THE CHANGING PATTERN OF NEUROLOGICAL DISEASES IN SINGAPORE[+]

CHONG-HAI, TAY*

In the last few decades, we in the Tropics, have observed a rapid change in the pattern of diseases but the extent of this change is difficult to estimate accurately since statistics in many countries are lacking. Notwithstanding this, the general impression amongst us is that many of the so-called 'tropical' diseases rampant in the past have greatly diminished in number since World War II. On the other hand, diseases previously considered rare and limited only to Western nations, have lately appeared in increasing numbers. In Singapore for instance, the principal causes of deaths in 1853 were cholera, debility, dysenteries and chronic diarrhoeas, in this order (Lee 1971) but today, our 'top-killers' are cancer, heart disease, cerebrovascular disease and hypertension—a pattern not very different from some Western nations. Undoubtedly, the change in disease pattern parallels that in environmental development and thus the more modernised the society, the more rapid the change.

Needless to say, the pattern of neurlogical diseases follows the same trend. However, many people including doctors, are not fully awarded of the neurological transition, owing to inadequate medical statistics and other pertinent data. Such data are best obtained through epidemiological surveys, but these are costly and few countries can afford them. Perhaps the next best method is by data collection and clinical studies from hospitals as we have done in Singapore. These data should be a fairly accurate reflection of the pattern found in the rest of the country since the majority of the local populace are served by these hospitals.

In this paper, hospital studies of a spectrum of neurological diseases found in Singapore over the past decade are presented to demonstrate the recent change in the local pattern. In addition, some interesting

Department of Medicine
Changi Hospital, Singapore 17

Chong-Hai, Tay* AM, MB, FRCP,
Head and Senior Physician

[+]**Lecture delivered at the First National Congress of Indonesian Society of Neurology, Psychiatry and Neurosurgery, Jakarta. November 8, 1976.**

but rare neurological disorders found in this period are described.

DISEASES OF THE CENTRAL NERVOUS SYSTEM

(1) Cerebrovascular Disease

In the past, most people succumbed to infective diseases before the age of 50 and thus the incidence of cerebrovascular disease was low. With effective control of infections and the increase in life expectancy in recent years, cerebrovascular disease has become one of the principal causes of death in Singapore as well as one of the major neurological problems in this country. The incidence rate rose from 29.4 per 100,000 in 1969 to 37.5 per 100,000 in 1971. Of the 755 hospital patients studied in one medical department, 55% were diagnosed as cerebral thrombosis, 33% as cerebral haemorrhage and 12% as cerebral ischemia (Gwee 1971). The ratios of Chinese, Malays and Indians patients were 14:1:1.2. The sex ratio was equal. Peak age of onset was between 51 to 60 years. About 40% had associated hypertension and the mortality was highest in the group with cerebral haemorrhage (45.5%). Compared to western countries, the local incidence of cerebrovascular disease is low perhaps because our population is younger—50% below the age of 20 and only 2% are above the age of 65 (Gwee et al, 1970). The incidence will probably rise with the age of the population.

(2) Arteriovenous Malformations (AVM)

In western countries, 60 to 80% of subarachnoid haemorrhage are caused by congenital berry aneurysms and only 2 to 10% are due to AVM (Paterson and McKissock 1965; Pakarinen 1967). Among the Asians, the aetiology of subarachnoid haemorrhage appears to be different. Spillane (1969) observed that the incidence of AVM was four to six times more common than berry aneurysms in patients with subarachnoid bleeding from Malaysia and Thailand. This observation was confirmed by our study (Tay et al., 1971 (c)). Subarachnoid bleeding which forms 5 to 9% of all cases of cerebrovascular accident is more often caused by AVM than by berry aneurysms, by a ratio of 3:1. The local incidence of AVM was higher than that found in other western centres and it was postulated than the prepondence of this malformation in one particular race could be regarded as genetically determined. Of the 50 cases of AVM studied by us, the majority were Chinese males between 11 to 30 years. Major presentations were subarachnoid and intracerebral haemorrhage (64%), epilepsy (24%), migranious headache (6%), paresis (4%) and dementia (10%). Carotid bruits were audible in 12%. Most of the malformations were medium or small in size — 48% and 38% respectively, and two-third of them were deepsited. Although they were found in all areas of the brain, the sites commonly affected were the frontal area (32%), parietal area (34%) and frontoparietal area (12%). Most of them were supplied by middle cerebral (42%) and anterior cerebral (36%) arteries. In our series the mortality rate was 6% after the 7½ years of followup. This figure is better than that for berry aneurysm because the bleeding from AVM is less destructive as it is from the large veins. Interestingly, we also found 5 cases where AVM was accompanied by another congenital abnormality, namely, the berry aneurysm in the same patients (Onn et al., 1971).

