Medical genetics around the world

Genetic services in Hong Kong

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Background

Hong Kong is geographically an integral part of south China. In the past 150 years, its population has increased from a few thousand to 5.7 million.¹ This is the result of episodic influxes of a great mass of people from China, often associated with political upheavals or economic crisis. It explains a population structure of 97.5% Chinese, the majority of whom originates from the southern provinces of China. This structure is also reflected in the finding of genetic variants in this population, which bears resemblance to neighbouring regions in China. For example, the thalassaemias and lactose intolerance are common.^{2,3} In addition the impact of migration from other parts of China has also been substantial. This is evident from studies of glucose-6-phosphate dehydrogenase (G6PD) variants and other protein polymorphisms. The remaining 2% of the population is a heterogeneous group of minorities including Europeans, Indians, Japanese, and south-east Asians. Although their contribution to the cultural and economic growth in Hong Kong is phenomenal, their impact on the genetic load is small.

Historical development

Before 1969, organised activities in medical genetics in Hong Kong were minimal. The following decade witnessed a slow start when one of us (ASC) introduced cytogenetics into the laboratories of the Department of Paediatrics, University of Hong Kong.

This was followed later by the formal establishment of a genetic counselling clinic in Queen Elizabeth Hospital in 1975. For the next five years, this clinic was conducted on a monthly basis. Chromosome studies (on orcein stained preparations) were performed at the back bench of a paediatrics laboratory without the benefit of assistance from any technician. This was the modest start of medical genetics in Hong Kong.

Towards the end of this period, it was considered desirable to set up a formal clinical genetic service. Professor M Ferguson-Smith from the University of Glasgow was invited in 1978 by the Medical Faculty of the University of Hong Kong to recommend the establishment of a genetic department at the university. Subsequently, Professor P E Polani from London was invited by the Department of Medical and Health Services of Hong Kong (DMHS) to look into the feasibility of establishing a genetic service in Hong Kong. As a result, a comprehensive scheme was proposed,⁴ defining in detail the structures of such a service, with its components of genetic counselling clinics, cytogenetic laboratories, and neonatal screening programmes. It also dealt with the staffing of these services and training of personnel. This plan was adopted by DMHS and has been followed faithfully in the past decade. As a start, clinicians and technologists were sent for in depth training to various genetic centres and laboratories.

Implementation of service

The year 1981 saw the establishment of two genetic counselling services. The need for a prenatal diagnostic service was first envisaged by Professor H K Ma of the Department of Obstetrics and Gynaecology, University of Hong Kong. Under her initiative, private donations and Government funding were forthcoming and the prenatal diagnostic laboratory was established in 1981. It was named Mrs Wu Chung Prenatal Diagnostic Laboratory and it is based at the Tsan Yuk Hospital (the maternity teaching hospital of

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the University of Hong Kong). It is staffed by obstetricians and technologists with experience in prenatal diagnosis, and administered by Professor H K Ma. The second genetic counselling service, known as the Clinical Genetic Service, was placed directly under the administration of MHSD, and is staffed by paediatricians trained in clinical genetics and technologists trained in cytogenetics. To facilitate collaboration, the two laboratories were housed in the same building. These two teams have always complemented one another.

Work of the Clinical Genetic Service

The Clinical Genetic Service accepts referrals from all hospitals and medical practitioners. Patients are seen either at the counselling clinics or in hospital wards. The first three years of the service witnessed a progressive increase of referrals as the service gained popularity. The number of referrals has levelled off since then (table). This pattern is similar to that observed in other genetic services⁵ and limitations in staff and other resources play a significant role in this phenomenon. A genetic register is kept to facilitate retrieval of patients.

Since genetic diseases vary in incidence in different ethnic groups, it was considered important to define the pattern in our community. The first task of the Clinical Genetic Service was the collection of data to build up a 'bank' of information on our local inheritance patterns. For the past few years, sufficient data have been available to define the incidence of common chromosomal diseases,⁶⁻⁸ to highlight the contribution of malformations to our genetic load,⁹ and to illustrate the type of biochemical genetic diseases prevalent in this region.¹⁰

The cytogenetic laboratory of the Clinical Genetic Service constitutes the most important adjunct to the counselling clinics. It has the facilities to perform most of the important cytogenetic techniques in current use. In 1988, tissues dealt with at this laboratory included 973 peripheral blood samples, 41 bone marrow aspirates, solid tumours, and skin biopsies, and 37 fetal blood samples. G banded chromosome analyses were performed 755 times, while prometaphase and fragile X studies numbered

246 and 139, respectively. On 20 occasions, other techniques were used, including late replicating X chromosome study, sister chromatid exchange, Q banding, C banding, R banding, and NOR staining studies. A limited amount of enzymology work is also performed in this laboratory for biochemical genetic diseases. 'Extramural' consultations are conducted for cases which require laboratory investigations not readily available, for example, DNA repair studies and some biochemical analyses.

Work of the Prenatal Diagnosis Service

Established in 1981, this unit serves the whole population of Hong Kong. At present, five counselling clinics and five prenatal diagnostic and ultrasound sessions are held weekly. Over the years the number of referrals has increased considerably (figure). In 1988, a total of 1514 couples was counselled, and 1039 amniocenteses, 80 chorionic villus biopsies, and 46 percutaneous fetal blood samplings were performed. Chromosomal and biochemical studies are performed at the Wu Chung prenatal diagnostic laboratory and molecular studies are performed at the Medical Unit of the University of Hong Kong. Special biochemical tests are arranged with overseas laboratories. The laboratory is also responsible for thalassaemia and maternal serum AFP screening.

