Short Communication

Building Reproductive Genetic Services from Bottom Up: Over 30-year Experience of a Major Prenatal Diagnostic Center in Guangdong Province

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Prenatal diagnosis plays an important role in preventing birth defects and improving birth quality. Through continuous efforts from the past three decades, the Guangdong Women and Children's Hospital has transform a small department of medical genetics into a prenatal center for genetic disease diagnosis and treatment (PCGDDT). A wide spectrum of genetic tests including clinical cytogentics, biochemical screening and molecular genetics has been performed. A biobank of patient specimens for translational research has been established. PCGDDT has been one of the key disciplines of Guangdong Women and Children Hospital and master degree training hospital for Guangzhou Medical University, state-level professional training base in clinical and laboratory technology, and priority specialty of Guangdong Province. Our experience represents a bottom up approach to build sustainable hospital-based and institute-affiliated genetic services in China.

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INTRODUCTION

The Department of Medical Genetics of Guangdong Women and Children's Hospital (GDWCH) was started in 1981. At that time, it was a small unit with only three staffs performing preliminary genetic tests in a 40 square meters laboratory. In 1994, aiming to provide better diagnostic services and genetic counseling for women and children, this small Department of Medical Genetics was expanded to a Prenatal Center for Genetic Disease Diagnosis and Treatment (PCGDDT). Continuous efforts in the past two decades have made the PCGDDT at GDWCH a major regional medical genetics center. As the public awareness of genetic diseases increased, there has been more and more governance support for prenatal, pediatric and reproductive genetic diagnosis in China. This report aims to present the spectrum of genetic services, the status of clinical training programs and the scope of translational research projects developed in the PCGDDT. Our experience reflects a bottom-up model for the development of a hospital-based and institution-affiliated genetic service, education and research program.

COMPREHENSIVE GENETIC SERVICES

To date, PCGDDT at GDWCH have equipped with a wide spectrum of technologies and occupied a space of approximately 3,600 square meters. The diagnostic laboratories are capable to perform fluorescent in situ hybridization (FISH), quantitative fluorescent polymerase chain reaction (QF-PCR), BACs-on-Beads (BoBs), multiplex ligation-dependent probe amplification (MLPA), array-based comparative genomic hybridization (aCGH), allele-specific PCR-based universal array, PCR-based Microsphere Hybridization Assay, DNA sequencing, next generation sequencing (NGS), flow cytometry (FCM), time-resolved fluorescence (TRF), enzyme-linked immunosorbnent assay (ELISA), automatic chromosome scanning and karyotyping, etc. All these technologies have been validated and used in different genetic tests.[1-10]

The CGDDT is composed of 76 clinical doctors and researchers, including nine with doctoral degree and 32 with master degree. Additionally, outstanding experts, including the Fellows of American College of Medical Genetics and Genomics and Diplomats of American Board of Medical Genetics from USA, are engaged as scientific advisers. The jointed efforts from internal staffs and external experts have kept us informed with the current advances and catch-up with the cutting edge technologies.

There are seven departments in the PCGDDT, including the Departments of Clinical Genetics, Molecular Genetics, Cytogenetics, Molecular Cytogenetics, Biochemical

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Genetics, Molecular Microbiology Genetics, and Translational Medicine. The Center also runs the Biobanking facility of the hospital. The Department of Clinical Genetics provides inpatient and outpatient consultation services including medical genetics assessment and diagnosis, as well as providing genetic counseling and support services. The physicians are specialized in dealing with recurrent spontaneous abortions, hereditary diseases, obstetric abnormality, as well as congenital hemolytic infection and blood diseases. In 2012, The Department of Clinical Genetics provided genetic counseling to 75,903 patients, multi-department consultation to 372 patients, and preformed prenatal diagnosis procedures for 5540 high-risked patients.

