths reported to the Epidemiological Unit from 1989 to 1997 and the CFRs are given in Table 1. Compared to 1996, the total number of dengue cases went down from 1294 to 980 in 1997.

The distribution of cases by Regional/Deputy Provincial health divisions is given in Table 2. The highest number of cases was reported from the Colombo health division (544 cases). Kandy and Gampaha health divisions also reported large numbers of cases. The highest number of cases was reported in the month of November (192 cases).

The distribution by age of DF/DHF cases based on the notification for the year 1997 is given in Table 3. The highest percentage of cases (29.7%) occurred in the 5–9-year-old age-group. Four hundred and eighty-four (49.3%) of the dengue cases were reported in the 0–14-year age-group. The male-to-female sex ratio for dengue/dengue haemorrhagic fever was 1.2:1. In 1997, 980 cases of DF/DHF and 17 deaths were reported to the Epidemiological Unit with a case fatality rate of 1.7%.

The highest number of cases was reported in November (129 cases) and the lowest in February (20 cases)\(^8\). Blood from the DF/DHF patients was
examined for dengue antibody in the Virology Department of the Medical Research Institute, Colombo, and 193 cases were found positive.

To further strengthen the National Dengue Control programme, dengue task forces are being set up at provincial and district levels. Training of clinicians on clinical management, epidemiologists on surveillance and laboratory staff on diagnoses is being continued. Health Education Bureau is preparing information modules on IEC activities. It is hoped that implementation of the above programme in close collaboration with the other government, non-governmental organizations and maximum co-operation of the community, the morbidity and mortality due to DF/DHF will be reduced in Sri Lanka in the near future.

Table 1. Number of cases, morbidity rates, deaths and case fatality rates of dengue/dengue haemorrhagic fever – 1989–97

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of suspected cases of DF/DHF</th>
<th>Serologically confirmed cases</th>
<th>Deaths</th>
<th>Case fatality rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1989</td>
<td>203</td>
<td>87</td>
<td>20</td>
<td>9.9</td>
</tr>
<tr>
<td>1990</td>
<td>1350</td>
<td>363</td>
<td>54</td>
<td>4.0</td>
</tr>
<tr>
<td>1991</td>
<td>1048</td>
<td>218</td>
<td>31</td>
<td>3.0</td>
</tr>
</tbody>
</table>

1992 656 113 15 2.3
1993 756 189 7 0.9
1994 582 77 7 1.2
1995 440 92 11 2.5
1996 1294 401 54 4.2
1997 980 193 17 1.7

Table 2. Dengue/dengue haemorrhagic fever cases, positives and deaths by RDHS divisions – 1997

<table>
<thead>
<tr>
<th>RDHS Division</th>
<th>1997</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cases</td>
<td>Positive</td>
</tr>
<tr>
<td>Colombo</td>
<td>544</td>
<td>140</td>
</tr>
<tr>
<td>Gampaha</td>
<td>82</td>
<td>5</td>
</tr>
<tr>
<td>Kalutara</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Kandy</td>
<td>119</td>
<td>20</td>
</tr>
<tr>
<td>Matale</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nuwara Eliya</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Galle</td>
<td>29</td>
<td>6</td>
</tr>
<tr>
<td>Hambantota</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Matara</td>
<td>56</td>
<td>15</td>
</tr>
<tr>
<td>Jaffna</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Vavuniya</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Ampara</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Batticaloa</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Trincomalee</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Kurunegala</td>
<td>43</td>
<td>1</td>
</tr>
<tr>
<td>District</td>
<td>&lt;1 year</td>
<td>1 – 4 years</td>
</tr>
<tr>
<td>---------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Puttalam</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Anuradhapura</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Polonnaruwa</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Badulla</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Moneragala</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Kegalle</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Ratnapura</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Not available</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>980</td>
<td>193</td>
</tr>
</tbody>
</table>

Table 3. Dengue/dengue haemorrhagic fever cases and deaths by age-group – 1997

<table>
<thead>
<tr>
<th>Age</th>
<th>Cases</th>
<th>Percentage</th>
<th>Deaths</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1 year</td>
<td>10</td>
<td>1.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1 – 4 years</td>
<td>147</td>
<td>19.2</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>5 – 9 years</td>
<td>227</td>
<td>29.7</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>10 – 14 years</td>
<td>100</td>
<td>13.1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>15 – 19 years</td>
<td>56</td>
<td>7.3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20 – 24 years</td>
<td>74</td>
<td>9.7</td>
<td>4</td>
<td>25.0</td>
</tr>
<tr>
<td>25 – 29 years</td>
<td>46</td>
<td>6.0</td>
<td>1</td>
<td>6.3</td>
</tr>
<tr>
<td>30 – 34 years</td>
<td>36</td>
<td>4.7</td>
<td>2</td>
<td>12.5</td>
</tr>
</tbody>
</table>

References


Dengue Haemorrhagic Fever in Thailand

By

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Abstract

Dengue haemorrhagic fever was first reported in Thailand in 1950. Since then the reported number of cases has been showing a gradually increasing trend. In earlier outbreaks, the disease was mainly found in Bangkok and surrounding areas. Since 1965, it has been reported from all regions of Thailand. The factors that facilitate the spread of DHF include rapid demographic and societal changes, population movement, uncontrolled urbanization, poor water management systems and indiscreet disposal of used automobile tyres and plastic materials in the environment.

The main interventions used for DHF prevention and control in the past comprised of three approaches: (1) the control of Aedes breeding sites; (2) health education to raise public awareness; and (3) the provision of standard and effective medical care for DHF patients in order to reduce mortality. Despite the active implementation of these efforts, the disease has not been brought under control. The spread of DHF epidemic is on the increase both in terms of the number of people affected and the areas covered. The main weakness of the DHF control programme is its failure to mobilize all sectors who should be involved in the effort.

At present, a series of activities are being undertaken to reform the DHF control programme in Thailand. These include: (1) the formation of a national dengue prevention and control committee; (2) the establishment of a Dengue Division; and (3) the development of a national plan for dengue prevention and control. The main direction of the plan emphasizes the improvement of the environment at home and in the community, human development, and the development of technology to promote dengue prevention.
and medical care for DHF patients. The main dengue control interventions currently being conducted are the Aedes-free programme, the integration of DHF control into the primary health care programme, a massive public education campaign, a national DHF seminar, publication of the DHF newsletter, external review of the programme, and the development of DHF technical materials. The main difference between the current programme and the previous one is the active involvement now of other sectors, especially those working in the areas of environment, rural development, local administration, mass mobilization and basic education. This will ensure that the DHF programme will be implemented by all sectors to result in the widest coverage in the country.

Keywords: Dengue haemorrhagic fever, environmental improvement, human development, national DHF seminar, Thailand.

Introduction

Dengue haemorrhagic fever (DHF) is becoming a major health problem in Thailand. It has long been among the top five of the most common communicable diseases in the country, which are: diarrhoeal diseases, conjunctivitis, pneumonia, DHF, and malaria. It is also one of the leading causes of morbidity among children under 10 years of age. Although the mortality and case fatality rates of DHF have been gradually decreasing, thanks to the technical advancements and the higher quality of medical care, the morbidity from this disease has been on the increase since the disease was first reported in 1949.

Realizing the ever-increasing threat of DHF to the population, especially children and the youth, the Ministry of Public Health has decided to give the DHF control programme the highest priority, with the aim to reduce effectively the DHF morbidity and mortality. The problem is so acute that His Majesty the King of Thailand himself has expressed concern about the growing danger of DHF in the country.

Situation and trends of DHF in Thailand

Dengue haemorrhagic fever was first reported in Thailand in 1950. In the beginning, about 50 to 100 cases were diagnosed annually until the first large outbreak of the disease in 1958 when 2158 cases and 300 deaths were...
reported. Since then, the reported number of cases has been gradually increasing. In the first few outbreaks, the disease was mainly found in Bangkok and its surrounding areas, and the majority of cases were children aged between 2 and 6 years. Since 1965, the disease has been reported from all regions of the country.