(3) Meningitis

Over the. past two decades, menigitis caused by pyogenic organisms, tuberculosis and syphilis has rapidly declined as a result of improved health services and effective chemotherapy (Paul, 1976, Chia and Tsoi, 1971; Tay et al., 1972B).

General Paralysis of the Insane (GPI) Prior to 1917, 5 to 15% of hospital admission to the mental institution were patients with GPI, but now only 0.8% was recorded (Chia & Tsoi 1971). Of the 136 cases studied from 1960 to 1970, majority of the patients were males (14 times more than females) and 70% were between the ages of 40 to 50. Majority were Chinese (77%) and the usual modes of presentation were dementia, acute confusional state, grandiose and paranoid states. Some were depressed. Positive blood serology was detected in 81% and it was found that penicillin therapy for these patients was only marginally effective.

Tuberculosis Meningitis All forms of tuberculosis have declined in incidence because of the improved preventive and curative measures available in recent years. Thus in 1956, there were 106 cases of TB meningitis in the paediatric wards, but by 1965, the number found that year was only five. (Paul 1967A). During the same period, the number of primary complex declined from 213 cases to only 10 (Paul, 1967 B). In the adults, TB of all forms was detected in 5,666 persons in 1959 and the number of cases declined steadily so that by 1970, only 3,292 cases were reported, but the number of adult TB meningitis over the past 20 years however, remained about the same—between 10 to 22 a year. (Tay et al 1972 A)

Cryptococcal Meningitis There has been an apparent increase of crptococcal meninitis in Singapore during the last ten years following the decline of TB and other

pyogenic meningitis. From a single case in 1959, the number of cryptococcal meningitis rose every year till in 1969 and 1970 when 5 and 6 cases were reported respectively. Thus during a 7-year period, we were able to study 30 cases locally (Tay et al., 1972 A). Majority affected were local Chinese. It occurred in all ages, both sexes, all occupations and in a third of this series, it appeared more often in those with systemic diseases e.g. SLE, PTB. Contact with pigeon was not important. Initial symptoms were often protean masquerading as other systemic disorders but clinical signs often revealed evidence of meningitis (80%), raised intracranial pressure simulating brain tumour (67%), cranial nerve paralyses (33%), mental aberrations (20%), hemiplegias (18%) and others. A third even showed pulmonary lesions, sometimes mistaken for cancer or tuberculosis. The CSF findings in all instances were consistent with meningitis but only half will yield the positive smear for C. neoformans. The pathogens were sometimes detected in ventricular fluid during a shunt bypass and in 4 cases, the diagnosis was only made at autopsy. Most of our cases (73%) were treated with parenteral amphotericin-B and a few with oral 5-fluorocytosine. (Tay et al 1972 C) Mortality of 40% in this series was found and majority that survived after treatment had lived 3 to 8 years. Only 7% were physically disabled. Ventricular decompression for those with obstructive hydrocephalus should be done early since most patients usually perished from medullary coning in spite of chemotherapy.

