Plenary 1

March 25, 2022 9:00-10:10 / Track 1

C-PL1-1 Early and mid-term outcomes with total arterial revascularization vs non-total arterial revascularization of off-pump coronary artery bypass grafting

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BackgroundFavorable results of off-pump coronary artery bypass grafting (OPCAB) in multivessel coronary artery disease have been reported. However, the choice of conduits remains controversial. In this study, we compare the early and mid-term outcomes with total arterial revascularization (TAR) vs non-TAR of OPCAB.MethodsFrom April 2011 to March 2021, consecutive 1470 patients underwent isolated OPCAB with at least two distal anastomoses (at least one arterial graft) in our hospital. We retrospectively reviewed the data from medical records.Results385 (26.2%) patients received TAR. Of these patients, left internal mammary artery was used as a conduit in 100%, right internal mammary artery in 78.2%, radial artery in 47.8%, and gastroepiploic artery in 35.8%. The total number of distal anastomoses were 2, 3, and 4 or more in 95 (24.7%), 178 (46.2%), and 112 patients (29.1%), respectively. 30-day mortality (3 [0.8%] vs 30 [2.8%], P<0.05) differed between TAR vs non-TAR group. In the 1 , 3 , and 5 year follow up TAR group, the rate of all-cause death was 4.6%, 12.9%, and 19.5%; the rate of cardiac death was 1.9%, 6.7%, and 9.0%. There was a significant difference between TAR vs non-TAR group in all-cause death (P<0.05), cardiac death (P<0.05), and major adverse cardiac and cerebrovascular events (cardiac death, repeat revascularization and myocardial infarction, stroke, or hospitalization for heart failure) (P<0.05).ConclusionOPCAB with TAR was associated with favorable early and mid-term outcomes.

C-PL1-2 Feasibility of previous wound (such as sternotomy)-sparing Redo OPCAB Surgery

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Background: Redo CABG is still remained as a major concern to cardiac surgeons due to high morbidity and mortality. Off-pump technique and minimally invasive approach thru avoiding redo-sternotomy are a safe combination modality to treat repeated coronary artery atherosclerosis. We evaluate the feasibility of redo OPCAB thru avoiding previous wound re-access, and its results.Methods: From April 1998 to November 2021, 821 patients underwent CABG. Among them, we conducted OPCAB in 376 patients (46%), and redo OPCAB in 61 cases (7%). These 61 patients are the subjects of this study. Median age is 71 years old and all male. Coronary access routes were Lt anterior small thoracotomy in 30, para-sternal vertical thoracotomy in 13, inverted U laparotomy in 9 and full-sternotomy (previous MICS) in 9. Time interval between 1st and redo is 9.2 years. Timing of redo is early failure in 5 at 8.4 months, midterm failure in 10 at 1.9 years and long-term failure in 44 at 10.5 years. The reason of redo is newly-developed native coronary lesion in 8 (13%), remained intermediate disease progression in 12 (20%) and previous graft failure in 43 (71%). Failed grafts were LIMA-to-LAD in 21, non-LAD arterial graft in 18 and non-LAD vein graft in 15, respectively.Results: Median op time is 315 minutes, and there was no on-pump conversion but intraoperative IABP support in 17 cases (28%). Postop ICU-stay and hospital-stay are 3 and 15 days. There was 6 cases of operative mortality (10%) and 26 morbidities (43%). All-cause and cardiac death-free mean survival times are 13.4 and 16.7 years. 1-, 5-, 10-, 15-year overall and cardiac death-free survival rates are 80%, 74%, 74%, 74% and 94%, 94%, 94%, 94%, respectively.Conclusions: Conducting redo off-pump CABG surgery avoiding previous wound re-access is feasible and its results are acceptable.

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C-PL1-3 Early results of aortic valve sparing operation for patients with aortic regurgitation.

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OBJECTIVE: To analyze clinical outcomes of aortic valve sparing operation for aortic valve regurgitation (AR). METHODS: From April 2018 to October 2021, 48 patients with aortic regurgitation (AR) underwent aortic valve repair. Patients were divided in 3 groups. Four patients had an isolated valve repair (group P), 22 patients had aortic valve sparing root replacement (VSRR) (group R), and 22 patients had VSRR plus valve repair (group P+R). RESULT: There was no early mortality. The ages at surgery were 67.3 ± 13.2 years. The echocardiographic follow-up period was 11.8 ± 9.3 months. Three patients had bicuspid valve (BAV), two patients had unicuspid valve. The grade of preoperative AR in group R was severe in 4, moderate in 9, mild in 5, trace in 3, and none in 1. In group P, AR was moderate in 2 and mild in 2. In group P+R, AR was severe in 17, and moderate in 5. The preoperative left ventricular end-diastolic dimension (LVDd) was 41.6 ± 2.5mm in group P, 49.7 ± 5.8mm in group R, and 58.2 ± 6.5mm in group P+R, respectively. The left ventricular end-systolic dimension (LVDs) was 27.5 ± 2.8mm in group P, 31.5 ± 5.6mm in group R, and 40.1 ± 6.1mm in group P+R. The grade of postoperative AR in group P was mild in 2, and none in 2. AR in group R was mild in 11, trace in 9, and none in 2. AR in group P+R was mild in 8, trace in 10, and none in 4. The postoperative LVDd was 44.1 ± 3.0mm in group P, 45.8 ± 5.9mm in group R, and 50.5 ± 5.1mm in group P+R. The LVDs was 28.5 ± 3.7mm in group P, 30.4 ± 6.1mm in group R, and 34.8 ± 6.0mm in group P+R. CONCLUSION: Aortic valve sparing operation was safely performed and reproducible. The early outcome was satisfactory.