Wangroongsab (1997)\(^2\) reported the details of the DHF situation in Thailand by presenting a table which showed the number of cases, deaths, the morbidity rate, the mortality rate, and the case fatality rate from 1958 to October 1997. The data presented clearly demonstrated that DHF was on the increase in spite of the active campaigns conducted in the country.

The situation of DHF in 1997 and 1998 deserves serious attention. The number of DHF cases reported was 101 689 in 1997 and 126 348 in 1998 (Table 1)\(^3,4,5\). Since the first outbreak of the disease 40 years ago, the cases for 1998 and 1997 were the second and the third highest ever following the highest ever number of 174 285 cases reported in 1987.

**Table 1. Morbidity, mortality and case fatality rates of DHF in Thailand, 1997–1998**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
<th>Deaths</th>
<th>Morbidity rate</th>
<th>Mortality rate</th>
<th>Case-fatality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>101 689</td>
<td>253</td>
<td>169.13</td>
<td>0.42</td>
<td>0.25</td>
</tr>
<tr>
<td>1998</td>
<td>126 348</td>
<td>432</td>
<td>207.75</td>
<td>0.71</td>
<td>0.34</td>
</tr>
</tbody>
</table>

*(data as of 4 January 1999)*

Fig.1 presents the monthly distribution of DHF cases in 1998. Although 50% of the cases were diagnosed in the rainy season (June to August), the disease was observed all the year round. Table 2 indicates the wide spread of DHF in all the regions of Thailand. Variations in numbers may be due to population density and the extent of movement within each region.

**Table 2. Region-wise number of DHF cases and deaths reported in Thailand, 1998**

<table>
<thead>
<tr>
<th>Region</th>
<th>Cases</th>
<th>Deaths</th>
<th>Case fatality rate (per 1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>21 532</td>
<td>73</td>
<td>3.4</td>
</tr>
<tr>
<td>North-Eastern</td>
<td>48 710</td>
<td>210</td>
<td>4.3</td>
</tr>
<tr>
<td>Central</td>
<td>28 334</td>
<td>59</td>
<td>2.1</td>
</tr>
</tbody>
</table>
It is observed that DHF has a tendency to affect populations in higher age-groups. As compared to 1988, the percentage of patients aged over 15 years increased from 7.25% to 19.75% (Table 3).

Table 3. Age-group-wise number of DHF cases in Thailand, 1998

<table>
<thead>
<tr>
<th>Age-group</th>
<th>Number of cases</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4 yrs</td>
<td>19 205</td>
<td>15.20</td>
</tr>
<tr>
<td>5–9 yrs</td>
<td>46 787</td>
<td>37.03</td>
</tr>
<tr>
<td>10–14 yrs</td>
<td>35 403</td>
<td>28.02</td>
</tr>
<tr>
<td>15 yrs and over</td>
<td>24 953</td>
<td>19.75</td>
</tr>
<tr>
<td>Total</td>
<td>126 348</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Figure 1. Month-wise No. of DHF Cases Reported in Thailand, 1998
Epidemiological Phases

The DHF situation in Thailand in the past 40 years can be summarised as having four different epidemiological phases\(^6\).

Phase 1: The First Decade of DHF (1958 – 1967)

The epidemics of DHF occurred once every two years with a slightly increasing trend. The average number of patients per year ranged between 2000 and 8000. Most of the patients were in big provinces. The case fatality rate was initially high, over 10\%, and gradually declined to 3\% at the end of the phase.

Phase 2: The Second Decade (1968 – 1977)

The disease occurred once every 2 to 3 years during this phase. The morbidity increased very significantly, from less than 20 per 100 000 pop. at the beginning of the phase to over 80 per 100 000 at the end. The case fatality varied from 1\% to 4\%, and the trend did not decrease. The average annual number of cases ranged from 3000 to 38 000. The majority of the cases still occurred in big cities, municipal areas, or urban zones.


In this phase, the disease began to spread from urban to rural areas throughout the country. The average number of cases was 50 000 per year. The highest ever incidence of DHF in the country was observed in 1987 when 174 285 cases were reported. However, the case fatality rate was declining significantly from 2.45\% in 1978 to 0.58\% in 1987.


During this phase, DHF became a major public health problem throughout Thailand. The trend of the disease was on the increase significantly while the case fatality rates were quite low (0.3\% – 0.6\%). Some unusual features were observed in this phase, and the significance of these observations needs to be explored. For example:

(a) Alteration in the concept of seasonal variations in that the DHF outbreaks in 1997/1998 not
only occurred in the rainy season but throughout the year; and (b) There seemed to be a shift in the age–groups that got affected – from younger people to older ones.

The extensive spread of DHF in Thailand has resulted in premature death of many patients as well as economic loss due to both direct and indirect costs. A study of the cost of DHF, using the incidence data of 1994 in which 51,688 cases were reported, showed that it cost the country at least US$ 12.6 million, of which 54.8% was borne by the government and the rest by the patients and their families(7).

Causes of spread of DHF
There are many factors that facilitate the spread of DHF in Thailand. Rapid demographic and societal changes have taken place in the past 20 years. The movement of population from rural areas to Bangkok and other big cities has resulted in uncontrolled urbanization with poor water management systems which facilitated the breeding of mosquitoes. The indiscreet scattering around of used automobile tyres and plastic materials further aggravated the already uncontrolled DHF vector multiplication. Moreover, shortage of piped water supply in both urban and rural areas has created the practice of conserving water in household containers which are the most potential breeding places of Aedes mosquito, the main vector of DHF in Thailand. The massive population movement in recent years has further facilitated the spread of the dengue virus from high endemic areas to the rest of the country. All these factors coupled with ineffective DHF control measures in the past, have resulted in high morbidity caused by DHF and the ever–increasing trend of the disease in Thailand.

Dengue prevention and control measures
During the first decade of the DHF epidemics, the primary control interventions were health education and vector control conducted as a vertical programme by medical and health workers(6). The main focus of the vector control activities in the first two decades was spraying of chemicals to reduce the mosquito density in areas where cases of DHF
were reported. In the last two decades, the control programme was integrated into local health services at the provincial level and the logistics were provided by health authorities at the central level. In the last decade, more attention has been given to school settings as the potential risk areas for children who stayed at school during day time, and were therefore more likely to be bitten by *Aedes* mosquito. Cooperation between the Ministry of Public Health and the Ministry of Education has been very successful in mobilizing children to take part in vector control activities in schools\(^2\). At the same time, patients with DHF are effectively treated which has resulted in a low case fatality rate\(^6\).

In conclusion, the main interventions for the prevention and control of DHF in the past comprised of three approaches:

(1) The control of *Aedes* breeding sites. The interventions included the use of chemical larvicides such as Abate or Temephos sand granules to kill mosquito larvae in uncovered water containers, outbreak investigation, and chemical spraying or fogging after the detection of an outbreak.

(2) The provision of health education to familiarize the public about the danger of DHF and to cooperate with other sectors in destroying and eliminating mosquito breeding sites, and self-protection from mosquitoes.

(3) The provision of standard and effective medical care for DHF patients in order to reduce the mortality.

Despite the active involvement of the Ministry of Public Health and a few participating agencies such as the Ministry of Education, the disease has not been brought under control. The problem of DHF is rather on the increase both in terms of the number of people affected and the area covered by the disease.

The main constraint of the DHF control programme is its failure to mobilize all sectors who should be involved in the DHF control activities. In the past 40 years, the main agency responsible for the control programme has been the Ministry of Public Health. The experience gained from the HIV/AIDS prevention and control
programme points to the fact that it is almost impossible to control such a major health problem if all key sectors do not actively involve themselves in its control since DHF is an environmental problem, i.e. a problem of inappropriate environment that facilitates the growth of Aedes mosquito. Therefore, all agencies responsible for environmental control, rural development, local administration and mass mobilization should be actively involved in the programme.

Current approaches in DHF control

At present, a series of activities are being undertaken to reform the DHF control programme in Thailand. These include the following:

Formation of National Dengue Prevention and Control Committee

This committee, established with the approval of the Cabinet, comprises 49 representatives from various sectors within and outside the government®. The Prime Minister is the Advisory Chairman and the Minister of Health is the Chairman of the Committee. The main responsibilities of this multisectoral committee are: (1) to formulate policies and set up DHF control approaches; (2) to control and monitor the implementation of the DHF control programme; and (3) to direct and coordinate the programme among various agencies as well as to solve all problems of programme implementation in order to achieve the objectives of the programme. A set of specific subcommittees are being formed and regular meetings are held to monitor the progress of the programme.

