SEROPREVALENCE OF CYTOMEGALOVIRUS INFECTION IN CHILDREN

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Abstract. A hospital-based cross-sectional survey was conducted in Bhumibol Adulyadej Hospital between February and May 1997 to study the seroprevalence of cytomegalovirus (CMV) infection in hospitalized infants. Of 83 cases, 46 were boys and 37 girls, with the mean age of 11.87 months. The seroprevalence of CMV infection was 80.95, 61.90, 80.95 and 70.00% in infants at the age range of 0-6, 6-12, 12-18 and 18-24 months respectively. After excluding infants below 6 months of age, the seroprevalence rate was 70.97%. The family income of infants with positive CMV antibody was significantly lower than that of infants with negative results. There were no statistical correlations between seroconversion and age, sex, number of children in family and place of child rearing.

INTRODUCTION

Cytomegalovirus (CMV) is a ubiquitous agent that commonly infects individuals of all ages, from all part of the world, and from all socioeconomic and cultural backgrounds (Demmler, 1992). Seroepidemiologic studies have show that infection with CMV is very common and is usually inapparent (Demmler, 1992). However it can cause serious sequelae in seronegative or immunocompromised recipients such as newborn infants and transplant patients (Adler *et al*, 1983; Glen, 1981). The prevalence of CMV-IgG antibody is influenced by many factors, including age, geographic location, cultural and socioeconomic status, and the child rearing practices of the group (Demmler, 1992). In developing countries, 80% of children acquire CMV by the age of 3, and almost all persons have been infected by adulthood (Ashraf *et al*, 1985; Wang and Evans 1986; Alford *et al*, 1987). In Thailand, there were two large studies on CMV antibody in blood donors, indicating seroposotive rate of 97.3 and 93.3% (Charoen *et al*, 1992; Urwijitaroon *et al*, 1992). However, there were limited data of CMV antibody in Thai children (Tantivanich and Prasertsiriroje, 1981). So we conduct this research in order to study sero-prevalence of CMV infection in a group of Thai children.

MATERIALS AND METHODS

Study subjects

The study was carried out in Bhumibol Adulyadej Hospital and the research is a hospital-based cross-sectional survey. The eligible study subjects were children aged 15 years or younger admitted between February and May 1997.

Those who were diagnosed of primary immunodeficiency, HIV infection, including perinatally HIV-exposed infants, cancers, chronic hepatic or renal diseases, and those who received blood or blood component in the past three months, and who were admitted in nursery or intensive care unit, were excluded.

Sample size estimation

The present study was designed to have an acceptable error of 80% to detect statistically significant differences at the 5% level. A pilot study of 25 cases in each four age groups; 0-3, 3-6, 6-9 and 9-12 years of age, sampled from 287 cases revealed seroprevalence rate of 72, 92, 80 and 100% respectively. In age group 0-3 years, the least seroprevalence rate, 72% of these children would have positive test for CMV antibody. Thus, on the basis of this information, the sample size of 77.78 was calculated. We selected children under two years since several factors might facilitate in influencing the outcome of patients after two years of age. Twenty-five cases in each for age groups; 0-6, 6-12, 12-18 and 18-24 months of sampling age with a total of 100 cases were sampled in stratified method.

Data collection

Information was obtained by interviewing all subjects' parents with structured questionnaires. These included children's age and sex, parental

income, number of children in the family and place of child rearing. Two milliliters of blood was obtained and the serum was tested for CMV antibody.

Detection of anti-CMV IgG+IgM

All sera were determined for the presence of anti-CMV IgG and IgM using commercial kit of Enzyngnost Anti-CMV IgG/IgM perchased through Behringwerke AG, Germany. The assay is an enzyme immunoassay based on the indirect test principle. In brief, CMV antibodies (IgG and IgM) in sera bind to the CMV antigen-coated surface of the ELISA-well plate. After that, the immune complexes react to anti-human IgG+IgM/peroxidase conjugate. Then, the subsequent enzymatic reaction using tetramethyl benzidine dihydrochloride (TMB) as substrate is developed. The results were measured as the optical density at 450 nm using spectrophotometer. The positive and negative results were analysed as recommendation of the company.

Data analysis

Demographic data were presented by using mean, range and percentage. Categorized variables were analyzed by chi-square- test and noncategorized variables were analyzed by Student's *t* test. The level of significance was set at the alpha = 0.05.

