

Department of Surgery

Division of Pediatric Surgery and Vascular Surgery

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General Summary

Pediatric Surgery

The Division of Pediatric Surgery at The Jikei University Hospital is dedicated to providing expert surgical care for fetuses, infants, children, and adolescents with congenital and acquired conditions. Our surgeons remain committed to the ongoing development of new surgical techniques for treating diseases in children, particularly minimally invasive approaches to replace more invasive open procedures that require large incisions.

Vascular Surgery

Research projects of our department have focused on the development of the endovascular repair of aneurysms, treatment of peripheral arterial disease with drug-eluting stents, and clinical studies of specific antibodies for heparin-platelet factor 4 (PF4) complexes.

Research Activities

Pediatric Surgery

1. Education

Education for medical students: Children undergoing surgery often have congenital anomalies. Lectures in pediatric surgery for students are based on embryology.

Education for training physicians: Three objectives for training physicians in pediatric surgery are: 1) learning how to obtain blood samples from pediatric patients, 2) understanding fluid therapy for pediatric patients, and 3) learning how to bury sutures.

Education for surgical residents: Residents are able to act as lead surgeons or assistants during pediatric surgery.

2. Clinical studies

a. Endoscopic treatment for vesicoureteral reflux using Deflux[®]

There are 3 options for managing or treating vesicoureteral reflux. We select treatment with Deflux[®] (Oceana Therapeutics, Ltd., Dublin, Ireland), an injectable dextranomer/hyaluronic acid copolymer. Treatment was successful in 2 of 3 cases.

b. Electrolyte and acid-base balances in laparoscopic surgery

Carbon dioxide alters electrolyte and acid-base balances in laparoscopic surgery.

c. In severe cases of gastroesophageal reflux, a surgical procedure called fundoplication is performed. This procedure is performed laparoscopically in our hospital. With minimally invasive laparoscopic surgery, pain is minimized, and the postoperative recovery time is shorter. The number of neurologically handicapped children treated at our hospi-

tal for gastroesophageal reflux has been increasing.

d. The Nuss procedure for treating pectus excavatum aims to force the sternum forward and hold it there with an implanted steel bar without requiring a large incision to resect the abnormal cartilage. In this procedure, the curved steel bar is placed under the sternum through 2 small incisions on the sides of the chest. The number of patients with pectus excavatum treated surgically in our department is the third highest in Japan.

3. Basic studies

a. Laparoscopic surgery contributes to global warming

Carbon dioxide, the most important greenhouse gas, is indispensable for laparoscopic surgery. To assess CO₂ emissions, we first determined the number of laparoscopic operations performed in Japan. Next, we measured the quantity of CO₂ used in our hospital.

b. Inhibitory effects of an antiangiogenesis drug on the metastasis of human neuroblastoma

The loss of antiangiogenesis factors was discovered. We evaluated the effects of several potent antiangiogenesis drugs on the metastasis of neuroblastoma in a mouse model of liver metastasis.

c. Plasmapheresis in severe sepsis or septic shock

During sepsis, microorganisms release various that activate cascade systems, including cytokines, such as tumor necrosis factor alpha and interleukin 6, and complement components. Plasmapheresis is used to remove these factors. We created a rat model of sepsis and evaluated the effects of plasmapheresis.

Vascular Surgery

1. Development of endovascular repair of thoracoabdominal aneurysms

Although stent grafts for the treatment of abdominal aortic aneurysms (AAAs) have been developed and are commercially available, no such stent grafts are available for the treatment of thoracoabdominal aortic aneurysms (TAAAs). The surgical mortality rate following open surgery for the treatment of AAAs is satisfactory, but that for TAAAs remains unacceptably high at 15% to 20%, and further improvement is desperately needed. Because a TAAA involves 1 or more visceral arteries, visceral perfusion must be maintained while the aneurysm is excluded with stent grafts. We have used a custom-made branched stent graft in combination with covered stents (for visceral reconstruction) for the treatment of TAAAs that were considered inoperable because of comorbid conditions or a hostile thorax/abdomen. Although stent graft repair for TAAAs requires long operative and fluoroscopic times, this treatment is feasible and safe.