Establishment of Dengue Division

In the past, DHF control was the responsibility of a small vector control section within the Division of General Communicable Diseases. In order to cope with the increasing trend of the disease, the Office of Dengue Control has been upgraded to the division level and made responsible for the implementation and coordination of DHF control activities conducted by various sectors. It acts as the secretariat of the National Dengue Prevention and Control Committee (NDPCC), similar to the role of the
AIDS Division of the Department in the National AIDS Prevention and Control Programme.

Development of national plan for dengue prevention and control

At present, a multisectoral plan is being developed to be known as the National Plan for the Prevention and Control of Dengue Haemorrhagic Fever in the country\(^9\). The plan will provide policy direction which conforms to the changing disease situation and the consideration of self-reliance. It will reflect the concept of modifying the attitude and the behaviour of the people to realize the importance of and the necessity to control *Aedes* breeding sites. The plan will lay particular emphasis on the following aspects:

(i) Improvement of environment at home and in the community in order to render it unfit for the breeding of *Aedes* mosquitoes.

(ii) Human development. This will include education, information and communication activities aimed at raising the awareness of the people to be conscious about the danger of DHF and to prevent themselves from possible exposure to the disease. The plan will also emphasize the creation of a public norm of controlling the environment and destroying the breeding sites of *Aedes* mosquitoes.

(iii) Development of technology to promote dengue prevention and medical care for DHF patients. This plan will emphasize measures to build people's capacity to take proper care of the sick persons at home, and to build up responsive medical and health manpower to provide effective treatment for DHF patients.

The main objectives of the National Plan in the first two years (1999–2000) are:

(i) To prevent and reduce the problems resulting from the spread of DHF in Thailand; and

(ii) To reduce the socioeconomic and health impacts resulting from the spread of DHF at the family, community and national levels.
Strategic objectives of the national plan

These are:

(i) To control the environment in the families and the communities so that it will not be suitable as breeding sites of *Aedes* mosquitoes;

(ii) To create the potential of individuals, families, communities, and community-based organizations to control and reduce the sources of DHF; and

(iii) To develop the prevention and care capability of concerned government and non-government agencies and institutions.

Specific objectives of the national plan

These are:

(i) Reduction of morbidity and mortality:
   • To take control measures not to allow the morbidity rate of DHF to exceed 50 cases per 100,000 population.
   • To control the case fatality rate so that it does not exceed 0.2%.

(ii) Reduction of the prevalence of mosquito vector:
   • To eliminate household breeding sources so that the Breteau Index does not exceed 50 in any community.
   • To reduce breeding sources in all schools so that the Container Index does not exceed 10.

Main components of National Dengue Prevention and Control Programme (NDPCP)

The National Plan for Dengue Prevention and Control is comprised of five projects:

(i) Environment improvement for the control of *Aedes* mosquitoes;

(ii) Public information and education for the prevention and control of dengue haemorrhagic fever;

(iii) Manpower development for the implementation of dengue prevention and control;
Dengue Haemorrhagic Fever in Thailand

(iv) Technical development and improvement of prevention technology and medical care; and

(v) Development of a long-term national plan for dengue prevention and control.

Dengue control interventions

The following interventions for DHF control are being implemented in Thailand:

*The Aedes-free programme*

This will be conducted in various institutions and communities such as households, communities, schools and medical and health facilities. The Ministry of Public Health has laid down a policy to conduct the *Aedes*-free programme in all hospitals, health centres and health facilities in the country in order to demonstrate to other sectors the methodology to implement, monitor and evaluate the programme.

*Integration of DHF control into PHC programme*

This programme will involve all village health volunteers (VHVs) (approximately 650,000 persons) who will be trained and assigned to work primarily on DHF control in 1999. By this approach, DHF control activities in all villages will be conducted and supervised by VHVs.

*Massive public education campaign*

Experiences gained in raising the awareness of the people in HIV/AIDS control will be utilized in the DHF control programme to ensure the implementation of a full-scale public campaign. The role of the private sector in the development of appropriate efforts by the mass media will be promoted.

*National DHF seminar*

The first national seminar in DHF prevention and control will be conducted in April 1999. This will be used as a platform for educating officials from other sectors to realize the importance of DHF control and to ensure their participation in the programme. It will also provide an opportunity for all stakeholders to exchange opinions and experiences in the area of DHF prevention and care.
DHF Newsletter

A monthly DHF Newsletter has been developed to provide all stakeholders relevant information about the progress of the programme, including the latest situation of DHF in the country.

External review

A team of international experts in DHF prevention and control will conduct a review of DHF control in Thailand in order to collect information, assess the situation, and recommend appropriate strategies for the prevention and control of DHF. This activity, supported by WHO, will be a good opportunity for the country to learn from and exchange experiences with international experts and to learn about its weaknesses.

Development of technical materials

With support from WHO, a set of materials will be produced to collect technical information in various areas. A technical forum currently conducting monthly meetings will use this information to develop materials for use in the country.

Conclusion

There seems to be no new interventions that are required to make the control of DHF more effective. The main strategies are: mosquito control, awareness about safety measures against DHF, and effective medical care. The main difference between the current programme and the previous one is the active involvement of other sectors, especially those working in the areas of environmental control, rural development, local administration, mass mobilization and basic education. This will ensure that the programme will be implemented by all sectors in the community to provide it the widest possible coverage.

References


Control of DHF Outbreak in Cambodia, 1998

By
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Abstract
In January 1998, an unprecedented dry-season outbreak of dengue haemorrhagic fever (DHF) occurred in Phnom Penh. An immediate and adequate outbreak response quelled the outbreak which was limited to the Capital. However, the nationwide DHF case figures remained at the normal level during the dry months of April and May.

After June 1998, the expected sharp increase in the number of cases occurred: from 807 cases in May, the number grew to 3291 cases in July. The virus succeeded in spreading to many new areas, affecting, at the same time, 18 of Cambodia’s 22 provinces as compared to only six affected during the last epidemic of 1995. The virus had invaded rural areas down to a population density level as low as 45 inhabitants/km². Consequently, the population at risk, which was formerly restricted to urban and peri-urban areas, had suddenly increased from 1 485 000 to 7 350 000 living in 1 343 000 households.

During 1 January–31 December 1998, 16 215 cases of DHF were recorded in Phnom Penh’s two children’s hospitals and the 19 paediatric wards of hospitals in the provinces affected by the outbreak. The cumulative number of deaths among these cases was 475. The overall case fatality rate (CFR) of 2.9% in 1998 was lower than the CFR of 4.7% in the previous outbreak in 1995. However, the CFR in certain provincial hospitals was still very high (10%).
The control operations undertaken by the National Dengue Control Programme (NDCP) included Temephos application, ULV spray supported by a strong IEC-based programme across sectors and donors. DHF treatment and management facilities were upgraded at several Cambodian Children’s Hospitals and wards with WHO support.

**Keywords:** DF/DHF, *Aedes aegypti*, case fatality rate, Temephos, Red Cross, treatment and management of DHF, Cambodia.

**Introduction**

The first case of dengue haemorrhagic fever (DHF) occurred in Cambodia in 1962. Since 1980, when 347 cases and 20 deaths were reported, DHF has become a major public health problem in the country. DHF appears to be cyclic in Cambodia as in other countries in South-East Asia with large outbreaks occurring every two to three years\(^1\). The last major outbreak occurred in 1995 when 10 199 cases, with 424 deaths, were reported in children, giving a CFR of 4.7%.

During 1998, strangely enough, a large number of DHF cases originating in Phnom Pehn were diagnosed during the dry season, a phenomenon recorded for the first time. The number of cases during the 1995 dry-season outbreak were ten times less, thus indicating an impending epidemic of high proportion in the coming rainy season.