The Biochemical Genetics Service in the center mainly includes maternal serum screening for Down syndrome and Hemoglobin test for screening thalassemia. In 2012, the Department of Biochemical Genetics has tested 262,034 maternal serum samples to screen for Down's syndrome and neural tube defects and performed hemoglobin electrophoresis on 33,735 pregnant women to screen for thalassemia. According to the epidemiological survey carried out by the PCGDDT in 40,808 blood samples of Guangdong Province, the carrier rate of α-/β-globin gene mutations is about 16.83%.[1]

The Department of Cytogenetics preformed chromosome analysis on peripheral blood, cord blood, amniotic fluid and chorionic villi samples. In 2012, the Department of Cytogenetics provided prenatal service to 3622 women with high-risk pregnancies, and postnatal service to 6278 patients with craniofacial dysmorphism, multiple malformations, mental retardation, developmental delay, primary infertility or spontaneous abortion.

The Department of Molecular Cytogenetics preformed QF-PCR and FISH tests on 4169 subjects in 2012 for rapid screen of common aneuploidies of chromosomes 13, 18, 21, X and Y. Furthermore, array CGH analysis was performed to reveal submicroscopic chromosomal abnormalities, which enhance the detection rate by 10 to 16 percent of pregnancies with fetal ultrasound anomalies but not detected by conventional cytogenetic or molecular cytogenetic techniques.

The Department of Molecular Genetics carry out mutation analysis for thalassemia genes, BRCA1/2 genes detection, Prader-Willi syndrome (PWS) genes, deafness-related genes, cystic fibrosis, Duchenne & Becker Muscular Dystrophy, Fragile X, as well as other rare hereditary diseases for probands, carriers, and fetuses with known family history. In 2012, The Department of Molecular Genetics provided services to 11,724 patients for thalassemia, 112 for BRCA1/2 gene detection, 1,476 for PWS gene detection, and 5,732 for deafness-related genes. According to the epidemiological survey carried out by the center, the carrier rate for a spectrum of mutations of hearing-loss genes in South China was 4.17%.[1] Moreover, The Department of Molecular Genetics successfully diagnosed 19 patients with rare hereditary diseases in the last year.

The Department of Molecular Microbiology Genetics performed molecular microbiology genetic diagnosis of common infections in women and children, including UU, VT, NG, HSV, HPV, EV71 and CMV. Besides, the Department of Molecular Microbiology Genetics carry out the research of gut microbiota, host genetics and diet composition, for better nutritional consulting, diagnosis and therapy of overweight or obese subjects.

GENETIC TRAINING AND TRANSLATIONAL RESEARCH

After three decades' efforts, the PCGDDT has developed into one of the key disciplines of Guangdong Women and Children Hospital, master degree training hospital for Guangzhou Medical University, state-level professional training base in clinical and laboratory technology, and priority specialty of Guangdong Province.

The Department of Translational Medicine focuses on the course of predicting, preventing, diagnosing, and treating diseases. Translational Medicine also uses what can be gleaned in clinical studies to sharpen and improve what is done in pre-clinical efforts to discover new medicines. Translational medicine represents a paradigm shift in the biomedical research enterprise, and is highly valued by the Center and the Hospital.

The biobank has become a supportive resource for many types of research projects like genomics and personalized medicine. The biobank of Guangdong Women and Children Hospital contains more than 100,000 biological samples with related patient records. Researchers can access the samples and data for projects using large case series and disease cohort. Furthermore, samples in the biobank and the data derived from those samples can often be used by multiple researchers for multiple purposes.

SUMMARY

The PCGDDT has established cooperative relationship with over 130 women and children hospitals to provide comprehensive prenatal screening and genetic disease diagnosis. Every year, over 50,000 patients and 500,000 samples were transferred to our Center. Cooperative services are provided by every department in the Center to provide comprehensive screening and diagnosis of genetic diseases for women and children. Under comprehensive screening and diagnosis projects, we detect about 300 fetal chromosomal abnormalities and 400 moderate to severe thalassemia fetus each year, as well as other hereditary diseases. The experience of PCGDDT represents a bottom-up approach to build up sustainable hospital-based and institute-affiliated reproductive genetic services.

CONFLICT OF INTEREST

None.

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