C-PL1-4 Hemodynamic assessment of aortic valvuloplasty for aortic regurgitation

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Background: Aortic valvuloplasty (AVP) for bicuspid aortic valve (BAV) carries the risk of postoperative stenosis. We evaluated hemodynamic differences by transthoracic echocardiography (TTE) between AVP for BAV or tricuspid aortic valve (TAV) and aortic valve replacement (AVR). In addition, we assessed whether postoperative stenosis affects mid-term outcomes of AVP. **Methods**: Patients who underwent AVP between March 2014 and October 2021 were classified into 2 groups: AVP for BAV (Group-PB) (n=42) and AVP for TAV (Group-PT) (n=70). We also enrolled patients who underwent AVR for aortic regurgitation (Group-R) between November 2002 and October 2021 (n=132). Mean age of Group-PB, PT, and R were 38.2 ± 13.2, 55.5 ± 14.8, and 62.9 ± 14.0 years old, respectively. Valve-sparing aortic root replacement, cusp repair, and external suture annuloplasty was performed in 16 (38.1%), 39 (92.9%), and 42 (100%) patients in Group-PB and 32 (45.7%), 49 (70.0%), and 62 (88.6%) patients in Group-PT, respectively. Group-R consisted of 93 (70.5%) bioprosthetic- and 39 (29.5%) mechanical valves. Mid-term outcomes were compared within Group-PB by peak transvalvular gradients: ≥ 20mmHg (subgroup-H) and <20mmHg (subgroup-L). **Results**: A 7-day and 1-year TTE showed the highest peak/mean transvalvular gradients in Group-PB (21.1 ± 10.0/12.5 ± 6.2mmHg and 21.2 ± 10.6/11.7 ± 6.1mmHg, respectively) and the lowest it in Group-PT (10.4 ± 6.6/5.7 ± 3.5mmHg and 9.9 ± 6.2/5.2 ± 3.4mmHg, respectively) ($p<0.001$). In addition, higher transvalvular velocity was shown in Group-PB (2.3 ± 0.5m/s and 2.4 ± 0.6m/s) ($p<0.001$). In subgroup-H and L, freedom from aortic regurgitation>2 at 5 years were 94.4% vs. 87.2% ($p=0.687$) and reoperation were 94.4% vs. 100.0% ($p=0.317$), respectively. **Conclusion**: AVP for TAV may maintain favorable valve function, whereas AVP for BAV has a risk of postoperative stenosis. However, higher transvalvular gradient after AVP did not affect the mid-term outcomes in this study.

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C-PL1-6 Early clinical results of the clover technique for severe tricuspid regurgitation

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[Objectives] This study assesses the early clinical results of the clover technique functional or primary severe tricuspid regurgitation (TR) in terms of tricuspid valve function and right ventricular function.

[Methods] From March 2015, 22 consecutive patients (mean age 76 ± 10 years) with severe TR underwent the clover technique with ring annuloplasty. The etiology of severe TR was functional in 17 patients, primary in 5 patients. Preoperative transthoracic echocardiography demonstrated severe TR associated with significant tricuspid annular dilatation (tricuspid annulus diameter index; 28 ± 4 mm/m²). There were 3 redo cases following mitral valve replacement (n=2) and mitral valve repair (n=1). Concomitant procedures (mainly mitral valve repair) were performed in 19 patients (86%). An echocardiographic study was performed before surgery, at discharge, and at follow-up.

[Results] Hospital mortality was 4.5% (1/22). At hospital discharge, all survivors demonstrated mild (n=2) or less than mild (n=19) TR. Clinical signs of right heart failure disappeared and NYHA functional class improved in all survivors. During follow-up extending 80 months (mean 37 months), 4 patients died due to stroke (n=2) and cancer (n=2). At latest echocardiographic study in 17 patients, TR was mild in 3 patients and less than mild in 14 patients. Mean tricuspid gradient was 2.3 ± 1.0 mmHg.