**Dry-season morbidity – 1998**

Beginning January 1998, a total of 247 cases of DHF were recorded in Phnom Pehn. An immediate epidemic response operation was able to quell the locally-limited outbreak by March 1998 when the cases receded to 80 and 90 respectively during the dry months of April and May, thereby showing a reduction of about 55%.

**Wet-season morbidity and mortality (1998)**

With the onset of rains in June 1998, a sharp increase in DHF cases occurred nationwide when the number of cases rose from 807 in May to 4627 in July. These ultimately touched a figure of 16 216 cases with 475 deaths by December with a case fatality rate of
2.9%. However, in certain provincial hospitals CFR was as high as 10%. The monthly DHF figures for the period 1995–1998 are given in Fig.1. The epidemic spread to 18 of the 22 provinces of Cambodia as shown in Fig.2.

Measures taken for epidemic control

The following steps were taken in chronological order for the containment of DHF during the dry season:

- Control of the DHF outbreak in Phnom Penh (February);
- Fund-raising and implementation of epidemic preparedness measures to counter the nationwide DHF epidemic (March–May);
- Containment of the expected nationwide DHF epidemic (June–November).

Figure 1. Monthly DHF cases – 1995–1998

Figure 2. Distribution of DHF/DSS cases – July 98
Concurrently, the following epidemic preparedness measures were also undertaken:

- Development of a nationwide DHF action plan;
- Fund-raising;
- Strengthening of the clinical case reporting system;
- Setting up of a virological and immunological DHF disease confirmation network, including the differential diagnosis of murine typhus, enterovirus 71 and Japanese encephalitis;
- Refresher training for staff in hospitals and hygiene stations in preventive measures in dengue-prone provinces;
- Production of TV and radio messages, reproduction of leaflets and other IEC materials;
- Building-up stocks of larvicides, drugs, and equipment, and their distribution;
- Proactive distribution of Abate based on entomological surveillance;
- Peri-focal space spraying around early cases in conjunction with quarter-wide Abate distribution; and
- Large-scale distribution of Abate and space spraying when the epidemic threshold level was reached.

Elements of “crisis management” of DHF control included fund raising appeal by Centre national de maliariologie (CNM), coordinated by WHO, stepping in of International Federation of the Red Cross (IRFC) in a big way in emergency procurement of ULV spraying generators/ pick up trucks, requisite quantities of larvicide, distribution in packages of 20 grams (correct dose for a standard Cambodian jar of 200 litres). Magnitude of the task can be gauged by the fact that 56 tonnes of Temephos was distributed within three months to 560,000 households, protecting an estimated 2.6 million inhabitants. Most importantly, the newly set up geographical information system (GIS) for dengue control proved very helpful in determining the priority areas for control interventions. (Figure 3). National NGOs, the Cambodian Red Cross, the media and other sectors actively participated in the control of an epidemic which had
engulfed nearly 82 percent of the country.

Clinical management of DHF cases

The problems connected with the clinical management of DHF cases were addressed by despatching three teams of paediatricians to the provincial hospitals which had the highest case-load and CFR (Battambang, Takeo and Kg. Cham). In addition, medical equipment such as haematocrit centrifuges and paediatric blood pressure meters were distributed to children’s wards. Sufficient quantities of IV fluids, plasma expanders and perfusion sets to treat 10 000 children were sent through the courtesy of IFRC. These drugs were distributed directly by the Red Cross to the paediatric wards and hospitals which were in greatest need, according to a Joint MoH/WHO contingency plan. The most crowded of the Phnom Penh children’s hospitals, Kantha Bopha, was upgraded, with WHO support, by adding 100 additional dengue beds. The IFRC provided disease test kits (HIV/HBV/HCV/VDRL) to these hospitals, which performed up to 70 blood transfusions each day.

Figure 3. Vector control activities Temephos distribution

Province boundaries
District boundaries
Temephos distribution by Jul 1998
Temephos distribution by September 1998
Temephos distribution by October
To sum up, it may be said, that there are options available in emergencies like the present DHF outbreak, like IFRC ever ready to step in for such large scale emergent and responsive actions.

Long-term strategy for DHF control

On the basis of the lessons learnt, a long-term strategy for DHF control should have the following elements:

(1) The early warning system of the national dengue control programme should be strengthened for early detection and rapid response to prevent DHF outbreaks.

(2) Preventive actions against vectors *(Aedes aegypti)* should comprise of regular treatment of jars with temephos through social marketing which costs only 7 US cents per household.

(3) There is a need for designing a ‘jar lid’ which will permit harvesting of rain water but will not permit *Aedes* breeding.

(4) Some supportive legislation/law enforcement might contribute to its general acceptance.

Reference

The Dengue Epidemic of 1998 in The Philippines

By

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Abstract

The year 1998 will be remembered as the Philippine’s worst year for dengue epidemics and, paradoxically, its best year in offsetting what potentially could have been a catastrophic health debacle. The lessons learned from this experience are so different from the established principles to lingering hypotheses on the appropriate actions in the prevention and control of dengue. For these reasons, the future of dengue prevention and control is its past and its present.

Keywords: Dengue haemorrhagic fever, epidemic, dengue warning signals, dengue operations centre, dengue treatment guidelines.

Introduction

Dengue fever (DF) and dengue haemorrhagic fever (DHF) are endemic in the Philippines\(^1\), where the reporting is not as ideal as in some other countries because DF and DHF are not reported separately. Heightened public awareness during peaks or epidemics has improved the reporting, which is greatly influenced by a physician’s suspicion rather than the true identification of DF or DHF.

Laboratory surveillance aimed at identifying the circulating viral serotype(s) is limited to two laboratories, each using a different
method: viral cultures at the Research Institute for Tropical Medicine (RITM), the national reference laboratory of the Department of Health (DH), and the polymerase chain reaction technique at the St. Luke’s Medical Centre in Manila, which is one of the leading and biggest medical centres in the country. Some laboratories make use of rapid serologic tests, which have remained imperfect.

Available data strongly suggests a 3–4-year cycle corresponding to the reappearance of new circulating viral serotype(s) and the occurrence of minor epidemics with each re-introduction of a new circulating serotype(s). DEN–2 and DEN–3 were reported in 1988–1991; DEN–1 in 1992–1995; DEN–2 and DEN–3 in 1995–1997; and DEN–2, DEN–3 and DEN–4 in 1997.

Beginning 1988, each cycle brought about significant increases in the morbidity, sometimes resulting in isolated epidemics in vulnerable communities \(^2\)\(^3\). After the 1996 epidemic, it was predicted that another upsurge would be observed between 1999–2001, possibly aggravated by the effects of the El Nino phenomenon.

**Dengue warning signal**

Since 1996, the DH has adapted a hierarchy of dengue warning signals (Table 1) which are aimed at alarming communities so that appropriate interventions can be taken in a timely manner. These include a dengue alert, dengue hot spot, and dengue epidemic.

The dengue alert is advised just before the start of the rainy season when DHF cases begin to peak. All 14 regions in the country have a Regional Epidemiology and Surveillance Unit (RESU) which reports through the National Epidemic Sentinel Surveillance System (NESSS) of the Field Epidemiology Training Programme (FETP) in the Central DH in Manila. Weekly trends are analysed for the occurrence of epidemics. Dengue hot spots are defined as areas (from barangays to villages to large cities) where a clustering of cases is observed for at least two consecutive weeks. Where cases have been reported to exceed the expected range, including a significant reporting of deaths, a dengue epidemic is declared. Interventions are targeted for each of these warning signals. These include, but are not
limited to, environmental and chemical vector control as well as the establishment of dengue treatment centres.

Table 1. Intervention Strategies for Dengue Warnings

<table>
<thead>
<tr>
<th>Intervention strategies</th>
<th>Dengue alert*</th>
<th>Dengue hot spot**</th>
<th>Dengue epidemic***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source reduction</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Tri-media campaign (IEC)</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Social mobilization and inter-agency collaboration</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Surveillance</td>
<td>+++</td>
<td>+++</td>
<td>+++</td>
</tr>
<tr>
<td>Treatment centres</td>
<td>Not recomended</td>
<td>Not recomended</td>
<td>Not recomended</td>
</tr>
<tr>
<td>Fogging/spraying</td>
<td>Not recomended</td>
<td>Not recomended</td>
<td>Not recomended</td>
</tr>
<tr>
<td>International assistance</td>
<td>Not recomended</td>
<td>Not recomended</td>
<td>May be considered</td>
</tr>
</tbody>
</table>

The plus (+) signs indicate the relative importance of the strategy in relation to the warning level.

