Department of Cardiovascular Surgery

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General Summary

The major achievements in our department included both clinical studies and experimental animal studies. The clinical studies included those establishing excellent surgical performance, investigating new techniques, and evaluating alterations in cardiac performance and long-term results after cardiac surgery. New projects we started in the adult team are a risk analysis in adult cardiac surgeries by using national cardiac database and the development of evaluation methods in surgical skill performance for trainees. The experimental animal studies were performed to address clinical problems we are facing. A recent topic for adult surgery is the introduction of new fields: transcatheter aortic valve replacement and a left ventricular assist device program. We started with them by collaborating with other departments. We are also continuously performing several experimental studies with in-vivo models. The experimental projects include evaluating protection of the heart during cardiac arrest and the pulmonary valve. A project we started last year was visualization of the cardiac conduction system in human heart specimens by the high-resolution phase contrast computed tomographic imaging. The major activities are described below.

Research Activities

Echocardiographic evaluation of the postoperative coaptation geometry of the left atrioventricular valve in a complete atrioventricular septal defect
Postoperative echocardiographic assessment was performed in 18 patients, who had undergone complete repair of an atrioventricular septal defect, to analyze the function of the left atrioventricular valve.

Development of a new quantitative method for assessing pulmonary vascular volume with computed tomography
A new method was developed to measure the total pulmonary vascular volume, and its clinical role was evaluated in 38 patients.

Clinical investigation on myocardial protection during a pediatric heart surgery
In infants who had undergone open-heart surgery for a ventricular septal defect, an atrioventricular septal defect, or other congenital malformations with various cardioplegic strategies, biochemical markers for myocardial injury (troponin T) and oxidative stress

(8-iso-prostane) were evaluated.

Experimental studies of "remote preconditioning" as a new therapeutic strategy of myocardial protection
An experimental study in an *in-vivo* piglet model was performed to test the cardioprotective effects of "remote preconditioning" (intermittent ischemia/reperfusion of a remote organ before myocardial reperfusion).

Visualization of the cardiac conduction system in human heart specimens by the high-resolution phase contrast computed tomographic imaging
The visualization of the AV conduction axis within whole heart specimens was feasible with the use of PCCT and verified by subsequent histological examination. Nondestructive evaluation of the AV conduction axis in cardiac specimens and its 3-dimensional representation may allow more comprehensive examination of the conduction tissue in congenital heart anomalies.

Clinical study of adult cardiac surgery
1. Comparison of the early hemodynamic performance between conventional and newly designed bioprosthetic aortic valves
To compare the early hemodynamics of the third-generation high-performance Trifecta valve (St. Jude Medical, St. Paul, MN, USA) and the Magna Ease aortic valve with those of the Perimount aortic valve (Edwards Lifesciences Corp., Irvine, CA, USA), we retrospectively examined 266 patients who had aortic valve replacement, using 173 Perimount valves, 52 Trifecta valves, and 41 Magna Ease valves. The Perimount valves demonstrated a higher pressure gradient than did the Trifecta and Magna Ease valves. Severe patient-prosthesis mismatch (PPM: indexed effective orifice area (EOA) < 0.65 cm^2/m^2) was present at hospital discharge in 8.3% of patients with the Trifecta valve, 5.6% with the Magna Ease valve, and 21.4% with the Perimount valve. The new valves were associated with excellent early hemodynamic performance and provided lower gradients and larger EOA to reduce the rate of severe PPM.
2. Avoidance of PPM after mitral valve replacement with a new type of prosthesis
The effect of PPM after mitral valve replacement is still controversial. In this clinical report, we described 2 patients with small stenotic mitral valves. These patients have received a new type of mechanical prosthesis (ATS M36022mm, Century Medical, Inc., Tokyo, Japan), which has an EOA larger than that of a conventional prosthesis. The new mechanical valve for a small mitral annulus played an important role in avoiding PPM, as identified by an indexed EOA of less than 1.2 cm^2/m^2.
3. Japanese Study of Bidirectional Evaluation of Surgical Performance on Cardiovascular Surgery (jBLADE Study-0)
Background: The cardiac surgery procedure consists of meticulous steps including: (1) opening the chest; (2) establishment of cardiopulmonary bypass (CPB); (3) harvesting saphenous vein graft; (4) harvesting the internal mammary artery for coronary artery bypass grafting (CABG); (5) main procedures, such as aortic valve replacement, mitral valve replacement, and mitral valvuloplasty; (6) cessation of CPB; and (7) closing the

chest. Every trainee should become familiar with and, finally, gain expertise in each step of these procedures. scheduled to elucidate the logistics of the study and the standardized evaluation form.

Purpose: The purposes of the study were (1) to establish, objective, generalize, and standardize then evaluation system and (2) to elucidate the logistics of obtaining informed consent, evaluation of surgical performance, data acquisition, data transfer and management, and final analysis.

Method: Included in this study were board-eligible and board-certified trainees before their first renewal who agreed to participate in the jBLADE-0 study.

Technical skills of these participants will be monitored with video recording. Video records of each case were blinded and evaluated by members of the evaluation committee. As a pilot study, 5 cases of each of 5 modules, including (1) opening chest, (2) establishment of CPB, (3) harvesting saphenous vein graft, (4) harvesting the i- m- a-, and (5) closing chest in 6 institutions, were evaluated, and standardized evaluation criterion were established.

4. Japanese Study of Impact of Body Mass Index on Morbidity and Mortality in Geriatric Patients. Part 1: Coronary Artery Bypass Grafting

Objective: We sought to determine the effect of preoperative nutritional status determined by the body mass index on early mortality and morbidity after CABG in Japan.

Methods: We retrospectively identified 35,674 elderly patients (age ≥ 60 years) who had undergone CABG from January 1, 2008, to December 31, 2012, and had been registered in the Japanese Adult Cardiovascular Surgery Database. These patients were divided into 4 groups on the basis of body mass index. The primary endpoint was defined as early mortality, and the secondary endpoints were defined as composite endpoints, including stroke, transient ischemic attack, new dialysis, mediastinitis, and prolonged ventilation (≥ 24 hours).

Publications

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