EXPERIENCES IN THE DIAGNOSIS AND PREVENTION OF MENTAL RETARDATION OF ENVIRONMENTAL ORIGIN IN SINGAPORE

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SUMMARY

Consideration is given to the recognition and prevention of various types of mental retardation due to hazards of environmental origin. Observations are presented on congenital syphilis, congenital toxoplasmosis, congenital rubella, Singapore kernicterus, Japanese B encephalitis, and tuberculous meningitis. Appropriate preventive measures have resulted in a significant reduction in Singapore of these conditions, and hence in a decreased frequency of environmentally determined mental retardation and related disabilities.

INTRODUCTION

Singapore, with a current population of 2.2 million, is an example of an Asian country where the problems of mental retardation are receiving increasing attention. In an earlier presentation [1] consideration was given to genetic aspects of the subject. The present text reviews some environmentally determined types of retardation; considerable reduction of which has been achieved in Singapore by means of appropriate preventive measures.

CONGENITAL SYPHILIS

Congenital syphilis, often resulting in mental retardation because of cerebral involvement, is still found in Singapore children as shown in Table I. However, as the Table indicates, there has been a steady decline in the number of cases in the 10 years since 1969. This can be attributed to routine blood testing for syphilis of all pregnant women attending antenatal clinics, and usually of mothers (80 percent of them in 1978) coming to infant welfare clinics. With early detection, effective treatment with penicillin can be undertaken with consequent reduction in the frequency of congenitally affected children.

TABLE I
CHILDREN FOUND TO HAVE CONGENITAL SYPHILIS IN SINGAPORE, 1969 - 1978

Years	No. of affected children
1969 - 70	100
1971 - 72	72
1973 - 74	62
1975 - 76	36
1977 - 78	32
Total	302

CONGENITAL TOXOPLASMOSIS

Congenital toxoplasmosis, due to maternal infection with the protozoal parasite, *Toxoplasma gondii,* is a well-established cause of mental retardation. However, few cases have been identified in Singapore, and only 3 instances were found by this author [2] in a survey of 1848 retarded children. A gravely affected infant is shown in Fig. 1; the child is severely retarded, microcephalic and

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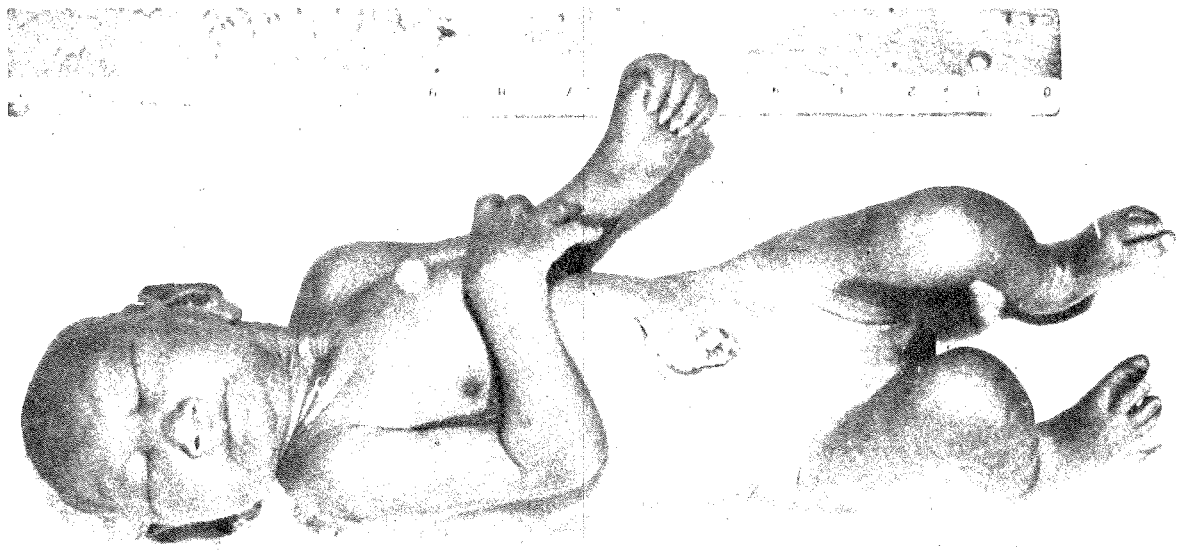

Fig. 1 Child with congenital toxoplasmosis.

blind with spasticity of the limbs.