* When increase in the number of cases is anticipated just before the onset of the peak months; based on past trends and future projections.

** When there is a clustering of cases in a defined geographical area for at least two consecutive weeks.

*** When the number of cases/deaths exceed the usual expectation.

Dengue situation in 1998

In 1998, epidemics began to appear in March in Aurora province in southern Luzon and in June in Iloilo province in the western Visayas (Table 2).

Table 2. Dengue fever, cases and deaths, by region, Philippines, January 1 – December 22, 1998

<table>
<thead>
<tr>
<th>Region</th>
<th>Cases</th>
<th>Deaths</th>
<th>CFR(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCR</td>
<td>6108</td>
<td>56</td>
<td>1</td>
</tr>
<tr>
<td>CAR</td>
<td>596</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>I</td>
<td>321</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>1802</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>3516</td>
<td>42</td>
<td>1</td>
</tr>
<tr>
<td>IV</td>
<td>2387</td>
<td>54</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>2067</td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td>VI</td>
<td>2311</td>
<td>83</td>
<td>4</td>
</tr>
<tr>
<td>VII</td>
<td>3219</td>
<td>95</td>
<td>3</td>
</tr>
<tr>
<td>VIII</td>
<td>3393</td>
<td>55</td>
<td>2</td>
</tr>
<tr>
<td>IX</td>
<td>1641</td>
<td>5</td>
<td>0.3</td>
</tr>
<tr>
<td>X</td>
<td>1868</td>
<td>18</td>
<td>1</td>
</tr>
<tr>
<td>XI</td>
<td>1050</td>
<td>1</td>
<td>0.1</td>
</tr>
<tr>
<td>XII</td>
<td>747</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>ARMM</td>
<td>346</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>CARAGA</td>
<td>427</td>
<td>6</td>
<td>1</td>
</tr>
</tbody>
</table>
By the year’s end, nearly 32 000 cases and 500 deaths were reported from all regions; the overall case fatality rate was 2%. Seventy per cent of those affected were children less than 15 years of age (Table 3).

The number of cases reported monthly in 1998 exceeded the expected range of cases reported monthly in the previous three-year period of 1995–1997 (Fig. 1).

This was the single highest occurrence of dengue in the country’s history. Heightened public awareness became a double-edged sword, one side contributing to allay the fear of the disease, the other resulting in fever phobia that resulted in overcrowded hospitals and unnecessary depletion of blood supply in some areas.

**Table 3.** Dengue cases and deaths by age-group (N=5992) San Lazaro Hospital, January 1 – December 19, 1998

<table>
<thead>
<tr>
<th>Age-group (years)</th>
<th>Cases</th>
<th>Deaths</th>
<th>Case fatality rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–4</td>
<td>1150</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>5–9</td>
<td>1806</td>
<td>46</td>
<td>2.6</td>
</tr>
<tr>
<td>10–14</td>
<td>1154</td>
<td>16</td>
<td>1.4</td>
</tr>
<tr>
<td>15–19</td>
<td>911</td>
<td>5</td>
<td>0.5</td>
</tr>
<tr>
<td>20–24</td>
<td>591</td>
<td>7</td>
<td>1.2</td>
</tr>
<tr>
<td>25–29</td>
<td>193</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30–34</td>
<td>78</td>
<td>1</td>
<td>1.3</td>
</tr>
<tr>
<td>35–39</td>
<td>52</td>
<td>2</td>
<td>3.8</td>
</tr>
<tr>
<td>40–44</td>
<td>18</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>45 and above</td>
<td>39</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>5992</td>
<td>103</td>
<td>2</td>
</tr>
</tbody>
</table>

The DH was poised to declare a national emergency but instead allayed fears by its repeated assurances to the public that the reported epidemics were isolated episodes which had since been adequately controlled. Eventually, the public heeded this advice. The DH worked with the media, which managed to closely monitor the situation, and delivered timely and relevant information to the public.

**Dengue operations centres**

A Dengue Operations Centre (DOC) was established in the Central DH as well as in areas with widespread epidemics. The DOC was a quick-response central hub aimed at coordinating all intervention activities based on available surveillance data. The DOC had four main components: 1) prevention and control;
2) information and education campaigns; 3) case diagnosis and treatment; and 4) surveillance. Each of these components had defined goals and objectives as well as established roles and functions. All activities were supervised by a DOC manager. By synchronizing these activities, optimal utilization of existing resources prevented unnecessary costs and impractical methods of dengue control (e.g. widespread fumigation campaigns) which local government officials resorted to as a means of offsetting the public’s sometimes angry reactions.

**Prevention and control strategies**

Source reduction as the most effective means of controlling the epidemic was of utmost priority. There was a conscious undertaking in affected communities to eliminate mosquito breeding sites. The challenge was to convince unaffected communities to take action in destroying breeding sites before cases occurred in their areas. It will be some time before we can assess the impact of the effectiveness of such strategies.
Consensus of national working group on the management of DF and DHF

A standard for the diagnosis and treatment of DF and DHF was a necessary step to prevent unnecessary hospitalizations and deaths. The recommendations for treatment were formulated by the newly-organized National Working Group Consensus on the treatment of DF and DHF and were aimed at making all existing treatment recommendations applicable to the vast majority of the patients in most parts of the country in various health settings, to foster physician confidence, and to enable others to institute simple, initial interventions. The DH, through San Lazaro Hospital, convened this working group of experts from the government, medical societies, the academia, the private sector and WHO in September 1998.

The treatment recommendations were derived from published and unpublished data on dengue diagnosis and treatment and also from the consensus of the working group members when no definitive data was available. The intent of the Working Group was for the guidelines to be flexible and not to supplant the clinical judgement of experienced health care providers. It was recognized that these guidelines would need to be modified as new information became available.

The new guidelines were disseminated through site-visit conferences, regional seminars and short course training workshops on hands-on patient care. An integrated approach was adapted in which modules on prevention and control, information and education campaigns, and surveillance were incorporated in these courses and workshops. Also, participating agencies (hospitals or rural health units) were supervised in the establishment of dengue fast lanes which were aimed at the early recognition of the illness and successful DHF treatment at home.

The National Voluntary Blood Programme assisted in providing guidelines for the proper use and provision of blood and blood components. This restored the confidence of health providers in distant health facilities and referrals to health facilities in urban centres were
The Dengue Epidemic of 1998 in the Philippines

Gradually minimized. Such guidelines appeared to have been a factor in saving many lives.

Lessons learned

The 1998 dengue epidemic in the Philippines was the worst in the country’s history but it underscored the bold and sometimes innovative approaches that were made to contain the epidemic. It is true that there are no existing formulae for success but sound judgement based on relevant information always saves the day. That “communities determine their own death rate” is one observation we do not wish to prove again.

References

Rapid Dengue Diagnosis: A Prospective Study using a Commercial Rapid Test*

By

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Abstract

Several commercial test kits are available for the diagnosis of dengue infection but their sensitivity and specificity have not been evaluated extensively. Those that have been evaluated has been done retrospectively using stored serum samples. The PanBio Dengue

* A similar evaluation of rapid ICT (PanBio, Windsor, Australia) has been undertaken in 1998 by Proell et al.(12) (Department of Infectious Diseases and Tropical Medicine, University – Munich, Germany) in comparison to standard immunofluorescence antibody test (IFAT). In all, 25 serum samples for patients returning from dengue endemic areas, presenting clinical signs or recent histories compatible to DF, 30 patients with diarrhoea, and five persons with no history of illness who had been vaccinated against other flaviviruses were evaluated. The results showed that by IFAT, all the 25 patients with clinically suspected DF developed at least a diagnostic four-fold rise of IgG antibody titres against dengue virus and/or had significant IgM titres. In rapid ICT 23 patients (92%) with compatible symptoms had detectable IgM or seroconversion of IgG antibodies. All samples taken from the diarrhoea or the vaccination group were negative for IgM and IgG. The results showed a sensitivity of 92% and specificity of 100% for ICT when compared to IFAT. –Editor
Immunochromatographic Rapid Test takes five minutes to detect IgM and IgG using a capture assay format, and it is used in this study to assess its usefulness in a clinical setting. Of the 185 patients with severe dengue infection, there was an overall agreement of 91.35% cases based on IgM detection alone and 96.76% if combined with HAI results. Three clinical cases were cited in which the rapid test helped in patient management. However, serological results must be interpreted with caution, taking into consideration clinical and other laboratory findings.

