Trop. Med., 35 (4), 209－215, December, 1993

Dengue and Dengue Haemorrhagic Fever in French Polynesia - Current Situation

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Abstract: All four dengue virus serotypes have occurred in French Polynesia. The first epidemic of dengue on Tahiti island of known serotype (dengue 1) occurred in 1944 as part of the Pacific-wide spread of the disease during World War II. The next outbreak of dengue took place in 1964 and was the result of the introduction of dengue 3 virus. With the increase in air travel by humans, dengue has occurred as successive epidemics, especially between 1969 and 1979 with each epidemic involving a different serotype. Each time, the epidemic serotype replaced the unique endemic serotype that had been transmitted during the preceeding inter-epidemic period: dengue type 3 in 1969, dengue 2 in 1971, dengue 1 in 1975-1976 and dengue 4 in 1979. With the exception of the dengue 2 epidemic, during which severe haemorrhagic cases and several deaths were observed on Tahiti on 1971, cases of dengue haemorrhagic fever/dengue shock syndrome (DHF/DSS) were not common. Following a long inter-epidemic period involving a low transmission of dengue 4, two back-to-back epidemics of dengue 1 and dengue 3 took place during 1988-1989. Of great interest was the occurrence of DHF/DSS in the latter epidemic (11 fatalities) while mildness characterized the former. Surveillance of both epidemics involved clinically and laboratory-based systems. Public health control measures were instituted. These viruses were throughoutly spread in the Pacific region with varying degrees of disease severity. Molecular epidemiology studies provided new information on geographic distribution, origin, evolution and strain variation among dengue viruses.

Key words: Dengue, epidemiology, surveillance, current situation, French Polynesia

HISTORICAL BACKGROUND

Dengue viruses are the only mosquito-bone flaviviruses involved in French Polynesia. All four dengue virus serotype have occurred in epidemic form during the last 50 years. The first epidemic with known serotype was due to dengue 1 in 1944 as part of the Pacific-wide pandemic (Rosen, 1958). The reappearance of the disease paralleled with the advent of jet air travel and the increased urbanization of French Polynesia in the 1960's.

Thus, a succession of epidemics occurred at short intervals: dengue 3 in 1964-1965 and 1969, dengue 1 in 1971, dengue 1 in 1975-1976, dengue 4 in 1979 (Laigret *et al.*, 1967; Saugrain *et al.*, 1970; Moreau *et al.*, 1973; Kaueffer *et al.*, 1976; Parc *et al.*, 1981a and 1981b). From 1980 to 1988, transmission of dengue continued at a very low level (Chungue *et al.*, 1989).

The Recent Epidemics

Two successive epidemics took place recently: dengue 1 in late December 1988 and dengue 3 in August 1989. The trend and the surveillance of these epidemics have been described in details elsewhere (Chungue *et al.*, 1992; Chungue *et al.*, 1990). Briefly, surveillance of both epidemics was followed by (i) weekly reporting of the number of patients diagnosed by sentinel physicians (a case of dengue was defined as a patient who presented with a sudden onset of febrile illness with any of 2 of the following symptoms: headache, myalgia, arthralgia, rash or haemorrhagic manifestations), (ii) the weekly number of requests for laboratory confirmation, (iii) the number of virologically and/or serologically confirmed cases (virus isolation on C6/36 cell cultures and detection of dengue specific IgM by MAC-ELISA). Epidemic control involved adulticidal measures and larvicidal source reduction for both epidemics. Information messages were delivered on vector control, on minimizing risk of infection, and on the procedure to be adopted in the event of illness.

Dengue 1 epidemic: December 1988-June 1989: In December 1988, dengue 1 virus was isolated from a 15 years old child who presented with a dengue-like illness. The patient lived in a suburb of Papeete. Subsequent survey showed that 2 family contacts harboured IgM anti dengue antibodies. Epidemic transmission was recognized in late December. Although control efforts were initiated few days after, the epidemic developed explosively and reached its peak in Tahiti island in February (Fig. 1). The serological attack rate was about 44%, 4 months after the onset of the epidemic. Among 6,034 cases reported by sentinel physicians, 60.3% were<20 years old. The illness was classical dengue. No fatality or case of dengue haemorrhagic/dengue shock syndrome (DHF/DSS) was reported. Of 1,752 documented cases, 701 (40%) were confirmed in laboratory. The frequency of the various clinical symptoms among these confirmed cases are shown in Table 1. Overall, laboratory diagnosis of 4,836 patients resulted in 41% of confirmed cases (Table 2). Primary infection was predominant. Virus isolation from mosquitoes provided evidence that dengue 1 was transmitted by *Aedes aegypti*.