(4) Encephalitis

Viral encephalitis due to Arbovirus like Japanese-B or Dengue virus were not uncommon before the War. In recent years, with better control of the mosquito vector, the number has dwindled. Sporadic cases numbering 5 to 10 are found yearly. As expected, affected cases always carried a poor prognosis with high incidence of residual neruological damage or fatalities. During the past 15 years, we found 9 cases of viral encephalitis with atypical presentations. Most of these had symptoms and signs suggesting of brain abscess. To excluded this treatable condition, urgent cerebral angiography was carried out. Following this procedure, more of these cases either deteriorated rapidly or perished within 24 hours from ensuing cerebral oedema. (Tay 1978B). Hence, if possible, this procedure should not be carried out in cases with acute viral encephalitis.

DISEASES OF THE CRANIAL NERVES

Causes of cranial nerve paralysis are numerous but presently, the commonest causes in Singapore are brain stem thrombosis, brain tumour, basal meningitis, Gullian-Barre syndrome, diabetes mellitus, myasthenia gravis and others. However, there are 2 conditions which are of special interest to us locally and these are;—

(1) Paralysis due to Nasopharyngeal Carcinoma (NPC)

The high incidence of NPC in Southern Chinese residing either in mainland China or in South East Asia has been previously recognised. In Singapore it is the fourth common cancer after the lung, stomach and uterus. Majority affected were males (3 times more than females) in the 5th or 6th decade of life (Khor et al., 1975). Of the 369 cases studied over a 3-year period, 35% were Cantonese, 29% Hokkien and 17.5% were Teochew. Presenting features were neck swelling (61.4%), epistaxis (47%), tinnitus (38.9%) and various combination of cranial nerve paralysis (21.3%).

Commonest cranial nerves affected were the 6th, 9th and 10th (38.5% each), followed by the 5th (32%), the 12th (25.6%), the 3rd and 4th (24.4%) and the 7th (14.4%). Olfactory nerve is often spared. Very often 2 or 4 cranial nerves were affected simultaneously (60%) and this was attributed by the direct extension of the tumour through the base of the skull, sphenoid sinuses, maxillary sinuses and the antrum. In about 95.1% of the cases histology showed poorly differientiated squamous cell carcinoma. The prognosis, even with radiotherapy, is invariably poor.

(2) Ophthalmoplegias Of Obscure Origin or "Collier's Syndrome"

During the last 10 years, we came across a number of ocular paralysis of undetermined origin. We studied 14 such cases over a 3-year period (Tay et al., 1974). The disease affected all ages, both sex and all social classes. Presenting symptoms were diplopia, proptosis, facial numbness or pain, retro-orbital pain, ptosis, chemosis, giddiness, headache, conjunctival irritation, blurred vision and rarely, blindness. Clinical signs were unilateral (12 cases) ophthalmoplegia due to sudden paralysis of cranial nerves 3rd, 4th, 6th, and first two sensory branches of the 5th. Rarely, the optic nerve was affected. Except for 4 cases with preceding coryza or viral conjunctivitis, none had any systemic complications. Aetiology was unknown and this was supported by a full battery of investigations showing negative results. In 12 cases, spontaneous remission occurred within 2 to 4 weeks. Oral corticosteriods usually accelerated the recovery but relapses were common. One patient developed permanent blindness from optic

atrophy while 2 had residual ptosis or partial recovery to the ocular nerves. This condition which we called "Collier's syndrome" is basically similar to many other obscure forms of ophthalmoplegias described under different names such as superior orbital fissure syndrome, orbital apex syndrome, orbital pseudotumour syndrome and 'painful' ophthalmoplegias. No known aetiology has been discovered in all these conditions but a virus or/and autoimmune process have been postulated as possible cause/s. The importance of recognising this disease is to avoid surgical exploration of the orbit as blindness will often ensue.

DISEASES OF THE CEREBELLUM AND SPINAL CORD

(1) Cerebellar Diseases

Except for degenerative cerebellar diseases such as the hereditary ataxias, lesions of the cerebellum are rare.