2. Development of endovascular repair of aortic arch aneurysms: Retrograde in-situ branched surgery

We have developed a new minimally invasive operation for aortic arch aneurysms. After carotid-carotid bypass surgery is performed and stent grafts are placed, a needle is used to push the stent graft through one side of a carotid artery, after which a covered stent is inserted as a branch and deployed into the stent graft (in an in-situ retrograde fashion). We have examined this retrograde in-situ branched surgery in an *in-vitro* study and have applied it clinically. This operation is expected to be a less invasive surgery for aortic arch aneurysms.

3. Research on drug-eluting stents in the superficial femoral artery

The Zilver PTX drug-eluting peripheral stent (Cook Medical, Bloomington, IN, USA) is specifically designed and approved to treat peripheral arterial disease affecting the superficial femoral artery, the main vessel of the thigh. The Zilver PTX is a self-expanding stent made of nitinol, a space-age “shape memory” metal that offers unique mechanical advantages for a stent in the superficial femoral artery.

Both a global registry and a randomized controlled trial, in which most patients were enrolled in the United States, but also in Germany and Japan, is awaiting its 1-year primary endpoint, which was reached in August 2009. We participated in this trial.

4. Clinical study of specific antibodies against heparin-PF4 complexes

Heparin is commonly used for anticoagulation in vascular surgery. Heparin-induced thrombocytopenia (HIT) is a rare but life-threatening complication with thrombosis of veins and arteries. Even if heparin use is limited, it occasionally induces the production of specific antibodies against heparin-PF4 complexes. Patients with such antibodies are at increased risk for HIT. The prevalence of these antibodies in patients receiving heparin is presumably underestimated. Accordingly, we prospectively measured antibodies against heparin-PF4 complexes and activity of PF4 and investigated whether they are related to symptoms of HIT, particularly in patients undergoing major vascular surgery. We measured these variables in 300 patients for 2 years.

The percentage of patients with antibodies to heparin-PF4 complexes was approximately 13%, which was higher than expected. Moreover, PF4 activity tended to be higher in antibody-positive patients than in antibody-negative patients. The results of this study are being statistically analyzed and were reported in 2009.

5. Research on prevention of reperfusion injury during endovascular aneurysmal repair

Large sheaths are usually chosen for endovascular aneurysmal repair. If the inserted sheath is retained at the femoral artery for a long time, the ischemic time of the lower extremities becomes longer, and reperfusion syndrome might occur. We have used a small sheath to supply blood flow to the distal lower extremities and to prevent complete ischemia of the lower extremities and consequent reperfusion syndrome.

Publications

Tanaka K, Hanyu N, Ishida T, Waranabe A, Kawano S, Usuba T, Iino T, Mizuno R. Lactate levels in the detection of preoperative bowel strangulation. *Am Surg.* 2012; **78**: 86-8.

Tanaka K, Kuwashima N, Ashizuka S, Yoshizawa J, Ohki T. Risk factors of infection of implanted device after the Nuss procedure. *Pediatr Surg Int.* 2012; **28**: 873-6.

Kurobe M, Baba Y, Mizutani T, Hiramatsu T, Ohashi S, Tanaka K, Kuwashima N, Ashizuka

S, Yoshizawa J, Yoshida K, Ohki T. Reduced-port surgery for hereditary spherocytosis with cholelithiasis in children. *Jikeikai Med J.* 2012; **59**: 11-5.

Kanaoka Y, Ohki T, Toya N, Ishida A, Tachihara H, Hirayama S, Kurosawa K, Sumi M, Ohta H, Kaneko K. Technical challenges in endovascular repair of complex thoracic aortic aneurysms. *Ann Vasc Dis.* 2012; **5**: 21-9.