CONGENITAL RUBELLA

Rubella infection of the mother in the early months of pregnancy has been an important cause of mental retardation, microcephaly, cataract, hearing deficit and congenital heart disease. The first few cases of rubella syndrome in Singapore were reported by this author. [3]

Rubella epidemics continue to occur in Singapore. A widespread epidemic which began in November, 1977, among National Servicemen spread to the civilian population and became amplified in close contact groups such as school children and factory workers. From 3000 specimens received for rubella serology, 173 persons were found to have active infection and 77 of these were pregnant women. Furthermore, examination of the immune status of 497 women showed that 52 percent of them had no antibody. Thus, despite widespread epidemics, there remains a large pool of non-immune females in the reproductive age group.

Although rubella immunization is offered to young women, many do not avail themselves of this. Because of the hazards to unborn children, immunization of susceptible groups is an essential requirement.

SINGAPORE KERNICTERUS

Neonatal jaundice due to glucose-6-phosphate dehydrogenase (G6PD) deficiency is common in South-East Asia. [4] Environmental factors responsible for triggering off haemolysis due to deficiency of the enzyme, G6PD, are herbs taken traditionally by pregnant and nursing mothers and, secondly, exposure to naphthalene balls in the newborn. An extract of dried roots, called *Coptis Chinensis,* is given to infants after boiling it with water and honey. Wong showed that infants with G6PD deficiency, when given *Coptis Chinensis,* had a significantly increased incidence of severe jaundice. Furthermore, the newborn baby in Singapore is often exposed to napthalene because of the local custom of putting moth-balls in stored clothes. Each moth-ball contains 5 grams of naphthalene which is absorbed via the skin or inhaled and taken to the liver for conjugation. α-naphthol produces haemolysis of normal erythrocytes and Wong also found that G6PD-deficient infants are prone to develop severe jaundice when exposed to naphthalene.

About 90 percent of Singapore babies are delivered at major government maternity hospitals and all newborns have their blood screened for G6PD (Table II). If deficient, all siblings, parents and grand-parents also are screened for this enzyme. Deficient infants are kept in the maternity unit for 3 weeks to prevent exposure to trigger

factors. If neonatal jaundice occurs, a timely exchange transfusion is done to prevent mental retardation. Also, with the help of the Ministry of Health, an intensive medical and lay public education campaign has been organised to draw attention to the dangers of herbs and naphthalene.

As a result of these endeavours, there has been a gradual fall of deaths from kernicterus from 37 in 1963 to one per year between 1975 and 1979 (Fig. 2), and mental retardation in kernicterus survivors has been almost totally eliminated.

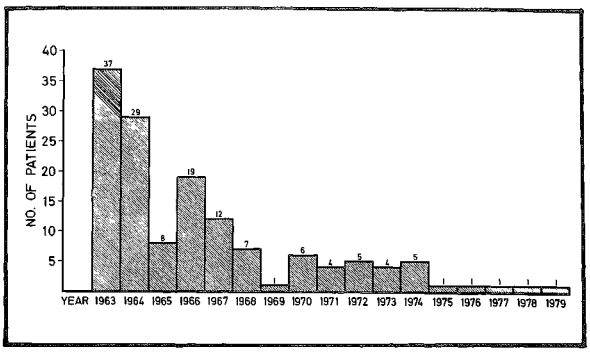

Fig. 2 Kernicterus deaths in University of Singapore Department of Paediatrics, 1963 - 1979.

JAPANESE B ENCEPHALITIS

Japanese B encephalitis exists in South-East Asia and Far East Asia. Man gets infected from a mosquito which has bitten a pig which has the virus. Hale and Lee [5] showed that 70 percent of the population above 12 years of age in Malaya, Borneo and Singapore had neutralising antibodies to the Japanese B encephalitis virus.

Fig. 3 illustrates a typical case of Japanese B encephalitis. The child was admitted to hospital with a history of acute onset of fever, malaise and drowsiness for 3 days with convulsions on the day of admission. About 70 percent of such children were admitted with varying degrees of coma, neck rigidity, pupillary changes, abnormalities of conjugate eye movements, facial palsies and abnormal purposeless movements due to basal ganglia involvement. [6] The children remained unconscious for 8 to 9 days with the temperature falling by lysis on the 8th or 9th day. Common sequalae include mental retardation, behaviour disorders mainly in the form of temper tantrums, emotional imbalance and hallucinations. [7]

The majority of children with Japanese B encephalitis come from rural areas, probably because of the greater abundance there of mosquitoes *(Culex tritaenorrhyncus)* and of the animal reservoir, namely pigs. In countries where Japanese B encephalitis is endemic (for example, Japan), epidemics in human population are preceded by a peaking of viraemia in pigs; seasonal peaking is due to seasonal breeding of pigs.