(2) Infection and Trauma of the Spinal Cord

The incidence of spinal cord diseases due to pyogenic infection, poliomyelitis, syphilis e.g. tabes dorsalis and transverse myelitis, TB (Pott's paraplegia) and others has declined rapidly during the last fifty years. On the other hand, most of the spinal cord lesions are due either to trauma or to degenerative changes e.g. from osteoarthritis, rheumatoid disease etc.,

(3) Multiple Sclerosis and Neuromyelitis Optica (Devic's Disease)

In common with other tropical countries, Multiple sclerosis is extremely rare in Singapore. Although many cases were diagnosed clinically, we have not as yet a single case proved by autopsy. However, the other types of demyelinating diseases are not uncommon here and these are the neuromyelitis optica (Devic's disease), acute encephalitides, primary lateral sclerosis, posterio-lateral sclerosis and transverse myelitis of unknown aetiology. Twenty cases of Neuromyelitis optica were studied and reported in 1970 (Gwee & Toh, 1970). All except two, were Chinese and the sex ratio was equal. The age of onset was between 15 to 40 years. Optic atrophy with unilateral or bilateral loss of vision were found in all cases but 3 had transverse myelitis and one, cerebellar signs as well. Of the five deaths in this series, two were confirmed at autopsy.

No explanation has been offered for the difference of incidence between Multiple sclerosis and Neuromyelitis optica (both demyelinating disease) in the tropics and indeed, in other parts of the world.

(4) Motor Neurone Disease

The incidence rate of this disease in most western countries is 1.4 per 100,000 population per year (Kurland 1957). Locally however, the incidence is 0.1 per 100,000 population per year (Tay &F Jek 1972). Of the 13 cases studied over a 7-year period, 8 were males and 5 were females. There were 11 Chinese and the other two were Malay and Indian. The disease onset was between the 5th and 6th decade of life. Majority presented as amyotrophic lateral sclerosis (6 cases) or progressive muscular atrophy (5). The bulbar form was rare. Four cases perished during the followup while the rest deteriorated gradually over the years.

(5) A typical Juvenile Form Of Motor Neurone Disease

Recently 5 such cases from Malaysia (Lim 1971) and 14 cases from Singapore were described and studied (Loong et al., 1975). This form differs from the classical motor neurone disease in that the onset was early, usually before the age of 25; predominantly found in males; initial unilateral and distal involvement with little tendency to spread; absence of pyramidal signs; presence of fascicular twitching of the digits and tremor; and a peculiar pattern of muscular atrophy affecting the interosseous muscles more than the thenar intrinsics and the ulnar half of the forearm flexors more than the radial muscles. This condition was initially described in Japan in 1963 (Hirayama et al., 1963). Whether this disease represents a variant of the classical PMA or is a distinct clinical entity remains to be seen.

(6) Kugelberg-Welander Disease

We had studied 6 cases with this rare disease during the past 12 years. Five were females and one, a male. The onset of disease was between 7 to 15 years of age and majority had the disease for 10 to 22 years. In three, the condition was initially mistaken for Limb-girdle muscle dystrophy. Although all were disabled or bedridden, their mental functions in the majority remained intact. None had a positive family history. (Tay 1978C).

(7) Rarer Diseases

In 1973, a Chinese female with classical features of *Subacute Myelo-Optico-Neuropathy (SMON)* was reported (Tay 1973A). No additional case has so far been found locally.

In 1971, we also documented a very interesting case of *Foix-Alajouenine syndrome* in a young Chinese girl (Tay 1971A).

DISEASES OF THE NEUROMUSCULAR JUNCTION AND THE MUSCLES

(1) Myasthenia Gravis

This is not uncommon in Singapore. An average of 4 to 6 new cases are found annually and the majority presented with ocular symptoms (Tay et al., 1976A). In a few cases, there were associated thyrotoxicosis or thymoma. Details of this condition will be published in another paper.

(2) Myotonia Congenita

One Chinese family was recently found with this rare condition (Cheah & Toh, 1969). Since then, a few sporadic cases have been detected locally.

(3) Myotonia Dystrophica

Ten members of one Chinese family were found to have myotonia dystrophica as an autosomal dominant trait with incomplete irregular penetrance. (Tay et al 1972A) Majority affected were males over the age of ten. They had typical pattern of muscle wasting, myotonia, and various dystrophic features. Anticipation and potentiation were also evident in this family. Besides this family, we had seen 3 other sporadic cases—all males and in their 40s.