[Conclusions] The clover technique is an easy and rapid procedure to correct severe TR without residual TR. The long-term follow-up is required to establish the feasibility of this unique technique in terms of recurrent TR and recovery of right ventricular dysfunction.

C-PL1-7 The role of left atrial wall thickness as a prognostic factor for recurrence of atrial fibrillation after maze operation

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The influence of left atrial wall thickness (LAWT) on outcome of Maze operation is unclear. Changes in the structure and electrical behavior of the left atrium (LA) are known to occur with conditions that predispose to AF. We analyzed the role of LAWT as an important prognostic factor for sinus rhythm conversion after Maze operation. Data was collected on 98 patients who underwent maze operation (with mitral valve surgery, n=92) from August 2018 to July 2021. All patients` LA was resected for size reduction and pathologically analyzed. Pre- and postoperative echocardiogram, electrocardiogram and preoperative cardiac computed tomography (CT) were evaluated.Sinus rhythm was maintained in 70 of 98(71%) during follow-up (mean, 736 days). Multivariate logistic regression identified myocardium thickness as an important prognostic factor (mean 2.2mm) for sinus rhythm conversion and maintenance.The cutoff value for predicting sinus conversion was 2.5mm (p=0.02) by using receive operating curve method. Also preoperative CT measured LAWT is well correlated with pathologic real thickness. In our study, LAWT is important predicting factor for sinus rhythm conversion and maintenance after maze operation and preoperative CT measured LAWT is very useful information for predicting the maze operation result.

Plenary 2

March 25, 2022 13:00-14:10 / Track 1

C-PL2-1 Minimally invasive coronary artery bypass grafting: Early Experience in a Provincial Hospital of Thailand

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Objective: At Present, minimally invasive coronary artery bypass grafting through small left anterior thoracotomy can be performed either with single bypass or multiple bypasses or even in combination with percutaneous coronary intervention. We retrospectively reviewed early outcomes in our first 170 cases undergoing this technique.Methods: from 2014 to 2021, 170 patients underwent minimally invasive coronary artery bypass grafting: 52 patients () with isolated left anterior descending artery bypass and 118 patients() with multivessel disease as a part of complete revascularization or hybrid procedure. Early results, major adverse cardiac and cerebral events and death were analyzed.Results: Mean age of patients was 72 ± 10.2 years, and median Society of Thoracic Surgeons Score was 2.4 (interquartile range, 0.5-7.7%) . Median sternotomy conversion in 1 patient (0.6%), On-pump conversion in 2 patients (1.2%). 30-day mortality occurred in 2 patients (1.2%) and perioperative stroke occurred in 1 patients (0.6%). Computed tomography scan was performed prior to discharge (n=149), demonstrated a 95.1% graft patency rate. Kaplan-Meier survival survival curve shows 90% at 5 years (95% confidence interval, 83-92.1). Survival freedom from major adverse events was 87.0% (95% confidence interval, 85.7-89.0) at 5 years.Conclusion: Minimally invasive coronary artery bypass grafting can be performed safely with low postoperative morbidity and mortality with excellent short and midterm survival with a reduction in surgical invasiveness

C-PL2-2 Impact of the no-touch harvesting technique on vessel diameter of saphenous vein grafts for coronary artery bypass grafting

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BackgroundSaphenous vein grafts (SVG) have been important conduits for coronary artery bypass grafting (CABG). There are increasing numbers of studies on the potential advantages of the no-touch harvesting technique of SVG for CABG. However, the impact of the no-touch harvesting technique on vessel diameter still remains unclear.MethodsThis retrospective single-center study comprised 166 consecutive patients who underwent isolated CABG using SVGs in Yamaguchi University Hospital. SVGs were harvested in the conventional manner in 83 patients (conventional group: CV group), and using the no-touch technique (no-touch group: NT group) in the other 83 patients. We analyzed the pre- and post-operative vessel diameters of SVG. The preoperative diameter was measured using ultrasound images, and the postoperative diameter was measured with the image analyzing software Ziostation (Ziosoft Inc., Tokyo, Japan) using the enhanced CT scan image. The diameter discrepancy between the SVG and the coronary artery at the anastomotic site was also analyzed.ResultsA total of 135 SVGs (66 grafts in CV group, 69 grafts in NT group) were evaluated by postoperative CT scan or angiography. Early graft patency was 96% in the CV group and 100% in the NT group (p=0.24). More detailed evaluations were performed in 109 SVGs (52 grafts in the CV group, 57 grafts in the NT group), because they had high resolution CT scan images. Preoperative vessel diameters were not significantly different between the two groups (CV 2.6 ± 0.7mm vs NT 2.8 ± 0.4mm, p=0.07). Postoperative vessel diameters were significantly smaller in the NT group (CV 3.40. ± 5mm vs NT 2.7 ± 0.4mm, p<0.001). The diameter ratio of SVG to coronary artery was significantly smaller in the NT group (CV 1.79 vs NT 1.57, p<0.001).ConclusionsNo-touch harvesting technique prevented expansion of the grafts and resulted in less mismatch in the diameter between the SVG and the coronary artery.

