

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, analysis based on the Japanese cardiovascular surgery database 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) Postoperative geometry of left atrioventricular valve in atrioventricular septal defect: Echocardiographic assessment was performed in 14 patients who underwent intracardiac repair to identify the risk profile of LAVV regurgitation.
- 2) Clinical benefits of blood cardioplegia (BCP) during a pediatric heart surgery: Biochemical markers for myocardial injury (troponin T) and oxidative stress (8-isoprostane) were evaluated to show the role of BCP.
- 3) 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.
- 4) The cardiac conduction system (CS) in human heart specimens with various types of cardiac anomaly was visualized by the high-resolution phase contrast CT imaging, and 3D reconstruction of CS was feasible.
- 5) A quantitative assessment of pulmonary vasculature was performed by the newly developed index, the total pulmonary vascular volume index, using computed tomography.

- 6) 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 19 AVPs since June 2018 and achieved good early outcomes. 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.

7) 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 $89 \pm 6\%$ 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 as an article entitled "Safe use of glutaraldehyde to repair the destroyed valve in active infective mitral valve endocarditis (Circ J. 2018; 82: 2530-4)". Kuniyoshi published an editorial comment for this article entitled "Fixation or disinfection? (Circ J. 2018; 82: 2472-4)".

8) 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.

9) 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.

10) Registry study of early outcomes after valve-sparing root replacement and composite valved-graft replacement for aortic regurgitation.

11) Investigating the mechanism of inner mitochondrial collapsing by acute overstretch, and the mechanism of heart failure by acute volume overload:

Acute overstretch of an isolated rat papillary muscle caused inner mitochondrial collapsing with preserved sarcomere structure. Abrupt disruption in mitochondria structure by acute diastolic overstretch could account for the mechanisms on pathogenesis of acute volume-overloaded heart failure.

Publications

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