(4) Muscular Dystrophies

A ten-year survey of this disease in Singapore recently revealed 45 cases of muscular dystrophies (Tay et al., 1972 B). Of these, 27 had Pseudohypertrophic (Duchenne's) dystrophy, 11 had Limb-girdle (Erb's) dystrophy, 4 with Facioscapulohumeral (Landouzy-Dejerine's) dystrophy, 2 with Distal (Gower's) dystrophy and one with Ocular (Kiloh & Nevin's) myopathy. With the exception of the Facioscapulohumeral type, the pattern of diseases in our cases was similar to those reported in the West.

(5) Dermatomyositis

Compared to other connective tissue diseases, dermatomyositis is rare in Singapore. A clinical study of 15 cases from 1965 to 1975 revealed that the disease was common in Chinese (12 cases) and occurred more in the males. The age of disease onset varied from 14 years to 72 years. The majority of cases had no known aetiology but 4 had associated malignancy such as nasopharyngeal carcinoma, cancer of prostate and cancer of the lung.

Prognosis of these cases was poor as 9 died during the 10 year followup (Tay 1978D).

DISEASES OF THE PERIPHERAL NERVES

In the past, it was observed that the commoner causes of peripheral neuropathy were deficiency diseases such as beri beri, pellagra or malnutrition; or infections such as syphilis, leprosy or dysentries. Presently however, most of the patients with peripheral nerve diseases suffer from diabetes mellitus, alcoholism, poisoning from toxic chemicals, drugs or heavy metals or from Gullian-Barre Landry syndrome, disease of unknown aetiology. However, there are two interesting polyneuropathies which have recently brought into focus and these are:—

(1) Lead Polyneuropathy

From time to time, sporadic cases of lead poisoning have been discovered among Chinese opera actors and actresses who had used contaminated face powder for their makeup. Cases have been found also in some workers of unsupervised factories and a few cases developed the disease after taking Chinese herbal drugs containing high concentration of lead. Vigorous checking from health authorities has resulted in marked reduction of this disease.

(2) Arsenic Polyneuropathy

In 1971, many asthmatic patients who gave the history of consuming an antiasthmatic Chinese herbal preparation called "SIN LAK" pill were discovered to suffer from arsenic poisoning (Tay 1973B). The investigations that followed revealed another 28 brands of Chinese herbal drugs with very high concentration of inorganic arsenic content and these were banned locally. A study of 74 cases of arsenic poisoning revealed that neurological complication was very common (52%) in the victims (Tay & Seah 1975). Most of the neurological manifestations were the sensorimotor neuropathy with involvement of the distal parts of the limbs (40%). Other neurological disorders were toxic encephalopathy presenting with persistent headache (18%), lethargy, weakness, insomnia, depression or frank psychosis (10%), or acute delusions and delirium (5%). One patient had cord lesion and one cerebral metastasis from a lung cancer probably induced by arsenic. All had typical skin changes of arsenic poisoning (Tay

1975). In acute poisoning, administration of B.A.L. often reversed the neurological signs but in those with chronic intoxication, treatment was of marginal benefit.

OTHER INTERESTING NEUROLOGICAL DISORDERS

(1) Periodic Paralysis

1) *Familial hypokaelemic periodic paralysis* - Although a few families have been discovered with this disease, most of the cases found have no family history.

2) *Familial hypokaelemic periodic paralysis with Waardenburg's syndrome* A local Chinese family was discovered to have the features of the combined autosomal dominant diseases. (Tay 1971 B). The association of these two diseases in families has not been previously reported.

3) *Thyrotoxic hypokaelemic period paralysis* As observed in Japan and HongKong, we in Singapore have also noted the presence of hypokaelemic periodic paralysis among young Chinese males with thyrotoxicosis (Tan, 1968; Cheah 1974). This condition which tends to occur in oriental males, respond to antithyroid therapy.