RESULTS

A total of 100 cases was enrolled. Seventeen cases were excluded due to incompleteness of the data. Of 83 cases, 46 were boys and 37 were girls, with the mean age of 11.87 months and were categorized into 62 cases (73.49%) of positive CMV antibodies and 22 cases (26.51%) of negative results. The mean age and sex of the study patients, family income and number of children in the family were not significantly different between the two groups. The infants with positive CMV antibodies were reared at home significantly more than those with negative results (Table 1).

There were 21 infants in age groups of 0-6, 6-12, 12-18 months and 20 infants in age group of 18-24 months. Seroconversion of CMV was 80.95, 61.90, 80.95 and 70.00% in infants in the age range of 0-6, 6-12, 12-18 and 18-24 months respectively. There were no significant differences of seroconversion rate among these four age groups (Table 2).

After excluding infants below 6 months of age, the seroconversion rate was 70.97%. The family income of infants with positive CMV antibody was significantly lower than that of infants with negative results. There were no statistical correlations between seroconversion and age, sex, number of children in family and place of child rearing (Table 3).

DISCUSSION

Studies from two developing countries showed that CMV seroconversion in infants from Saudi Arabia was 69% (Ashraf *et al*, 1985) while the seroconversion in Chinese infants was up to 100% (Wang, 1986). The only study on prevalence of CMV antibodies among Thai children revealed that seroconversion rate in infants was 60.7% (Tantivanich and Prasertsiriroje, 1981). This study showed a CMV seroconversion of 70.97% in children below two years of age. These two studies from Thailand could be compared even though they were performed in two different hospitals since both are government hospitals, situated in Bangkok, taking care of children from low to mid-socioeconomic families. The seroconversion rate in our study was expected to be decreased due to improvement in the standard of living at present comparing to that in 1981 (Demmler, 1992). This can be explained by the fact that there were several factors influencing the CMV seroconversion rate among Thai infants. We need a more nationwide longitudinal study in order to obtain data for considering the use of CMV vaccines in the future.

The findings that infants with positive antibody tests tended to live in families with lower incomes, confirmed the previous studies (Demmler, 1992). However, there were no statistical correlations between seroconversion and other factors, including age, sex, number of children in family and place of child rearing. Increasing sample size may lead to statistical differences of related factors between groups of positive and negative seroconversion. Performing a longitudinal study to determine the exact seroconversion age or a crossection analytic study along with controlling confounders to study

Table 1

Age, sex, income of family, number of children in family, place of child rearing of study patients, classified by CMV seroconversion.

Characteristics	CMV positive (n = 61)	CMV negative (n = 22)	p-value
1. Age (months)			
mean ± standard deviation	11.39 ± 7.70	13.18 ± 7.12	0.6536
2. Boys : girls	31 : 30	15 : 7	0.1605
3. Income of family (baht)	11,083.61	15,431.82	0.1161
mean ± standard deviation	± 10,629.76	±12,440.62	
4. Number of children (person)			
mean ± standard deviation	1.84 ± 0.84	2 ± 0.93	0.5463
5. Place of child rearing			
home : others	57 : 4	17 : 5	0.0346

Table 2

CMV seroconversion of study patients, classified by age group.

Age group	CMV positive		CMV negative	
(months)	Number	%	Number	%
0–<6	17	80.95	4	19.05
6–<12	13	61.90	8	38.10
12–<18	17	80.95	4	19.05
18–24	14	70.00	6	30.00
Total	61	73.49	22	26.51

p-value = 0.7564

Table 3

Age, sex, income of family, number of children in family, place of child rearing of study patients age 6-24 months, classified by CMV seroconversion.

Characteristics	CMV positive (n = 44)	CMV negative (n = 18)	p-value
1. Age (months)			
mean ± standard deviation	15.07 ± 5.63	14.94 ± 6.66	0.9390
2. Boys : girls	25 : 19	11 : 7	0.7585
3. Income of family (baht)	10,206.82	17,138.89	0.0267
mean ± standard deviation	± 10,007.32	±13,139.31	
4. Number of children (person)			
mean ± standard deviation	1.80 ± 0.82	2.06 ± 1.00	0.2933
5. Place of child rearing			
home : others	40 : 4	13 : 5	0.0600

the possible risk factors may yield more reliable and accurate data.

In conclusion, the seroconversion rate of CMV infection in 6- to 24-month-old infants who were admitted in Bhumibol Adulyadej Hospital, Bangkok, Thailand was 70.97%. The family income of infants with positive CMV tests was significantly lower than that of infants with negative results.

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