Plenary 2

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C-PL2-3 Totally 3D-Endoscopic Aortic Valve Replacement Using Various Valve Designs

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Purpose: Few have reported on totally endoscopic surgical aortic valve replacement (AVR). We describe our approach and perioperative outcomes of totally endoscopic AVR using various valve designs. Methods: 153 patients (75 males, mean age 75 ± 11years) underwent totally endoscopic AVR from June 2017 to July 2021 in a tertiary care center. We utilized the three-port technique; 3-4 cm main port without rib-spreading, 10 mm 3D-endoscopic port, and 5 mm left-hand port. Cardiopulmonary bypass (CPB) was established through groin cannulations. All the sutures were hand-tied with a knot-pusher. Outcomes up to 30 days after the operation were described. Cross-clamp time was compared between patients who received rapid deployment/sutureless valve and standard stented valve. Results: 138/150 words Of 153 patients, concomitant surgery was performed in 41 (27%) patients. 16 (10%) had a concomitant mitral procedure, 6 (3.9%) had tricuspid annuloplasty, and 29 (19%) had left atrial appendage closure. A stented bioprosthesis was implanted in 112 (73%) patients, a mechanical valve in 13 (8.4%) patients, and rapid deployment/sutureless valve in 28 (18%) patients. Mean operation time, CPB time, and aortic cross-clamp time were 191 ± 122, 123 ± 114, and 83 ± 32 minutes, respectively. Rapid deployment/sutureless valve had shorter cross-clamp time than standard stented valve in isolated AVRs (72 ± 28 vs. 91 ± 32 minutes, p=0.0029). Thirty-day mortality occurred in one patient (0.6%). Two patients (1.3%) converted to sternotomy. One patient (0.6%) required permanent pacemaker implantation. Major neurologic events occurred in two patients (1.3%). Median ICU stay and hospital stay were 1 (interquartile range 1 to 2) and 8 (7 to 10) days, respectively. No patient had greater-than-mild aortic insufficiency at discharge. Conclusions: Totally endoscopic AVR is safe and reproducible in various valve designs and is able to address concomitant valve diseases. Rapid deployment and sutureless valves shortened cross-clamp time. Totally endoscopic AVR is an attractive alternative approach.

C-PL2-4 Early Results and Hemodynamic Outcomes Associated with Perceval Sutureless Aortic Valve Replacement Single Institutional Experience in Japan

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Background The aim of this study was to evaluate the safety and performance of the Perceval valve for AVR in patients including a minimally invasive approach at one and two years after undergoing AS.
Methods Data were collected retrospectively for 82 consecutive patients (mean age 77.1 years, 53.7% females) who underwent Perceval AVR from May 2019 to June 2021. In 34 (41.5%) of those cases, isolated Perceval AVR with a less invasive approach was performed and the results were compared to patients who underwent sutured AVR with a less invasive approach (n=147) between April 2015 and June 2021 by the same surgeon and prospectively stored in a database. Analysis of those cases resulted in 22 patients in each group who were matched and reviewed.
Results Implantation was successful in all 82 patients (100%) who received a Perceval valve with mean cross clamp and CPB times of 64.8 and 98.5 minutes, respectively. In analyses of the less invasive approach cases, those times were shorter in the Perceval group as compared to the sutured group (60.8 vs. 94.5 minutes, P<0.001, 87.1 vs. 128 minutes, P<0.001, respectively). Postoperative thrombocytopenia (platelet count <50000) occurrence was significantly greater in the Perceval group (n=12, 55%) as compared to the sutured AVR group (n=1, 4.5%) (P<0.001). The two year site reported event rate was 9.8% (n=8) for all cause mortality, 1.2% (n=1) for cardiac mortality, 1.2% (n=1) for stroke, and 2.4% (n=2) for endocarditis and valve related reoperation, while there were no instances of paravalvular leak or structural valve deterioration. At the last follow up examination, preoperative mean pressure gradients were decreased from 45.3 mmHg to 11.6 mmHg (P<0.001).
Conclusions The Perceval valve represents a promising alternative to biological AVR, especially as part of a less invasive approach.

Plenary 2

March 25, 2022 13:00-14:10 / Track 1

C-PL2-5 Is it feasible to apply MICS approach for patients who have a history of previous open heart surgery?

