Epidemiol. Infect. (1997), **119**, 277–279. Printed in the United Kingdom

SHORT PAPER

Changing prevalence of antibody to Dengue virus in paired sera in the two years following an epidemic in Taiwan

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(*Accepted 25 April 1997*)

SUMMARY

To elucidate the epidemic pattern of a dengue outbreak in southern Taiwan during 1987–8, antibody prevalence rates were investigated in paired sera collected in both epidemic (Kaohsiung) and non-epidemic (Tainan) areas. In Kaohsiung, the IgG prevalence rate in 1989 was significantly higher (9·23%) than that in 1988 (5·29%) suggesting that new infections continuously appeared after the first bleeding in 1988. Although IgG antibody persisted in most infected blood samples, waning of antibody occurred in 6/355 (1·69%) of Kaohsiung sera. IgM antibody was only detected in Kaohsiung sera, suggesting that Tainan was not involved in the outbreak. Because IgG antibody was present in some samples collected in 1989, but not in 1988, from the non-epidemic area, sporadic infections perhaps occurred. Additionally, 4/355 (1·13%) of Kaohsiung sera showed IgM antibody positive in both 1988 and 1989. In turn, secondary infections may have occurred because of circulation of multiple-types of the virus. The possible relationship between low levels of dengue haemorrhagic fever (DHF) and the loss of IgG antibodies over time is also discussed.

Dengue fever has been a serious health problem in many tropical countries [1, 2]. An epidemic occurred in southern Taiwan, primarily in Kaohsiung, during 1987–8 [3]. This outbreak caused 1387 reported cases in the area around Kaohsiung city in later 1987 and 10420 cases in 1988 [3, 4]. Kaohsiung, located in southern part of Taiwan, is one of the important local centres for international trade and travel. Thus, the risk of dengue being introduced into Kaohsiung is high. To evaluate the case distribution and spread of the 1987–8 epidemic, we investigated antibody prevalence rates of paired sera consecutively collected in 1988–9.

Population-based specimens were collected during May–June 1988 and March–May 1989 from two cities, Kaohsiung the major focus of this epidemic and Tainan, 50 km north from Kaohsiung, non-epidemic.

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In total, 378 and 401 serum samples were collected from Kaohsiung in 1988 and 1989, respectively, and 149 and 200 were obtained from Tainan during the same periods. From those individuals bled in both years, there were available 355 paired sera from Kaohsiung and 146 pairs from Tainan.

The ELISA test for IgM/IgG antibody detection (MAC/GAC-ELISA) used in this study has been described previously [5]. Previous experience indicates its sensitivity and value in differentiating between dengue and Japanese encephalitis virus which may currently circulate in Taiwan [6]. Positive control sera were obtained from patients who were diagnosed as dengue infection both clinically and serologically. Statistical analysis was carried out using Chi square test as 5% significant level.

The results show that the prevalence rate of IgG antibodies in 1989 (37/401; 9·23%) was significantly

Table 1. *Antibody to dengue virus in southern Taiwan in 1988–9 in epidemic* (*Kaohsiung*) *and non-epidemic* (*Tainan*) *cities*

Positive/negative combinations	IgG		IgM	
	Kaohsiung	Tainan	Kaohsiung	Tainan
1988(+); 1989(+)	13/355 (3·66%)	3/146 (2·05%)	4/355 (1·13%)	0
1988(−); 1989(+)	23/355 (6·48%)	1/146 (0·69%)	4/355 (1·13%)	0
1988(+); 1989(−)	6/355 (1·69%)	0	1/355 (0·28%)	0
1988(−); 1989(−)	313/355 (88·17%)	142/146 (97·26%)	346/355 (97·46%)	146/146 (100%)

higher than that of 1988 (20/378; 5·29%) (χ^2, $P < 0·05$). In contrast, the difference was not significant between 1988 (4/149; 2·68%) and 1989 (5/200; 2·50%) in Tainan. IgM antibodies were detected in both 1988 and 1989 in Kaohsiung. However, they were not detected in either year in Tainan.

Since there was a significant elevation of the IgG prevalence rate in Kaohsiung in 1989, it suggested that new infections by the dengue virus continuously occurred after the first bleeding in 1988. This was also suggested by the appearance of IgM antibodies in both 1988 and 1989. Other work has shown that dengue virus consistently circulated in Kaohsiung because seven indigenous incident cases were confirmed in 1989 [7]. It was believed that most infections were subclinical because clinically reported cases were much lower than the serological data [8].

Although IgG antibody was present in most serum samples, significant waning of this antibody was observed in 6/355 (1·69%) of Kaohsiung sera (Table 1). This is a surprising find because IgG antibodies are believed to be lifelong [9] although lower sensitivity of GAC–ELISA may contribute to these viewings. In addition, 23/355 (6·48%) of sera from Kaohsiung had IgG antibody only in 1989 but not in 1988, indicating all positive sera in 1989 were from individuals infected after the first bleeding. The same situation also occurred in Tainan even though only one case was detected in this investigation. Because GAC–ELISA has a lower sensitivity, usually detecting IgG samples with HI titre of > 80 (data not shown), suggesting prevalence rates of IgG antibodies could have been higher than the present data.

Of 355 blood pairs from Kaohsiung, 13 (3·66%) had IgG antibodies in both years. For IgM antibody detection, 4 pairs (1·13%) were positive in both 1988 and 1989, 4 pairs only in 1989 and 1 pair (0·28%) only in 1988. Of Tainan sera, 3 out of 146 pairs (2·05%) had IgG antibodies in both years and 1 pair (0·69%) only in 1989. IgM antibody was not detected in any blood sample collected in Tainan in either year. Of 19 individuals from Kaohsiung positive in 1988, 13 (68%) remained positive in 1989 (Table 1).

Our results show that Tainan was probably not involved in the 1987–8 outbreak. However, sporadic infections may have occurred in this so-called non-epidemic area because 1 of 146 blood pairs had IgG antibody only in 1989.

It was noted that 4/355 (1·13%) of blood samples from Kaohsiung were IgM antibody positive in both 1988 and 1989. This suggests that some individuals may have been infected by heterologous types of dengue virus although type 1 was dominant among viruses isolated during the outbreak. It is thought that dengue haemorrhagic fever or dengue shock syndrome (DHF/DSS) may occur due to the heterologous types of infection [10, 11]. However, few cases of DHF have been seen although 11 cases of typical DHF have finally appeared in 1994 [12, 13]. It is still not clear why the DHF cases were so limited in past intermittent outbreaks, and antibody decline in part may account for this phenomenon. Possibly, the IgG titre dropped to a level too low to play a role in antibody-dependent enhancement [10] after a certain period. As a result, the occurrence of DHF was limited.

ACKNOWLEDGEMENT

We thank Dr Duane J. Gubler, Centers for Disease Control and Prevention, USA for kindly providing some of reagents. This work was in part supported by a grant from the National Science Council, R.O.C. (NSC82-0412-B037-067).

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