**Keywords:** DF/DHF, Rapid test kit, case studies, Malaysia.

### Introduction

The laboratory diagnosis of dengue infection is based on three approaches, namely, virus isolation, serology, and polymerase chain reaction (PCR). Although there has been significant improvement in the isolation of the virus by using mosquitoes and mosquito cell cultures, it is still a relatively slow and technically laborious process. PCR has become more prevalent as evident from the number of publications in recent years (1,2,3,4), but its wide usage in a routine laboratory is difficult to perceive in developing countries.

In his review of the serological diagnosis of DF/DHF, Gubler(5) has mentioned that enzyme-linked immunosorbent assay (ELISA) for the detection of dengue IgM and IgG is widely used in dengue diagnosis and may replace other existing methods, including the standard haemagglutination inhibition (HI). A number of commercial test kits to detect dengue IgM and IgG are available but the accuracy of most of these tests has not been validated.

The WHO collaborating centre for DF/DHF in Malaysia (Department of Medical Microbiology, University of Malaya, Kuala Lumpur) provides facilities for the diagnosis of dengue for cases in the University Hospital as well as in private hospitals, using a variety of techniques including the haemagglutination inhibition test, in-house dengue IgM ELISA, virus isolation in mosquito cell cultures and reverse transcriptase polymerase chain reaction. The selection of a test or a combination of tests depends on the severity of the clinical disease and other economic factors. Generally, the in-house dengue IgM ELISA which we
developed in 1987\(^\text{6}\) is used routinely for all dengue infections and additional tests such as HI and virus isolation are applied to severe cases. PCR is used sparingly on selected specimens because of its cost.

A preliminary evaluation of the PanBio Dengue Immunochromatographic Rapid Test (RT) by this WHO Collaborating Centre using stored specimens has been published\(^\text{7}\). Data from similar studies conducted in other countries supported our preliminary findings that the assay has a sensitivity of 98% and a specificity of greater than 90\%\(^\text{8,9,10}\). However, to assess its usefulness in a clinical setting, we undertook a prospective study using the rapid test on patients with severe dengue infection.

**Materials and methods**

The study period was between 2 January 1997 and 30 July 1998. Tests were conducted on 185 severe dengue infections, 177 of which were DHF/DSS, seven with CNS manifestation and one with congenital infection. The ages of the patients ranged from 30 days to 64 years, with 10 patients under one year of age. The male:female ratio was 1.45:1.

**PanBio Rapid Test (RT):** The PanBio Dengue Immunochromatographic Rapid Test was used in this study. In this test, IgM and IgG were both determined using a capture assay format.

**Haemagglutination–inhibition (HI) test:** HI antibodies against DEN–2 and DEN–3 were determined as described \(^\text{11}\), except that the assay was modified to a microtitre format.

**In–house dengue IgM enzyme–linked immunosorbent assay (ELISA):** The in–house IgM ELISA was performed as described previously. Briefly, 96 well microplates coated with rabbit anti–human IgM were reacted with test sera. The antigen used was DEN–2, prepared in suckling mouse brains and the monoclonal antibody (WRAIR–2 3H5) to DEN–2 was used for detection of bound antigen.

**Clinical cases**

**Case 1**

A 13–year–old Chinese boy had one week of high fever, headache and
generalized body ache. Gum bleeding was noted on the day of admission. He had previously suffered from dengue shock syndrome (DSS) at the age of 8 years. Physical examination revealed a comfortable child with a pulse rate of 70 per minute and blood pressure 120/70 mmHg. He had palatal petechiae and small cervical and axillary lymph nodes. A soft liver was palpable. His haemoglobin was 108 gm/L, total white count 2.3 x 10^9/L platelet count 136 x 10^9/L. A differential diagnosis of dengue fever was considered. Dengue IgM was not detected and Widal Weil Felix was not significant. He was afebrile the next day and was discharged well. Although the clinical picture resembled that of dengue fever, the PanBio rapid test was negative and the final diagnosis was non-dengue viral fever. An early discharge was possible when his temperature returned to normal.

Case 2
A 16-month-old Malay girl who was previously well was admitted after five days of fever, lethargy and deteriorating levels of consciousness. Physical examination showed a starry eyed, dazed child who responded only to pain. Her respiratory rate was 36/minute, heart rate 110/min, blood pressure 90/65 mmHg, and she was warm and well perfused. There was no neck stiffness. A maculopapular rash present over the palms and soles and ulcers were noted on the tongue and buccal mucosa. The liver was 3 cm palpable below the subcostal margin. She was hypotonic but tendon reflexes were increased and plantar reflexes were upgoing. Soon after admission she had a generalized seizure which was stopped with intravenous diazepam. After this her breathing was laboured and her peripheral pulses became weak. She was intubated and ventilated with positive pressure. Her perfusion improved after 20 ml per kg of 0.9% normal saline intravenously. The diagnosis of enterovirus encephalitis was made – haemoglobin 130 gm/L, haematocrit 0.37, total white count 11.9 x 10^9/L, platelet count 21 x 10^9/L. Serum sodium was 125 mmol/L, potassium 5.4 mmol/L, urea 12.2 mmol/L, and creatinine 55 umol/L. PanBio IgM and IgG was positive. The diagnosis was revised to DSS and the patient was managed accordingly. She had a full
recovery. At discharge, the haematocrit was 0.24.

Case 3

A 5-year-old Indonesian boy was admitted on the fifth day of fever with drowsiness. He had been unresponsive eight hours before admission. On arrival in the Emergency Department he had generalized tonic clonic seizures lasting 10 minutes. Subsequently, he opened his eyes to call, but made no verbal responses. He was cold and clammy, heart rate was 190 per minute, and capillary refill was more than five seconds. Blood pressure was 75/23 mmHg and his temperature was 38.6°C. His breathing was laboured at 90 per minute with good air entry bilaterally. The liver was 4 cm enlarged. His pupils were 5 mm and reacted sluggishly to light. No fundal haemorrhages were noted. His muscle tone was increased and plantar responses were equivocal. He was given 30 ml per kg of 0.9% normal saline. His perfusion improved but his neurologic status remained the same. He was electively intubated and ventilated for cerebral protection. His haemoglobin was 171 gm/L, haematocrit 0.52, platelet count 37 x 10^9 and total white count 22.9 x 10^9/L. PanBio IgM and IgG was positive. A diagnosis of DSS with encephalopathy was made. The patient received blood transfusion but died of gastrointestinal haemorrhage 24 hours after admission.

Result

Of the 185 specimens confirmed to be positive serologically, 159 were IgM positive by both the ELISA and RT and 10 were negative by both tests, an agreement of 91.3% (Table 1). There were two specimens which were ELISA positive but RT negative and both these specimens had HI titre of 20 and 36.
of the 13 specimens which were RT positive but ELISA negative, 10 had HI titres of 1:1280 or greater, confirming a diagnosis of secondary dengue infection. If these 10 RT and HI positive specimens were added to the concordance result above, the agreement would be 96.76%.

Of the 185 specimens, only 180 were sufficient to perform the HI test for comparison with RT IgG results. Of the 180 specimens tested, 113 were positive by both RT IgG and HI (titre 1:1280 or greater) and 36 were negative by both tests, giving an agreement of 82.78% (Table 2). Twenty specimens were HI-positive but RT-negative, of which 15 were the results of primary infection and therefore not detected by RT, and 5 had HI titre of >1:1280. There were 11 specimens which were RT IgG-positive and HI inconclusive, and eight of these were also RT IgM-positive.