Neonatal genetic screening programme

The Clinical Genetic Service has also played a pivotal role in the planning and implementation of a screening programme for metabolic and genetic diseases. It had already been suggested⁴ that population screening for G6PD deficiency and congenital hypothyroidism in the neonatal period should be considered in Hong Kong. These two conditions were found to occur at frequencies that would justify such screening efforts.^{11 12} In 1984, the Central Genetic Neonatal Screening Unit started operation as part of the Clinical Genetic Service, screening for these conditions

Referrals to the Clinical Genetic Service.

Year (from Sept)	No of referrals
1981-82	342
1982-83	461
1983-84	604
1984-85	594
1985-86	609
1986-87	679
1987-88	707
1988-89	792

Number of referrals for prenatal diagnosis from 1982 to 1988.

in babies born at Government regional hospitals and maternal and child health clinics. In the following five years (April 1984 to March 1989), a total of 205 624 babies was screened. This represents 100% of the target population. It is found that G6PD deficiency occurs in 4.4% of Chinese boys and 0.41% of Chinese girls. For congenital hypothyroidism, a total of 65 cases has been identified, giving an incidence of 1 in 3163 newborns. This condition is predominantly found in girls (48 of the 65 patients were females). Of the 65 patients, 35 were found to have ectopic thyroids on scintigraphy. Parents and affected subjects receive counselling and treatment at the screening unit. Replacement therapy with L-thyroxine is given to confirmed cases of congenital hypothyroidism mostly before 1 month of age. The babies are then referred back to the paediatricians of the regional hospitals where they were born. Annual reassessment of their physical growth, developmental profile, and hormonal status are conducted. On the whole, their physical and intellectual development corresponds to chronological age. Up to the present, 24 confirmed cases have been reassessed at the age of 3 years by temporary cessation of thyroxine treatment. Five of these showed normal thyroid scans and have been taken off life long replacement therapy.

Organisation

In common with the development of other clinical disciplines in Hong Kong, the evolution of medical genetics here was initiated by several interested persons and institutions. Geographical proximity of these institutions and easy access to communication networks encourage a great degree of collaboration among these groups. This is exemplified in the organisation of the Clinical Genetic Service and Prenatal Diagnosis Service, and is also evident from the successful establishment of the Hong Kong Society of Medical Genetics in 1986. The objective of this society is to promote interest and knowledge of medical genetics via its scientific programmes. Its members are all currently involved in medical genetics services or research. This society also participates in public education activities, aiming at introducing medical genetics to a broader audience.

From the above account, it is evident that although we were comparatively late in starting this discipline, we have witnessed definite progress in the last 10 years. On the other hand, we have encountered a number of teething problems. The foremost of these concerns the overall organisation of genetic activities, including service and research. At this moment, funding of counselling clinics and laboratories is derived from the Department of Medical and Health Services (incidentally, this government department is undergoing major divisional and structural changes at present). Superficially, certain advantages exist in this

arrangement. Since a central body is responsible for funding, continuous implementation of the activities in these clinics, laboratories, and programmes is safeguarded. However, such a service oriented approach also imposes restrictions on research activities, which are of paramount interest in a developing discipline. Ideally, additional funding should be made available via public revenue or donations for development, promotion, and research.

Research

Since medical genetics is a new discipline in Hong Kong, initial efforts in research are of necessity 'applied' in nature. This is all the more important since we are dealing with a unique population of Chinese that may have many differences from other ethnic groups. In this regard, population studies have been performed for the pattern of dermatoglyphic variations and various chromosomal and biochemical genetic diseases, some of which have been mentioned earlier. Information obtained from research has generally been put to good use. For instance, research has provided the impetus for the setting up of screening programmes for genetic diseases. Apart from those mentioned above, a separate territory wide screening programme for thalassaemia is being actively planned. Some of the research programmes in this locality include the cytogenetic study of nasopharyngeal carcinoma and other solid tumours,¹³ molecular studies on collagen diseases, thalassaemias,^{14 15} haemophilia,¹⁶ and Duchenne muscular dystrophy,¹⁷ tissue typing for various genetic diseases, and studies on protein polymorphisms.

Future development

At present, the various clinics and laboratories in the universities and government departments each have goals of their own, working on areas that happen to be their main interest. Although collaborative efforts do exist among these groups, and the establishment of the Hong Kong Society of Medical Genetics has helped to promote further dialogues, there is still much room for improvement.

For the past 10 years, the main impetus of development seems to have come from the government department (represented by the Clinical Genetic Service), and the Obstetrics Department of the University of Hong Kong (represented by the Prenatal Diagnosis Service). In the near future, plans have been proposed by the Department of Health to expand its service. More clinical geneticists will be recruited and trained, and the laboratories and clinics of the Clinical Genetic Service will be expanded. Also, further screening programmes are planned, for example, for detection of thalassaemia carriers. At the Prenatal Diagnosis Service, it is envisaged that the

demand for prenatal diagnosis, particularly of chromosomal abnormalities and thalassaemia, will continue to increase in the future. To meet this demand, a comprehensive plan is now under way for further expansion and improvement of the service, including computerisation and automatic karyotyping. On a more academic note, the Institute of Molecular Biology has been set up at the University of Hong Kong. It is envisaged that molecular studies of the more prevalent genetic diseases will be studied at this institute.

Hopefully, via the concerted efforts of the Department of Health and the university faculties, some form of central policy can be devised to manage some of the existing problems in the allocation of resources for preventive genetic services and strategic research, training of personnel, and further development.

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