Dengue 3 epidemic: August 1989-May 1989: While the dengue 1 epidemic was declining, dengue 3 was detected for the first time since 1969, in Bora Bora island, in mid April. Overall 3 strains were identified between April and May. One of them was isolated in the neighbouring island of Raiatea. A few cases were detected between June

and July in Tahiti. Although French Polynesia was at high risk of epidemic dengue 3, transmission was rather low until September (Fig. 1). The peak was reached in October -November. The epidemic stretched out on several months, and epidemic transmission lasted about 8 months. As of March 1990, 6,330 cases were reported by sentinel physicians. Of 11 fatal cases, 10 occurred in children under 15 years old. Of 838 documented cases recorded between August to February among ambulatory patients, 266 (31.7%) were laboratory confirmed. The frequency of clinical symptoms was shown in Table 1. The major features of dengue 3 epidemic were its high frequency of cases with minor haemorr-

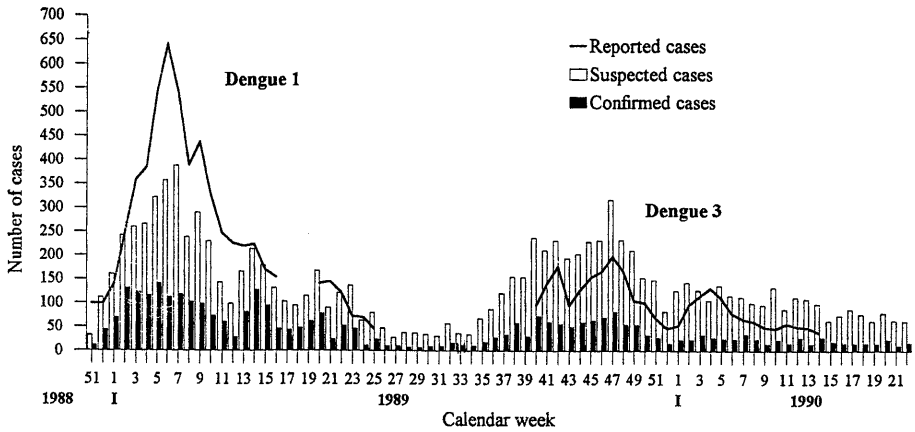

Fig. 1. Dengue 1 epidemic (Dec. 1988-June 1989) and Dengue 3 epidemic (Aug. 1989-May 1990): Weekly distribution of dengue cases.

Table 1. Frequency of clinical symptoms observed in laboratory confirmed dengue patients

Clinical symptoms	Frequency (%) among laboratory confirmed patients	
	Dengue 1 n=701	Dengue 3 n=266
Fever/Headache/Myalgia	98.3	88.7
Adenopathies	22.9	15.4
Macular rash	20.9	15.7
Digestive signs (vomiting, nausea, diarrhoea)	19.2	34.6
Taste alterations	16.1	19.9
Prurit/Paresthesia	9.9	13.9
Heamorrhagic signs (epistaxis, petechia, purpura)	5.1	14.3
Hepatalgia/Hepatomegaly	5.0	12.8
Papular rash	4.7	9.7

Table 2. Virological and serological results from suspected cases submitted to laboratory confirmation of dengue diagnosis

Epidemic	No. of suspected cases	No. of positive		Total
		Virus isolation	Mac-ELISA	Positives
Dengue 1 (Dec. 88-Jun. 89)	4,836	1,198 (24.7%)	778 (16.0%)	1,976 (40.8%)
Dengue 3 (Aug. 89-May 90)	5,583	589 (10.5%)	768 (13.7%)	1,357 (24.3%)

hagic signs (14.3%) and the occurrence of cases severe enough to require hospitalization. Furthermore, cases with thrombocytopenia were high (26.3%). Among 232 laboratory confirmed children hospitalized in the public civilian hospital of Papeete, 55.6% presented with hemorrhage, 30.1% with DSS, 63% with thrombocytopenia, 46% with SGOT > 99 IU, 55% with hepatomegaly, 40 % with a neurologic disorder (Glaziou *et al.*, 1992). Among 178 individuals for whom the type of HI antibody response was determined, 39% had a primary infection. DSS was observed in both primary and secondary infection (41% vs 30%). Of 5,583 patients subjected to laboratory confirmation, 24% were confirmed (Table 2). This confirmation rate was low compared to that observed during dengue 1 epidemic (41%). Whether this lower rate was due to clinical overdiagnosis in a context of more severe manifestations related to dengue 3 or to the lower frequency of virus isolation since most of cases are secondary infections, is difficult to assess. Furthermore, serological diagnosis was mostly performed on single serum specimen and level of IgM is known to be lower in secondary infections. However, the serological attack rate was estimated at about 49% in December 1989 (Chungue *et al.*, 1992).

The study of these epidemics emphasize the need of both clinically and laboratory -based system for an adequate surveillance of epidemic, and for early warning system.

Current Situation

Recent advances in dengue diagnosis: Urgent diagnosis by RT-PCR in case of suspicion of DHF/DSS was made available since we described a rapid, simple and efficient single-tube procedure for dengue viral RNA extraction from small amount of serum (10μl). Recovery of RNA is based on the lysing and nuclease-inactivating properties of guanidinium thiocyanate in the presence of silica. The RT/PCR can be completed within 5 hours starting from the RNA extraction to agarose gel electrophoresis. (Chungue *et al.*, 1993).