Conclusion
A rapid immunochromatographic test which takes only five minutes to perform has been evaluated in several retrospective studies in the last two years. The assay, besides being rapid, has the advantage of simplicity, does not require sophisticated equipment, and can be decentralized to peripheral hospitals and even clinics. Evaluation of this test by a number of laboratories showed the assay has a sensitivity of 98% and a specificity of >90% in the diagnosis of dengue infection. The sensitivity of the RT is further borne out by the result of this prospective study.

The three clinical cases presented exemplify how the test can be used to support clinical decision and patient management. In Case 1, the clinical course of the disease was very similar to DEN. However, when the rapid test was negative for dengue IgM, the patient was given oral fluids and was discharged as soon as he was well. If dengue had been suspected, the patient would have been kept for an additional 24–48 hours when fever would have subsided. This led to more cost-effective patient management.

In Case 2, the child was admitted during the peak of an enterovirus 71 encephalomyelitis outbreak, and since the patient had hand–foot–mouth lesions and CNS signs and symptoms, it was thought that this was due to EV71 infection. However, the rapid test for dengue was positive and the
haematocrit findings of more than 50% haemoconcentration confirmed a diagnosis of DSS and the patient was managed accordingly.

In Case 3, the clinical picture at presentation was that of encephalopathy with circulatory shock. A rapid diagnosis of dengue was useful in guiding fluid therapy and early blood transfusion. The patient’s suboptimal clinical response to crystalloid infusion suggested occult haemorrhage and early blood transfusion was necessary to reverse the shock. Unfortunately, this patient succumbed to gastrointestinal haemorrhage.

Despite the apparent usefulness of rapid diagnosis using this commercial kit, it must be remembered that the serological result should be interpreted with caution in acute dengue infection. The absence of IgM and IgG in the first week of illness may indicate a false negative and a repeat sample should be requested. Serological results must be interpreted alongside clinical history and other laboratory results.

**Acknowledgements**

We would like to thank Panbio Pty Ltd., Brisbane, Australia, for the Rapid Immunochromatographic Test Kits. This project is funded partially by a grant from the Ministry of Science, Technology and Environment, Malaysia (IRPA 06–02–03–0306) and by the World Health Organization, Western Pacific Regional Office, Manila, Philippines.

**References**

Treatment of Dengue Haemorrhagic Fever at Children’s Hospital No. 1, Ho Chi Minh City, Viet Nam, 1991–1996

By
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**Pasteur Institute, Ho Chi Minh City, Viet Nam.

Abstract
The clinical manifestation, diagnosis, and treatment of dengue haemorrhagic fever (DHF) presented in this communication were based on the data collected at the DHF Department, Children’s Hospital No. 1, Ho Chi Minh City, Viet Nam, during 1991–1996. The principal cause of death in most cases was circulatory failure (hypovolemic shock), thus making an early diagnosis, recognizing the impending shock and treating patients correctly were the best measures to save the life of DHF-afflicted children. At the DHF Department where a great number of DHF patients were seen each year, with these measures the case fatality rate (CFR) of dengue shock syndrome (DSS) was brought down significantly from 12.5% in 1975 to 0.5% in 1993–1995.

Keywords: DF/DHF, hypovolemic shock, case fatality rate, Viet Nam.

Introduction
Dengue haemorrhagic fever (DHF) has been a major public health problem in Viet Nam over the past three decades. DHF outbreaks have occurred every 3–4 years with the highest number being recorded in 1987 – 83,905 cases and 904 deaths\(^1\). The disease has been currently ranked as one of the leading causes of death in children in southern Viet Nam. Although the case fatality rate (CFR) of dengue shock syndrome (DSS) has been reduced significantly during the past ten years, it still remains rather high in some areas of the country. In this paper, some of the experiences in the diagnosis and management of DHF/DSS at the DHF Department, Children’s Hospital No.1, Ho Chi Minh City, have been summarized which can help in further reducing the CFR.

**Material and methods**

Material and data were summarized from clinical records at the DHF Department, Children’s Hospital No.1, Ho Chi Minh City, from 1991 to 1996. DHF has been clinically diagnosed based on the WHO criteria of 1986\(^2\) and confirmed by virus isolation, serological tests, and, recently, by RT/PCR.

**Results and discussion**

A total of 19,215 DHF patients were admitted in the Children’s Hospital. The severity of the disease, age-wise distribution, seasonality, and the clinical profile is summed up as follows:

(i) **Severity of the disease**

The distribution of DHF patients according to the disease severity between 1991 and 1996 is shown in Table 1.

The number of patients increased significantly in the rainy season from July to November, with the peak increase in August and September in which there were many severe cases with DSS (Fig. 1).

(ii) **Age-wise distribution**

Fig. 2 shows the age-wise distribution of DHF patients in 1996. A majority of the DHF cases occurred in children in the age-groups 5–9 years (37.4%) and 10–14 years (28.7%). Among these patients, there were 348 infants (8.6%) which was an interesting group for our study.

(iii) **Clinical manifestations of**
DHF/DSS

(a) Fever was a major manifestation of DHF and persisted for 2–7 days in almost all cases; a few exceptional cases with fever lasted for more than seven days.

(b) The next major manifestation of DHF was haemorrhagic tendency. Spontaneous bleeding in patients older than one-year-old such as petechiae, epistaxis, gum bleeding, gastrointestinal (GI) bleeding (melaena, haematemesis) were seen in 57%, 14%, 7%, and 12% of the patients, respectively.

Table 1. Distribution of DHF patients according to the disease severity at DHF Department, 1991–1996

<table>
<thead>
<tr>
<th>Year</th>
<th>Grade I (%)</th>
<th>Grade II (%)</th>
<th>Grade III (%)</th>
<th>Grade IV (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>385 (10.3)</td>
<td>2330 (62.7)</td>
<td>969 (26)</td>
<td>29 (0.7)</td>
<td>3713</td>
</tr>
<tr>
<td>1992</td>
<td>333 (8.6)</td>
<td>2580 (60)</td>
<td>1356 (31)</td>
<td>18 (0.4)</td>
<td>4287</td>
</tr>
<tr>
<td>1993</td>
<td>289 (14.3)</td>
<td>1382 (68.7)</td>
<td>513 (25.5)</td>
<td>26 (1.3)</td>
<td>2010</td>
</tr>
<tr>
<td>1994</td>
<td>288 (15.4)</td>
<td>1095 (58.6)</td>
<td>399 (21.3)</td>
<td>85 (4.7)</td>
<td>1867</td>
</tr>
<tr>
<td>1995</td>
<td>362 (10.8)</td>
<td>1973 (59.3)</td>
<td>875 (26.2)</td>
<td>117 (3.5)</td>
<td>3327</td>
</tr>
<tr>
<td>1996</td>
<td>351 (8.7)</td>
<td>2288 (57)</td>
<td>1193 (29.7)</td>
<td>179 (4.4)</td>
<td>4011</td>
</tr>
</tbody>
</table>

Figure 1. Monthly distribution of DSS cases in patients admitted to DHF Department, 1991–1996

Figure 2. Age distribution of DHF patients in 1996
(c) Hepatomegaly was another major clinical manifestation in DHF. It was observed in 86% of the patients of grade I and II and 98% of DSS cases. In 1995, we studied the impact of DHF on the liver function by measuring the transaminase level of 45 DHF patients confirmed by virus isolation and serodiagnosis. Abnormal levels of AST and ALT were seen in 97.7% and 37.7% of these patients, respectively. The fact that the level of AST was higher than that of ALT and the elevation of transaminase was mild to moderate in most cases (<5-fold greater than the normal upper limit for AST and ALT) showed that the involvement of the liver was mild to moderate in most DHF cases. Two patients with dengue encephalopathy (1992) and one patient with encephalopathy, who died of massive gastrointestinal haemorrhage (1995), had unusually high transaminase levels as a sign of acute liver failure(3). Acute liver failure in DHF leading to encephalopathy and death were also reported by other authors(4,5,6). In 1996, we made a post-mortem hepatic biopsy of a boy 10-month-old who had died of DSS (grade III) with massive GI bleeding and encephalopathy. His hepatic tissue specimen was later tested at the Pasteur Institute, Paris. The result revealed hepatic necrosis, steatosis, presence of councilman bodies, and PCR in situ-detected serotype DEN-3.