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Purpose: As the number of minimally invasive cardiac surgery (MICS) cases increases, the range of its application is expanding. In reoperation of the mitral valve and tricuspid valve in patients with a history of previous open heart surgery, MICS approach may have the potential to be useful procedure. We sought to evaluate its efficacy.Patients and methods: Seven patients (mean age 69 years old, 5 males) who had a history of previous open heart surgery by midline incision and underwent surgery using MICS approach were included. Five had mitral valve (MV) surgery, 1 root replacement, and 1 total arch replacement. Operative indications were recurrence after mitral valve repair in 5 cases, artificial valve dysfunction in 1, perivalvular regurgitation in 1, and tricuspid regurgitation in 1. We examined the operative methods and results.Results: (1) Re-MV repair was performed in 1 case, MV replacement in 4 cases, perivalvular regurgitation repair in 1 case, and tricuspid valve repair in 1 case,. (2) In two cases, it was difficult to cross-clamp the aorta after graft replacement, and surgery was performed under on-pump beating condition. Dissection of adhesion between the lung and pericardium was the key, and an incision slightly closer to the mid-line was effective. For the site of lung injury during adhesion dissection, we tried to repair before heparin administration. The surgical exposure was good in all cases. (3) All cases could undergo surgery by MICS. Cardiopulmonary bypass time tended to be longer than that of initial MICS surgery. There were no operative mortality. The postoperative course was acceptable.Conclusions: Re-operation by the MICS approach for patients with a history of previous open heart surgery requires attention to severe adhesion and pulmonary hemorrhage, and our results were satisfactory. It is considered to be feasible to apply MICS approach for this cohort.

C-PL2-6 Papillary Muscle Relocation Anteriorly Improves the Survival for Functional Mitral Regurgitation.

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Background

We have surgically intervened in the mitral subvalvular apparatus for functional mitral regurgitation. This study investigated our long-term outcomes.

Methods

The study investigated 86 patients undergoing valve repair with restrictive mitral annuloplasty for functional mitral regurgitation. Patients with reduced leaflet mobility due to tethering underwent additional bilateral papillary muscle relocation. The relocation was performed toward the posterior annulus in some cases and the anterior annulus in others.

Results

Independent preoperative risk factors for 5-year survival were left ventricular ejection fraction, patient age, and B-type natriuretic peptide (BNP) level. The 5-year survival for patients with a BNP level of less than 1000 pg/ml was 78.0%, but the BNP level of 1000 pg/ml or more was 28.4% ($p = 0.001$). In patients with BNP less than 1000 pg/ml, the survival with the anterior relocation was 84.7%, without papillary muscle relocation 78.6%, and with the posterior relocation 57.1%. The posterior relocation showed significantly higher risk than the anterior relocation when adjusting for preoperative risk factors by Cox proportional hazards regression (hazard ratio 12.77, $p= 0.011$). The risk of restrictive mitral annuloplasty alone was not significantly different from that of the anterior relocation. Reverse remodeling of the left ventricle was observed in the anterior relocation cases for three years after surgery.

Conclusions

Patients with significantly high BNP had poor survival after valve repair for functional mitral regurgitation. Long-term survival was excellent in patients who underwent bilateral papillary muscle relocation anteriorly when adjusted for preoperative risk factors.

Plenary 2

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C-PL2-7 Mixed Reality (Holography) - Guided Minimally Invasive Cardiac Surgery - A-First-in Man Comparative Feasibility Study

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Objective:The operative field and surgical exposure for Minimally Invasive Surgery (MIS) cardiac surgical procedures is limited. Meticulous preoperative planning and intraoperative guidance is required for successful MIS cardiac surgery.Methods:We describe the first MIS Cardiac Surgical procedures using HoloLens 2, which is a mixed reality (MR) device from Microsoft, as an intra-operative guide. The first procedure was a MIS Aortic Valve Replacement (AVR) via Right Anterior Small Thoracotomy in totally endoscopic technique. The second procedure was a MIS Coronary Artery Bypass Graft surgery (Totally Arterial CABG) - via Left Anterior Small Thoracotomy, in beating-heart technique. 3D segmentations were performed using patient's computed tomography (CT) images and subsequently rendered into a 3D hologram on the HoloLens. This hologram was then superimposed on the patient on the operating table using the xyphoid and the clavicle as a reference landmark and used as a real-time anatomical image guide for the surgery and incision site marked.Results:In both cases, the incision site marked with and without the HoloLens differed by 1 rib space. Both incision sites marked using HoloLens were found to be more suitable than conventional marking, providing better access to the operating field. The endoscopic tool distribution (camera insertion, LV vent, and the relation of the aorta and its angulation relative to the sternum) could be better appreciated and/or selected. The transparent visor of the HoloLens also allowed unobstructed views of the operating field. The xyphoid process and the clavicle provided a consistent reference point to lock the hologram in place, ensuring accurate placement of the hologram.Conclusion:The use of MR devices in MIS cardiac surgical procedures can improve pre-operative surgical planning and understanding of anatomical relationships, and intraoperative real-time image guidance, with a potential to improve surgical precision, decrease operating time, and improving patient safety.