Surveillance: Since 1988, the surveillance of dengue fever is based on the monitoring of reported cases by physicians, of suspected cases (cases in whom a laboratory confirmation of the diagnosis is seeked) and of confirmed cases (virologically and/or

serologically positive). Moreover, because of its immediate availability, the weekly incidence of suspected cases has been shown to be a valuable indicator of dengue activity together with the confirmation rate (Chan *et al.*, 1977 ; Chungue *et al.*, 1991). A sudden rise in laboratory requests urged to a survey among sentinel physicians.

The nature of the virus serotpype is continuously monitored. In order to trace movement of dengue viruses over time and geography, molecular techniques were used in recent studies (Deubel *et al.*, 1992). Evidence that the recent epidemics were due to the introduction of a new variant rather than the re-emergence of early viruses through silent transmission was shown (Chungue *et al.*, in press). For instance, the recent Polynesian epidemic dengue 3 virus strain clustered in a genotypic group that comprised recent strains from Indonesia and New Caledonia. Analysis of dengue 1 strains showed relatedness between recent Polynesia Strain (1988) and isolate from a Caribbean strain (unpublished data). Identification of virus strain regarding their genotypic grouping might of interest for a better understanding of the epidemiology of dengue viruses, and for vaccine development.

In view of continued entomological survey and vector control our effort are concentrated to the international airport area during interepidemic period while a community -based vector control is promoted by the public health service, especially in Tahiti.

Situation in 1993 : Table 3 summarizes the yearly distribution of dengue cases from 1988 to 1993. Since its introduction dengue 3 is continuously transmitted (Fig. 2) with sporadic severe cases (2 fatalities in 1992). In view of risk of epidemic dengue, when considering the distance from the more recent known serotypes epidemics and the subsequent sizeable population born after them, French Polynesia is at high risk for dengue 2 epidemic, and at a lesser extent, for dengue 4 epidemic.

Table 3. Yearly distribution of dengue cases in French Polynesia, 1988-1993

Year	Number of cases			
	Reported	Suspected	Confirmed	Hospitalized*
1988	262 (197)[a]	512 (111)[a]	78 (44)[a]	1[a]
1989	12,397	7,976	2,883	197
1990	3,605	3,050	618	204
1991	578	1,198	159	45
1992	609	1,451	248	74
1993	248[b]	504[b]	87[b]	--
Total	17,699	14,691	4,073	521

[a] : number reported on weeks 51 and 52 of 1988 ; [b] : up to June 1993
-- : not available
* : from public civilian hospital

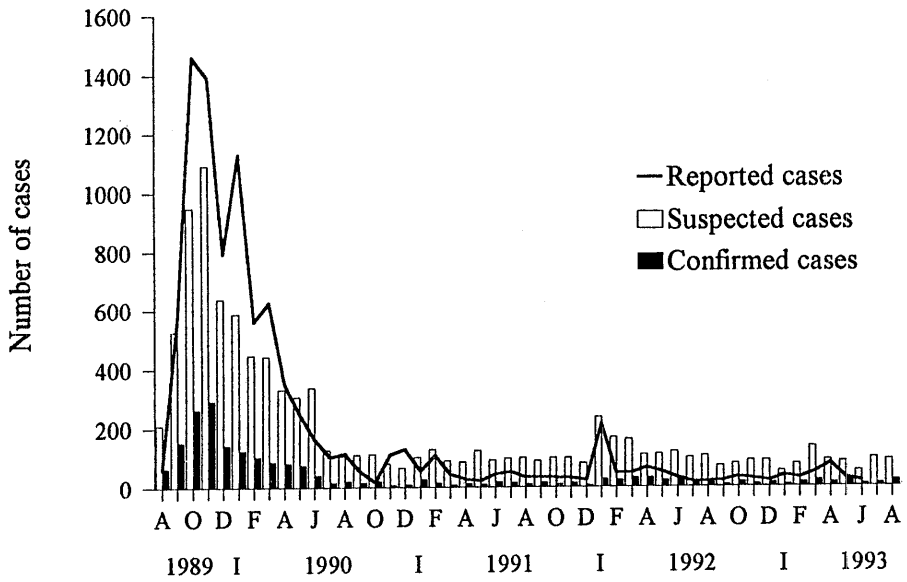

Fig. 2. Current situation: Monthly distribution of dengue 3 cases, 1989-1993.

In conclusion, improved laboratory-based surveillance, genetic investigation of circulating viruses, disease surveillance, health education programme, vector control programme are adopted for an efficient surveillance system.

ACKNOWLEDGMENTS

This work was supported by the Government of French Polynesia and the Ministére de la Recherche et de l'Enseignement Supérieur (decision 87-L-0557), France. We thank M. Lefévre, C, Roche, O. Cassar, M. Gay and the clinical laboratory, N. Maruhi, D. Chéou and all the sentinel physicians and the hospital physicians for their assistance.

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