(d) DSS, which is hypovolemic shock, is the main cause leading to death in DHF if it is not recognized early and is not treated correctly. DSS occurred in 23–39% of all the DHF patients. Most cases (85%) went into shock on the 4th or 5th day of the disease when there was a fall in the body temperature.

(e) As mentioned above, infants were an interesting group for this study. In 1996, we had reported the clinical manifestations of 47 infants confirmed by haemaglutination–inhibition test. High fever (100%), subcutaneous petechiae (97%) and hepatomegaly (100%) were the most common signs. GI bleeding was observed in 8.5% of these cases. The rate of
DSS was rather high (53.1%) (Table 2). All these infants suffered from primary dengue infection. 

**Table 2.** The observed frequency of clinical manifestations of DHF in 47 infants during 1996

<table>
<thead>
<tr>
<th>Clinical manifestations</th>
<th>Number of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>47</td>
<td>100</td>
</tr>
<tr>
<td>Subcutaneous petechiae</td>
<td>46</td>
<td>97</td>
</tr>
<tr>
<td>GI bleeding</td>
<td>4</td>
<td>8.5</td>
</tr>
<tr>
<td>Hepatomegaly</td>
<td>47</td>
<td>100</td>
</tr>
<tr>
<td>Shock</td>
<td>25</td>
<td>53.1</td>
</tr>
<tr>
<td>Cough</td>
<td>20</td>
<td>42.4</td>
</tr>
<tr>
<td>Rhinitis</td>
<td>20</td>
<td>42.5</td>
</tr>
<tr>
<td>Vomiting</td>
<td>9</td>
<td>19.1</td>
</tr>
<tr>
<td>Diarrhoea</td>
<td>2</td>
<td>4.2</td>
</tr>
<tr>
<td>Neurologic sign (convulsion, coma)</td>
<td>2</td>
<td>4.2</td>
</tr>
</tbody>
</table>

**Diagnosis of DHF/DSS**

The diagnosis of DHF was done on the above-mentioned clinical manifestations and two laboratory findings: haemoconcentration (more than 20% increase in hematocrit) and thrombocytopenia (<100,000/mm). The clinical diagnosis was confirmed by virus isolation, serological tests, and RT/PCR.

**Virus isolation**

In 1995, 105 blood specimens were sent to the Arbovirus Laboratory, Pasteur Institute, Ho Chi Minh City, for virus isolation. Positive results were obtained in 28 cases (27%) which consisted of 19 strains of DEN-1, 7 strains of DEN-2, and 2 strains of DEN-3. According to the results of virus isolation at the Institute during 1987–1996, DEN-2 was the predominant serotype (90.5%) during the largest outbreak in 1987. Thereafter, the serotypes have been changing. DEN-1 was introduced in 1990 and continued to spread during 1991–1996 with a peak in 1993 (62.5%). During this period a low-level transmission of DEN-3 was also documented.

**Serological test**

In 1991, 216 DHF patients were studied, of whom 87% were found positive by the haemagglutination inhibition (HI) test. The IgM capture ELISA (MAC-ELISA) had a high sensitivity, specificity and positive...
predictive value\(^{(10)}\) (76, 82.1 and 96.6\% respectively) (Table 3).

**RT/PCR**

This test has been recently introduced as a quick, sensitive and specific method to diagnose DHF\(^{(11)}\). In 1994–1995, we collaborated with the Pasteur Institute in Paris to study the use of RT/PCR to detect the dengue virus genome from the blood of 80 DHF patients to compare with the results of virus isolation by using the c6/36 cells. These results are given in Table 4.

**Table 3.** Sensitivity, specificity and positive predictive value of MAC–ELISA for DHF diagnosis as observed during 1991

<table>
<thead>
<tr>
<th>MAC–ELISA (Acute blood samples)</th>
<th>DHF Grade I, II (n=83)</th>
<th>DHF Grade III, IV (n = 133)</th>
<th>Total (n = 216)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (%)</td>
<td>71.6</td>
<td>78.1</td>
<td>76</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>78.2</td>
<td>100</td>
<td>82.1</td>
</tr>
<tr>
<td>Positive predictive value (%)</td>
<td>89.5</td>
<td>100</td>
<td>96.6</td>
</tr>
</tbody>
</table>

**Table 4.** Results of virus isolation and RT/PCR, 1994–1995

<table>
<thead>
<tr>
<th>Diagnostic method</th>
<th>1994</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virus isolation</td>
<td>5 DEN–2/35 (14%)</td>
<td>4 DEN–2/45 (8%)</td>
</tr>
<tr>
<td>RT/PCR</td>
<td>15 DEN–2/35 (43%)</td>
<td>10 DEN–2/45 (22.2%)</td>
</tr>
</tbody>
</table>

**Case management of DHF/DSS**

The principle of case management of DHF depends on the severity of the disease.

**DHF grade I, II**

When antipyretic was indicated, acetaminophen 10–15 mg/kg every 4–6 hrs was given; the child was sponged with lukewarm water to reduce high fever.

The child was encouraged to eat his favourite foods and drink fruit juices and Oresol solution as much as possible.

The mother was advised how to take care of her child. The mother was advised to take her child to the hospital immediately when any signs and symptoms of impending shock such as excessive vomiting, vomiting with blood, blood in the stool,
abdominal pain, cold extremities, etc., appeared.

For cases which had excessive vomiting, hepatomegaly and abdominal tenderness, high haemoconcentration, gum bleeding or GI bleeding Ringer's Lactate or Dextrose 5% in normal saline 5–10 ml/kg/hr was given. The rate of infusion was slowed down gradually.

**DSS grade III**

For DSS grade III, 20 ml/kg/hr of Ringer's Lactate was given. After the child had come out of shock, we slowed down the rate of infusion gradually. If the child was still in shock, we changed to colloid solution (gelatin, dextran 40,70).

**DSS grade IV**

Ringer's Lactate or colloid solution was given at the loading dose of 20 ml/kg/15 minutes to bring the child out of shock as quickly as possible. The major advantage of gelatin solution is its minimal effect on coagulation and bleeding due to its dilution effect and the relatively low incidence of hypersensitivity reaction as compared with blood. It was for the first time that modified fluid gelatin (MFG) was used to treat 40 patients of DSS in 1992. For 18 of those patients, MFG was used as the only fluid substitute to add to Ringer's Lactate. In the remaining 22 patients with symptoms of recurrent shock, dextran was added to MFG and no anaphylactic reactions were noticed. Thus, MFG can be used as the first-choice substitute for plasma in the treatment of DSS following the administration of Ringer's Lactate. If profound or recurrent shock still persisted after the infusion of MFG, the use of dextran was recommended(12).

Vital signs were monitored every 15–30 minutes until the period of shock had disappeared. Hematocrit was examined every 4–6 hrs. In case of prolonged shock, the central venous pressure (CVP) was measured to guide the therapy. Correction of electrolyte and the acid-base balance was also important. Blood infusion was indicated for cases with significant bleeding.

The case fatality rate of DSS at the DHF Department during 1986–1996 is given in Fig. 3. Treatment with the above-mentioned regimen resulted in a significant decline in the CFR of DSS from 12.5% in 1975 to 5.4% in 1986.
and then to 0.5% in 1993. Since then the same trend is being maintained.

In southern Viet Nam, the CFR of DSS cases in some provincial hospitals are still rather high, ranging between 2% and 6.4%. In Malaysia, Lucy C.S. Lum et al. (1997)\(^{(13)}\) reported that the CFR of 48 patients with DSS was 10.4%. In Indonesia, Sumar P. Soedarmo (1997)\(^{(14)}\) has reported an average mortality rate of 3.6% to 5.2% among the hospitalized DHF patients at the Department of Child Health, Dr Cipto Mangunkusumo Hospital, Jakarta. Therefore, we feel that the reduction in the CFR of the DSS cases at our Department was encouraging.

### Conclusion

DHF has been a major public health problem affecting children in southern Viet Nam. In order to reduce the fatality rate of this disease, making early diagnosis, recognizing the impending shock, and treating the DSS correctly should be recommended to all medical staff everywhere.

### References