Plenary 3

March 25, 2022 14:20-15:20 / Track 1

A-PL1-1 Mini-Access Aortic Root Reimplantation Surgery: Early Results

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Backgrounds Despite wide acceptance of minimally-invasive approaches in heart valve surgeries, its application on valve-sparing root surgeries has been limited because of its technical difficulties and complexity. Here we present our early experiences with mini-access root reimplantation procedure.
Methods The study enrolled 27 consecutive patients (age, 56.0 ± 14.7years; 23 males; MINI group) who underwent mini-access David procedure from November 2018 to February 2020. Mini-access approach involved upper hemi-sternotomy down to 3rd or 4th intercostal space through a small incision (5-10cm). Concomitant hemiarch replacement and ablation of atrial fibrillation through roof approach were also included. To compare outcomes against standard sternotomy approach, 26 patients with equivalent procedures selected from 61 patients who underwent David procedure between 2015 and 2020 served as control (CONV group).
Results At baseline, majority of patients had severe aortic insufficiency (AI) in both groups. Aortic clamping and cardiopulmonary bypass times were similar. There were no cases of early mortality or postoperative ECMO support while small numbers of complications occurred in either groups. MINI group had shorter mechanical ventilation time and less amount of transfusion than CONV group. Postoperative AI degree was similar for both groups with most remaining ≤ mild.
Conclusions Mini-access root reimplantation surgery showed excellent early postoperative outcomes equivalent or even superior to conventional sternotomy approach. These results should be further validated from larger experiences with long-term follow-up.

Plenary 3

March 25, 2022 14:20-15:20 / Track 1

A-PL1-2 Perioperative and long-term outcomes of redo Bentall procedure after cardiac surgery

Kyokun Uehara, Taku Shirakami, Yosuke Sugita, Junpei Kobiki, Yasue Fujiwara, Shinya Takimoto, Manabu Morishima, Atsushi Iwakura

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Objectives: Reoperative aortic root replacement is a complex procedure. The purpose of this study is to evaluate the operative and long-term outcomes of redo Bentall procedure after cardiac surgery, compared to the results of primary Bentall procedure.Methods: Between 2007 and 2020, redo Bentall procedure was performed for 20 patients and primary Bentall procedure for 41 patients. Redo operation within 30 days after the primary operation was excluded. There were 15 (75.0%) men with the mean age of 59.4 ± 15.3 years. Indications for reoperation were; aortic root dilatation in 10 (50.0 %) patients, recurrent aortic dissection in 5 (25.0%), pseudoaneurysm in 4 (20.0%), and prosthetic valve endocarditis in 1 (5.0%). The median interval between the previous surgery to the redo Bentall operation was 15.3 years. Perioperative and long-term follow-up data were analyzed.Results: In the redo Bentall operation with a composite graft with a mechanical valve in 10 (50%) and a biological valve in 10 (50%), coronary arteries were reattached using Carrel patch technique in 16 (80.0%), Piehler technique in 3 (15.0%) and Cabrol technique in 1 (5.0%). No patient required coronary artery bypass grafting. Operation time (555.9 ± 160.5 minutes), cardiopulmonary bypass time (301.2 ± 129.8 minutes), and cross-clamp time (185.4 ± 55.2 minutes) were longer in the redo Bentall operation ($p<0.001$, 0.020 and 0.047, respectively). In-hospital mortality rate was similar (5.0% vs 2.4%, $p=0.65$). The 3-year, 5-year, and 10-year survival were 92.3%, 92.3%, and 92.3%, respectively, and 86.0%, 81.9%, and 81.9%, respectively in the primary Bentall operation ($p=0.40$). The rates of 10-year freedom from the reoperation were 100% vs 93.4 % ($p=0.36$). Conclusions: Redo Bentall operation requires longer procedure time, however, acceptable perioperative and long-term outcomes would support that Bentall operation is a crucial option for redo aortic root replacement.

A-PL1-3 Svensson Procedure of the Aortic Root Replacement for Reoperations after the Proximal Aortic Surgery

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(Background)
Reoperative aortic root replacement is usually complex and challenging for surgeons, especially for the cases after the proximal aortic operations. It often requires several maneuvers adjusting for each situation. We have been performing a modified Bentall procedure reported by Svensson for such complicated cases. We herein examine our operative results.

(Patients and Operative methods)
We have reconstructed the left coronary artery ostium in our operations with a long interposed graft wrapping behind the composite graft. From April 2010 to April 2020, We performed this procedure for 18 reoperations of aortic root replacement (mean age 60.4 ± 16.7 years, 13 males) after the proximal aortic surgery. Their previous operation included aortic replacement (n=8), aortic valve replacement (n=8), and aortic root replacement (n=2). Operative indications included aortic root dilatation (n=6), pseudoaneurysm (n=9), and prosthetic valve endocarditis (n=6). As to other past medical histories, cerebrovascular disorders were seen in 7 patients (39%), and three patients (17%) were in New York Heart Association functional class 3 or 4.