(II) Connective Tissue Diseases

We have observed that the incidence of 'autoimmune' or connective tissue diseases has gradually increased over the past 20 to 30 years (Tay & Khoo 1970 A). This is partly because of our increased awareness of these diseases and partly because of improved facilities in the diagnosis of these conditions.

(a) *Systemic Lupus Erythematosus (SLE)* Recent studies in Singapore have shown that SLE is fairly common in Singapore (Tay & Khoo, 1971A; Tay & Lim 1975; Tay 1970 D). One new case is found every month (Tay 1978E). The clinical presentations were fairly similar to those found elsewhere. Neurological involvement was the sixth common presentation (30%).

A detailed neurological study of 75 SLE revealed that a third of the lesions were caused by the disease itself, usually in the form of microangiopathic vasculitis (Tay & Khoo 1971 B). Thus the patients presented with convulsions, cerebral thrombosis, cortical blindness, transient aphasia, subarachnoid bleeding, chorea, dementia, anxiety or psychosis. Other presentations included cranial nerve paralysis, paraplegia, mononeuritis, myopathy, retinal haemorrhage and blindness.

The second form of neurological disorder in SLE was caused by systemic complications such as hepatic coma, renal failure, cerebral bleeding from thrombocytopenia, bacterial and fungal meningitis from depression of the immunological defence system and others. About 27% of the series had this form of complication. The third form accounting 20% of the cases showed neurological signs due to complication of drugs in the treatment of SLE. Examples of these were steriod psychosis, steriod myopathy, steroid-induced infections, chloroquine retinopathy, herpes zoster etc.,

(b) *Progressive Systemic Sclerosis* (Scleroderma) This disease is rare in Singapore and the incidence of neurological complication is very low (Tay & Khoo 1970 B).

(c) *Polyarteritis Nodosa* Neurological manifestations such as convulsion, hemiplegia, paraplegia and other signs are common in patients with this disease (Tay & Khoo 1971A).

(III) Rare Diseases Associated with Mental Retardation

Three rare diseases not previously described in the English literature were recently found in Singapore.

(1) A Malay boy with severe mental retardation associated with porencephaly, epileptic fits, bilateral nasofrontal mucoceles, hyperteleroism and segmental vitiligo of the right lower limb and lower trunk (Tay 1970 A). There was no family history of similar condition. This neurocutaneous syndrome is most likely an ectodermal developmental defect.

(2) Severe mental as well as growth retardation was observed in two Indian sisters of recessive birth. They had peculiar facies, lentigene, café-au-lait spots, vitiligo, hepatic cirrhosis and aminoaciduria mainly of taurine, beta-aminoisobutyric acid and glycine (Tay et al., 1974).

(3) A new recessive disorder in one Chinese family with 3 affected cases was described presenting with mental and growth retardation, progeria-like appearance, nonbulbous ichthysiform erythroderma, hair erythroderma, hair shaft abnormalities such as pili torti and trichorrexis nodosa, atrophic gastritis, basal ganglia calcification and aminoaciduria of lysine, serine and threonine (Tay 1971 C; Tay et al., 1978A). This disease has been named Tay syndrome (Solomon & Esterly 1973) ©

(4) Other Rare neurological conditions found in Singapore were;—

A) A Chinese family with Huntington's chorea (Tay 1970 B).
B) Ramsay Hunt syndrom (Tay 1971 D) and
C) The Uveomeningoencephalitic Syndrom (Vogt-Koyanagi-Harada syndrom) (Tay 1970 C).

