Department of Cardiovascular Surgery

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General Summary

The major achievements in our department include both clinical and experimental animal studies. The clinical studies include those establishing excellent surgical performance, investigating new techniques, and evaluating alterations in cardiac performance and long-term results after cardiac surgery. In addition, multi-center analysis of surgical treatment for ischemic mitral regurgitation is becoming new projects. We are also continuously performing several in-vivo and in-vitro experimental studies. The major activities in congenital and adult sections are described below.

Research Activities

1) Experimental study on myocardial protection by a single dose Del Nido cardioplegia was performed and its safe ischemic time was demonstrated to be 90 min by the quantitative analysis of left ventricular functional recovery after ischemia-reperfusion. Subsequent study was conducted to establish the novel formulation of the modified Del Nido solution, which can be clinically applied in Japan.
2) The atrioventricular conduction system in human heart specimens with various types of cardiac anomaly including atrioventricular septal defect, corrected transposition of the great arteries, and right isomerism heart was visualized by the high-resolution phase contrast CT imaging, and the special anatomy of the cardiac conduction bundle in various types of malformations was reconstructed in 3D imaging.
3) Toward improvement of the clinical outcomes after aortic valvuloplasty surgery:
The majority of surgical intervention for aortic regurgitation (AR) had been aortic valve replacement (AVR) using a prosthetic valve. However, the majority of the patients with AR is relatively young, thus bleeding and thromboembolic events caused by life-long anticoagulation therapy for mechanical prosthesis have emerged as serious concern. On the other hand, biological prosthesis has lower durability, thus repeat surgeries have emerged as another concern, although anticoagulation therapy can be eliminated. Aortic valvuloplasty (AVP) can eliminate both concerns, however, long-term durability has still been unclear, therefore durable operative procedures should promptly be established. We have performed 22 AVPs in 2019 and achieved good early outcomes. Kunihara have published many articles with regard to AVP. We have also performed experimental studies with Tokyo Women's Medical University, Institute of Advanced Biomedical Engineering and Science (TWIns) and will continue this project from now on.

4) The impact of glutaraldehyde used for mitral valvuloplasty in patients with mitral infective endocarditis on mid-term outcomes:
We have directly, locally used glutaraldehyde in mitral valvuloplasty for mitral infective endocarditis (IE) since 2004 to clarify repair area and to stabilize anastomosis site. We could have preserved the mitral valve of 30 patients (86%) out of 35 with mitral IE. We have analyzed mid-term outcomes of these 30 cases. We have experienced only one in-hospital mortality. Cumulative survival rate was 89±6% with mean follow-up period of 4.3±3.7 years and 100% follow-up rate of operative survivors. Only one case underwent mitral valve replacement due to recurrent mitral regurgitation on two months postoperatively, although infection was well controlled. Other 29 patients underwent no reoperation. Nakamura published these results in 2018 (Circ J. 2018; 82: 2530-4) and we have used this method also in 2019.
5) Anatomical research for accurate tricuspid annuloplasty:
Tricuspid annuloplasty has widely been performed as a simple and safe procedure and several annuloplasty rings have been available from multiple manufacturers. Each annuloplasty ring is designed based on normal anatomy of the tricuspid valve, however, the detail of the background data has never been published. Therefore, designs of these rings are different from normal tricuspid valve geometry measured by 3D echocardiography. Commissural markers are indicated as points on an annuloplasty ring and their location and interval are not constant among each manufacturer. The tricuspid valve has a wide variety including the additional fourth or fifth leaflet and it is still controversial where each commissure should be fixed.
6) We have performed total arch replacement (TAR) for patients with the atherosclerotic aorta at high risk of embolic stroke. There was no difference in the incidence of stroke between with and without concomitant operation or between various operative procedures. Frozen elephant trunk technique is regarded as a risk factor for stroke in cases with the severely atherosclerotic aorta.
7) Registry study of early outcomes after valve-sparing root replacement and composite valved-graft replacement for aortic regurgitation:
From 2008 to December 31, 2017, the first elective aortic root replacement (excluding infective endocarditis) was performed for 5,303 cases with aortic regurgitation and registered in the JCVSD database. It was found that valve-sparing root replacement surgery was preferred for relatively young patients with mild aortic regurgitation, such as Marfan syndrome, compared with total root replacement surgery. After propensity-score matching (n=1164 each), the valve-sparing root replacement surgery was associated with longer operation time but less postoperative cerebral infarction, shorter ventilation time, and less hospital death (0.8% vs. 1.8%).
8) Investigating the mechanism of inner mitochondrial collapsing by acute overstretch, and the mechanism of heart failure by acute volume overload:
The pulmonary artery of a male SD rat was ligated for 30 seconds and the right ventricular papillary muscle was extended to 120% of the length of Lmax within 2 seconds and maintained for 5 minutes. As a result, it was found that acute and transient hyperextension disrupted the inner mitochondrial membrane, but no subsequent decline in cardiac function was observed.

9) 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, (6) cessation of CPB; and (7) closing the chest.

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

Basic technical skills of these participants were monitored with video recording. A total of 155 video records of each case were blinded and evaluated by members of the evaluation committee and standardized evaluation was confirmed with over 90% consistency.

Publications

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