(Results)
There was 1 hospital death (5.6%) of the salvage case for pseudoaneurysm rupture. During postoperative courses, 5 patients (27.8%) required prolonged ventilation, and 2 (11.1%) patients needed reoperations for bleeding or mediastinitis. The postoperative CT confirmed the patency of the interposed graft to the left coronary artery in all cases. However, among 3 patients of the late deaths, the left coronary artery stenosis was detected for at least 1 case.

(Conclusion)
Our early operative results were considered to be acceptable. Modified Bentall procedure using the Svensson technique would be helpful for the reoperation cases from the point that we could avoid dividing dense adhesion to reconstruct the coronary arteries.

Plenary 3

March 25, 2022 14:20-15:20 / Track 1

A-PL1-4 A surgical management for post-TEVAR complications: "Zone 0 arch repair" strategy using a frozen elephant

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Cardiovascular Surgery, Akita University Graduate School of Medicine

BACKGROUND: Post-TEVAR complications such as retrograde type A dissection (RTAD) and proximal endoleak (type Ia) are required to undergo secondary interventions for preventing life-threatening sequelae. We have performed the "zone 0 arch repair" strategy using a frozen elephant trunk (FET) as an open proximal aortic repair for the post-TEVAR complications.
METHODS: From 2015 through 2021, 281 patients underwent TEVAR, and FETs were deployed from the zone 0 aorta into the descending aorta in 8 (2.8%) patients (2 women, mean age, 71 years, range, 54-80 years). Complications after TEVAR included RTAD (n=4) and Type Ia endoleak (n=4). The median interval between the TEVAR and secondary proximal repair was 403 days (range: 18-2569 days). All secondary procedures were performed by a median sternotomy under hypothermic cardiopulmonary bypass and selective cerebral perfusion. After lower body circulatory arrest (CA) at the rectal temperature <25&degC, the ascending aorta was transected proximal to the origin of the innominate artery. The preexisting proximal bare stents were removed in some cases. A 10% - 20% oversized FET (J-graft Frozenix) was implanted into the preexisting TEVAR stent graft. The proximal FET segment was then anastomosed to a 4-branched arch graft together with the distal aortic end. After lower body reperfusion, the proximal aortic anastomosis was performed, followed by myocardial reperfusion. The arch vessels were then reimplanted with a separate branched arch graft in an end-to-end fashion.
RESULTS: The mean operation time, aortic cross-clamp time and lower body CA time were 381 min, 96 min and 45 min, respectively. There was no in-hospital death, major complication, or aorta-related reintervention. Successful repairs without endoleak were observed on the postoperative CT angiography.
CONCLUSIONS: Our results suggest that the "zone 0 arch repair" strategy may be a useful and easy method for open proximal aortic repair in patients with post-TEVAR complications.

A-PL1-5 The differences of midterm outcomes in debranching thoracic endovascular aortic repair between zone 0 and zone 1-2 landing

Yoshimasa Seike[1)], Tetsuya Fukuda[2)], Koki Yokawa[1)], Shigeki Koizumi[1)], Kenta Masada[1)], Yosuke Inoue[1)], Akiyuki Kotoku[2)], Hiroki Horinouchi[2)], Hiroaki Sasaki[1)], Hitoshi Matsuda[1)]

1) Cardiovascular Surgery, National Cerebral and Cardiovascular Center, 2) Radiology, National Cerebral and Cardiovascular Center