REFERENCES

1. Cheah J.S.: Thyrotoxic Periodic Paralysis. MD Thesis, University of Singapore. 1974.
2. Cheah J.S. and Toh. B.H.: Myotonia Congentia in a Chinese family. Sing. M.J. 10: 111-116, 1969
3. Chia B.H. and Tsoi W.F.: A study of 136 cases of G.P.I. (Dementia Paralytica) in a mental hospital, Sing. M.J. 12: 264-269, 1971.
4. Gwee A.L.: Cerebrovascular Disease—The Singapore profile. Sing. M.J. 12: 57-63, 1971.
5. Gwee A.K., Tham N.B., Chee, K.H. and Chew L.S.: Cerebrovascular Disease—Epidemiological and Clinical Considerations. Sing. M.J. 11: 2-13, 1970.
6. Gwee A.L. and Toh, C.S.: A search for Disseminated Sclerosis in Singaporeans. Far East Med J. 6: 51-55 1970.
7. Hirayama k., Tsubaki, T., Toyokura Y., and O. Kinaka S.: Juvenile Muscular Atrophy of unilateral upper extremity. Neurology, 13:373-380, 1963.
8. Khor T.H., Tan B.C., Chua E.J. and Chia K.B.: Tumours of the Nasopharynx—Singapore 1969-1971, The Presenting Picture. Sing. Med. J. 16:236-243, 1975.
9. Kurland L.T.: Epidemiological investigation of Amyotrophic Lateral Sclerosis. Proc. Mayo Clinic, 32:449, 1957.
10. Lee Y.K.: The Pauper Hospital (1850-1895), Part 4. Sing. M.J. 16:269-289, 1975.
11. Lim K.J.: Motor Neurone Disease in Young Adults. Proc. 6th Sing.—Mal. Congr. Med. 6:117-121, 1971.
12. Loong C.S., Yap M.H.L. and Nei I.P.: An unusual form of Motor Neurone Diseas. Proc. 10th Sing.—Malaysia Congr. Med. 10:315-319, 1975.
13. Oon C.L., Tay C.H., Lai C.S., Loong C.S. and Gwee A.L.: Coexistence of cerebral aneurysms with intracranial arteriovenous malformations. Sing. M.J. 12:71-76, 1971.
14. Pakarinen S.: Incidence, aetiology and prognosis of primary subarachnoid haemorrhage. Acta Neurol. Scand. 43: Suppl. 29 1967.
15. Paterson J.H. and McKissock W.: A clinical survey of intracranial angiomas with special reference to their mode of progression and surgical treatment: a report of 110 cases. Brain 79:233-266, 1956.
16. Paul F.M.: TB Meningitis in Children in Dept. of Paediatrics over a ten-year period Sing. M.J. 8: 102-110, 1967. (A).
17. Paul, F.M.: A Review of Primary Complexes in the Dept. of Paediatrics over a ten-year period. Sing. M.J. Sing M.J. 8'9-20, 1967 (B).
18. Solomon, L.M. and Esterly, N.B.: Neonatal Dermatology. 1st Edit. W.B. Saunders. Lond. 1973.
19. Spillane J.D.: Tropical Neurology. Proc. Royal Society of Med. 62:403-410, 1969.
20. Tan B.Y.: Thyrotoxic Periodic Paralysis. Sing. M.J. 9:31-38, 1968.
21. Tay C.H.: Porencephaly, nasofrontal mucoceles, hypertelorism and segmental vitiligo— A new neurocutaneous disorder. Sing. M.J. 11:253-257, 1970 (A).
22. Tay C.H.: Huntington's Chorea—report of a Chinese family in Singapore. J. Med. Genetics (Lond) 7:41-43, 1970 (B).
23. Tay C.H.: The Uveomeningoencephalitic syndrome (Vogt-Koyanagi-Harada syndrome) Far East Med. J. 6:314-318, 1970. (C)
24. Tay C.H.: Cutaneous manifestations of Systemic Lupus Erythematosus. Austral. J. Derm. 11:30-41, 1970 (D).
25. Tay C.H.: The Foix-Alajouanine Syndrome Med. J. Malaya 35:298-299, 1971. (A)
26. Tay C.H.: Waardenburg's Syndrome with Familial Periodic Paralysis—Clinical review. Postgrad. Med. J. (Lond.) 47:354-360, 1971. (B)