TABLE II
SCREENING FOR G6PD IN NEWBORNS, 1965 - 1979

Ethnic groups	Years	1965 - 67	1968 - 70	1971 - 73	1974 - 76	1977 - 79	Totals 1965 - 79
Chinese	No. tested	85093	73288	67298	62380	55962	344021
	No. (and %) G6PD defic.	1403 (1.6%)	1161 (1.6%)	1161 (1.7%)	1018 (1.6%)	1066 (1.9%)	5809 (1.7%)
Malay	No. tested	13057	10817	8681	8494	9432	50481
	No. (and %) G6PD defic.	263 (2.0%)	174 (1.6%)	155 (1.8%)	134 (1.6%)	171 (1.8%)	897 (1.8%)
Indian	No. tested	5806	4156	2501	1604	2254	16321
	No. (and %) G6PD defic.	15 (0.3%)	15 (0.4%)	14 (0.6%)	10 (0.6%)	13 (0.6%)	67 (0.4%)
Other	No. tested	2416	2192	1789	2050	1193	9640
	No. (and %) G6PD defic.	17 (0.7%)	8 (0.4%)	10 (0.6%)	9 (0.4%)	9 (0.8%)	53 (0.5%)
All	No. tested	106372	90453	80269	74528	68841	420463
	No. (and %) G6PD defic.	1698 (1.5%)	1358 (1.5%)	1340 (1.7%)	1171 (1.6%)	1259 (1.8%)	6826 (1.6%)

TABLE III
NUMBER OF CASES OF JAPANESE B ENCEPHALITIS
1976 — 1970

Year	No. of cases		Total no. of cases
	0-14 Years cases	15 & above	
1976	1	0	1
1977	11	4	15
1978	8	11	19
1979	7	6	13
1980	18	3	21

Mosquito control is a most important preventive measure. Since 1972, there have been very few cases of Japanese B encephalitis in Singapore due to the sustained efforts of the Public Health Department to control mosquito breeding.

TABLE IV
FREQUENCY OF, AND FATALITY FROM, TUBERCULOUS MENINGITIS IN CHILDREN ADMITTED TO SINGAPORE UNIVERSITY DEPARTMENT OF PAEDIATRICS, 1956 - 1979

Year	All Admissions	No. with TB meningitis	% fatality of TB meningitis cases
1956	6,473	106	46
1957	7,217	60	43
1958	9,697	62	31
1959	10,517	45	29
1960	10,712	46	14
1961	10,480	32	16
1962	11,928	15	15
1963	6,731	3	0
1964	6,249	8	28
1965	6,528	5	33
1966	6,873	6	16
1967	6,586	5	20
1968	6,308	2	50
1969	6,524	5	0
1970	6,356	5	20
1971	6,380	4	0
1972	6,250	1	0
1973	6,637	3	0
1974	4,876	1	0
1975	3,820	0	0
1976	4,787	2	0
1977	4,310	2	50
1978	4,375	1	0
1979	5,484	1	0

TUBERCULOUS MENINGITIS

Tuberculous meningitis still occurs in Asian countries, causing either death or severe mental retardation and spasticity of the limbs in affected children. A review of children with tuberculous meningitis seen in the University of Singapore Department of Paediatrics [8] showed that 60 percent

Fig. 3 Child with Japanese B encephalitis. Note conjugate deviation of eyes.

TABLE V
INCIDENCE OF TUBERCULOSIS MENINGITIS IN SINGAPORE, BY AGE/GROUP

Age Groups	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
0-4 years	1	0	2	1	1	0	2	1	0	1
5-9 years	1	1	2	0	0	1	0	0	1	0
10 years and above	16	25	20	19	14	25	12	18	12	8
All ages	18	26	24	20	15	26	14	19	13	9

of them were admitted in coma and that 35 percent had a history of illness of more than 2 weeks prior to admission, resulting in high mortality and morbidity rates.

There has been a progressive decrease in the number of affected children and in the frequency of fatalities as indicated in Table IV. The factors responsible for this decline are:

a. Introduction of B.C.G. vaccination. A UNICEF/WHO team started B.C.G. vaccination in Singapore in June 1961, and 90 percent of newborn infants in Government hospitals are now being vaccinated; in addition, both primary and secondary school children currently receive B.C.G. if their Mantoux test is negative.

b. Effective tuberculous case finding. Widespread detection of adult tuberculosis has been achieved by mass X-ray campaigns.

c. Good out-patient medical services.

d. Better nutritional status of children.

e. Improved housing conditions. Densely crowded shop-houses, especially in the "Chinatown" area, have been replaced by high-rise apartments. Furthermore, priority for housing is given to tuberculous patients.

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