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Research Activities

We have 8 subspecialty research groups: (1) the Medical Genetics, Endocrinology, and Congenital Metabolic Diseases group, (2) the Neurology group, (3) the Allergy and Immunology group, (4) the Cardiology group, (5) the Nephrology group, (6) the Infectious Diseases group, (7) the Hematology and Oncology group, and (8) the Neonatology group. The common goal of the groups is offering practical benefits to patients and families through research. To accomplish this, we encourage our staff members to engage in research.

Medical genetics, endocrinology and congenital metabolic diseases group
We focused on studies of the pathogenesis and treatment of genetic diseases, endocrinology, and digestive system disorders. We clarified the role of *shugosin* protein during mitosis. We successfully transduced genes into cultured neuronal cells using a baculoviral vector and corrected thalassemia with a retroviral vector in a mouse model. We identified a novel mutation of the POU1 gene and analyzed the function of mutated proteins in a patient with complex growth hormone deficiency. We established guidelines for children with Crohn's disease.

Neurology
We investigated the approach to rehabilitation in acquired brain injury, especially traumatic brain injury (TBI). Thirty-nine children with higher cortical dysfunction after TBI were evaluated. In children with diffuse brain damage the prevalence of memory disturbance was lower ($p<0.01$) and that of attention deficit was higher ($p<0.05$) than in children with focal brain damage. The prevalence of higher cortical dysfunction, especially the disturbance of visual perception, was higher in children with motor dysfunction. Intelligence quotient recovered mainly during the first 2 years after TBI, and profile patterns on the Wechsler Intelligence Scale for Children were almost the same 6 months after TBI. Support for re-entrance to schools should begin as soon as possible with cooperation among rehabilitation centers, schools, and homes. Because many problems were observed in study, behavior, communication, and other areas, considerable support from the rehabilitation center is necessary.
We studied human herpesvirus 6 (HHV-6) encephalopathy, to clarify diagnostic images

of HHV-6 encephalopathy. The findings of magnetic resonance imaging (MRI) and single photon emission computed tomography (SPECT) of HHV-6 encephalopathy were divided into 3 types: 1) frontal lobe predominantly damaged, 2) unilateral hemispheric damage, and 3) diffuse damage. Disturbances predominantly affecting the frontal lobes on MRI and SPECT images are considered to have similar pathophysiology as the diffuse type, which is more severe. The unilateral hemispheric type may be associated with pathophysiologic changes other than those found in the frontal lobe predominantly damaged type and the diffuse type.
We are studying various neurological disorders, including epilepsy; acute neurological disorders, such as acute encephalitis; and rehabilitation of patients with acquired brain damage. We have published several studies in the fields of rehabilitation, epilepsy, and acute encephalitis, as described below. We should strive to produce many reports, in rehabilitation, epilepsy, acute encephalitis, and other fields.

Allergy and immunology
We have been measuring several markers in exhaled breath condensate from young children with asthma. Levels of exhaled leukotriene (LT) E_4 were higher even in mild asthma than in control subjects without asthma. Exhaled LTE_4 levels were negatively correlated with the provocative concentration of methacholine causing a 15% fall in the forced expiratory volume in 1 second. These results suggest that airway cys-LTs play a role even in children with mild, asymptomatic asthma and reflect airway hyperreactivity based on chronic inflammation. These results are being published in *Chest*.
We have recently started to measure other exhaled breath condensate markers with the Luminex system (Austin, TX, USA) and to measure exhaled NO levels. These measurements were made for the early diagnosis and treatment of allergic diseases, including asthma, especially in infants and younger children. The mechanism of asthma exacerbation due to upper respiratory infection with rhinovirus has also been investigated.

Cardiology
In the pediatric cardiology group, our studies are as follows.
1. Prenatal diagnosis of congenital heart disease
2. Diagnosis, treatment, and long-term postoperative follow-up of congenital heart disease
3. Imaging of congenital heart disease with multidetector row computed tomography
4. Evaluation of breath circulatory dynamics using expired gas analysis for children with heart failure
5. Therapy for the acute stage of Kawasaki disease
6. Evaluation of respiratory function in congenital heart disease
7. Treatment of arrhythmias detected with cardiac screening in school-aged children
8. Epidemiology of Kawasaki disease
9. Magnesium dynamics in pediatric cardiology
10. Magnesium therapy for arrhythmia in childhood
11. Molecular biology in congenital heart disease

12. Dynamics of nitric oxide in children with heart disease
13. Secretion kinetics of atrial and brain natriuretic peptides in children with heart failure
14. Catheter treatment for congenital heart disease, in particular, atrial septal defect

We are engaged in our research after daily practice. In this year, we presented many findings at annual meetings. One of our staff has studied catheter treatment at Kobe Children's Hospital to extended our research in new field.

Nephrology

We performed a study of 11 patients with rhabdomyolysis with special emphasis on the relation to acute renal failure.

1. Causes of rhabdomyolysis were malignant hyperthermia, status epilepticus, hypernatremia, heat stroke, traffic accident, viral infection, and toxic shock syndrome.
2. In the development of acute renal failure associated with rhabdomyolysis, suspected risk factors were dehydration and a delayed treatment.
3. The severity of muscle damage seemed to be correlated with the severity of renal dysfunction, but the relationship was inconsistent and was affected by various factors.
4. The blood urea nitrogen/Cr ratio was 10 to 20 in patients with acute renal failure. The increase in Cr was not greater than that in adults. Hyperuricemia, hyperphosphatemia, and hypocalcemia, which are characteristic symptoms in adults, were not found.
5. The prognosis was poor in cases of rhabdomyolysis complicated by disseminated intravascular coagulation and other conditions.

Infectious disease

We researched into the new diagnosis and treatment based on our clinical experiences in the infections diseases, immunologic disorders and collagen diseases in children.

Our study of chronic granulomatous disease focused on gene therapy and made full use of our clinical experiences with bone marrow transplantation.

Expression of the CXCR4 gene in CD34-positive cells was increased to extremely high levels with a retrovirus vector, and the effect of CXCR4 is being examined in detail. Additionally, the method of diagnosing chronic granulomatous disease rapidly and with high precision is being studied continuously.

We have started studying DNA vaccines and performed clinical studies on the basis of a large number of cases, including those of bacterial meningitis and sepsis. Similar studies of collagen diseases have been performed. We are performing studies of various therapies that make use of our clinical experiences while assessing examinations showing disease activity in individual cases.

Publications

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