27. Tay C.H.: Ichthysiform erythroderma, Hair shaft abnormalities, Mental and Growth retardation—A new recessive disorder. Arch. Dermatology (USA) 104:4-14, 1971. (C)
28. Tay C.H.: The syndrome of Ramsay Hunt. Far East Med. J. 7: 194-197, 1971. (D).
29. Tay C.H.: Subacute Myelo-Optico-Neuropathy in Singapore. Lancet 1:1519, 1973 (A).
30. Tay C.H.: Recent discovery of Arsenic Poisoning in Singapore. Proc. 8th Sing. Malaysia Congr. Med. 8:71-78, 1973 (B)
31. Tay C.H.: Cutaneous manifestations of Arsenic Poisoning due to Chinese Herbal Preparations. Austral. J. Med. 15:121-131, 1974.
32. Tay C.H.: Atypical presentations of Viral Encephalitis and the dangers of carotid angiograms—In Preparation 1978(B).
33. Tay C.H.: Kugelberg-Welander Disease—A Singapore study. In Preparation 1978 (C).
34. Tay C.H.: Dermatomyositis In Preparation 1978 (D).
35. Tay C.H.: Systemic Lupus Erythematosus—The Clinical Aspects. Submitted for publication. 1978 (E).
36. Tay C.H., Chew L.S. and Lin, L.: Cryptococcal Meningitis—Apparent increased incidence in the Far East. Brain, 95:61-67, 1972 (A).
37. Tay C.H., Chew L.S. and Lin, L.: Cryptococcal Meningitis—a clinical study of 30 cases in Singapore. Neurology India 20:104-116, 1972 (B)
38. Tay C.H. and Jek Y.T.: Motor Neurone Disease. Med. J. Malaya 24:272-277, 1972
39. Tay C.H., Jek Y.T. and Seah C.S.: Spectrum of Progressive Muscular Dystrophies in Singapore Annals Acad. Med Sing. (NS) 1:26-38, 1972 (B)
40. Tay C.H. and Khoo O.T.: The pattern of autoimmune diseases in Singapore. Far East Med. J. 6:345-352, 1970 (A)
41. Tay C.H. and Khoo O.T.: Progressive Systemic Sclerosis (Scleroderma) Austral. Annals of Med. 19:145-150, 1970 (B)
42. Tay C.H. and Khoo O.T.: Systemic Lupus Erythematosus—an analytical study of 80 cases. Sing. Med. J. 12:92-100, 1971 (A)
43. Tay C.H. and Khoo O.T.: Neurological Involvement in Systemic Lupus Erythematosus. Sing. M.J. 12:18-23, 1971 (B)
44. Tay C.H., Khoo, O.T., Chew L.S., and Lin, L.: Meningitis due to Cryptococcal Neoformans in Singapore—experience with Amphotericin-B and 5-Fluorocytosine Asian J. Med. 8:361-370, 1972 (C)
45. Tay C.H. and Lim A.L.: Direct Immunofluorescent study of Systemic Lupus Erythematosus in Singapore Austral. J. Derm. 16: 22-31, 1975.
46. Tay C.H., McEvoy Bowe and Lim P.: Further features of Tay's syndrome. In preparation 1978 (A).
47 Tay C.H., Oon C.L., Lai C.S., Loong C.S. and Gwee A.L.: Intracranial arteriovenous malformation in Asians. Brain 94: 61-68, 1971 (C).
48. Tay C.H., Rajagopalan, K., McEvoy Bowe, Tock E.P.C. and DaCosta J.K.: A recessive disorder with growth and mental retaradation, abnormal pigmentation, peculiar facies, hepatic cirrhosis and aminoaciduria Acta Paediat. Scand. 63:777-782, 1974.
49. Tay C.H. and Seah C.S.: Arsenic Poisoning from Anti-asthmatic Herbal Preparations. Med. J. Austral. 2:424-428, 1975
50. Tay C.H., Tan, Y.T., Cheah C.S. and Ransome G.A.: Ocular palsies of obscure origin in South-East Asia. J. Neurology, Neurosurgery and Psychiatry 37:739-744, 1974
51. Tay C.H., Ng. H.S. and Tong H.I.: Clinical study of Myasthenia Gravis—In preparation (B).
52. Tay C.H., Yeoh H., and Seah C.S.: Dystrophia Myotonia—a family study Annals Acad. Med. (NS) 1:168-176, 1972.