Objective: Since 2007, we have applied debranching thoracic endovascular aortic repair (d-TEVAR) for elderly and/ or high-risk patients with aortic arch aneurysm. However, debranching TEVAR for zone 0 landing (Z0-TEVAR) is still challenging compared with zone 1 or zone 2 landing d-TEVAR (Z1/2-TEVAR). The aim of this study was to compare the mid-term outcomes between Z0-TEVAR and Z1/2-TEVAR to evaluate the appropriateness of Z0-TEVAR as the first choice for aortic arch aneurysm in the high-risk patients.Methods: Medical records of 200 patients who underwent d-TEVAR between 2007 and 2019 were retrospectively reviewed. Of these, 40 patients who underwent Z0-TEVAR (82 ± 6.1 years, 28 men) and 160 Z1/2-TEVAR (77 ± 8.1 years, 125 men) were compared. To adjust differences in patients' characteristics, 33 patients of each group were matched using propensity scores (PSM).Results: Freedom from all causes of mortality was significantly lower in Z0-TEVAR (2year/4years: 68%/45%) compared with Z1/2-TEVAR (87%/75%, p<0.001). Freedom from aorta-related mortality was significantly lower in Z0-TEVAR (79%/73%) compared with Z1/2-TEVAR (96%/92%, p<0.001). Freedom from stroke was significantly lower in Z0-TEVAR (79%/79%) compared with Z1/2-TEVAR (96%/94%, p=0.001). Freedom from reintervention was similar (Z0-TEVAR: 92%/92%, Z1/2-TEVAR: 96%/82%, p=0.326). Type A dissection post-TEVAR was observed in 3 (7.5%) of Z0-TEVAR, but none in Z1/2-TEVAR (p= 0.006). Pneumonia was also frequent in Z0-TEVAR (n=8, 30%) than Z1/2-TEVAR (n=4, 2.5%) (p<0.001). PSM also yielded worse (all causes of mortality (Z0-TEVAR: 66%/44% vs. Z1/2-TEVAR: 87%/72%, p=0.017), aorta-related mortality (77%/71% vs. 94%/94%, p=0.046) and stroke (79%/79% vs. 95%/95%, p = 0.027) in Z0-TEVAR. Freedom form reintervention (95% and 95%, 90% and 81%, p = 0.136) was similar.Conclusions: The mid-term results of Z1/2-TEVAR were favorable. While, higher mid-term mortality and stroke rates after Z0-TEVAR were confirmed by PSM. Z0-TEVAR would be an alternative choice for zone 0 landing TEVAR in high-risk patients.

Plenary 3

March 25, 2022 14:20-15:20 / Track 1

A-PL1-6 Does cold blood perfusion into critical segmental artery result in uniform temperature decrease at lower spinal cord?

Masayuki Otani, Koki Ito, Konosuke Sasaki, Ryuichi Taketomi, Kota Itagaki, Kay Maeda, Yusuke Suzuki, Tomoyuki Suzuki, Shintaro Katahira, Goro Takahashi, Kiichiro Kumagai, Yoshikatsu Saiki

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Objective: We have adopted selective hypothermic intercostal artery perfusion (HIAP) in thoracoabdominal aortic aneurysm (TAAA) repairs. A cerebrospinal fluid (CSF) drainage catheter incorporated with a temperature sensor is placed under fluoroscopy. In this study, we investigated the changes in CSF temperature according to differences in the height of the sensor.
Methods: Of the TAAA repair cases in which HIAP was performed from January 2011 to September 2021, a single critical segmental artery (cSA) was identified in 99 cases by preoperative diagnostic imaging modalities. After CSF drainage catheter insertion, the position was confirmed by CT scan. The classification of the positional relationship between the tip and the cSA was defined as; G0: the cSA and the tip were located in the same vertebral body level; G1: those within one vertebral body height difference; G2: those within two vertebral bodies level; and G3: those located apart more than two vertebral bodies.
Results: Fifty-one cases showed significant temperature decrease by perfusion of the single critical artery. We elected to analyze the temperature changes in 45 out of 51 cases, excluding postoperative mortality spinal cord injury cases. The temperature changes (° C) at 5 minutes were 4.30 ± 2.27, 2.29 ± 1.30, 3.04 ± 1.98 and 1.43 ± 0.75 in G0, G1, G2 and G3, respectively (p=0.006). The lowest CSF temperature was 20.76 ± 4.98, 21.90 ± 3.84, 22.66 ± 4.57 and 20.10 ± 3.80, respectively (p=0.733). The magnitude of temperature drop in the CSF between the temperature just before HIAP and the lowest CSF temperature was 7.53 ± 2.98, 5.83 ± 2.46, 5.60 ± 1.86, 6.07 ± 3.39 in respective group (p=0.23).
Conclusions: When the sensor assembled at the tip of a CSF drainage catheter is located apart from a perfused critical segmental artery, the monitor tends to reflect temperature changes with certain delay; however, eventually the entire CSF, or at least around the lower spinal cord, is cooled uniformly.

A-PL2-2 Double Jacket Wrapping root reconstruction method for proximal repair in acute type A aortic dissection

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Objective: To introduce a new method of root reconstruction for proximal repair of acute type A aortic dissection, and to retrospectively analyze its short-term efficacy. Methods: From January 2018 to October 2019, a total of 455 patients with acute Stanford type A aortic dissection received surgical treatment at Nanjing Drum Tower Hospital. Among them, 343 patients underwent double-jacket-wrapping root reinforcement (11 patients underwent leaflet suspension), and 81 patients underwent Bentall surgery (12 untreated roots, 15 Wheat operations, and 4 David operations). We compared 343 patients who underwent double-jacket-wrapping root reconstruction (DJW) and 81 patients who underwent Bentall surgery. The perioperative indicators and short-term survival of the two groups were compared. Results: No patients died intraoperatively. The 30-day mortality rate in the DJW group and the Bentall group was 10.5% and 7.4%, respectively (P = 0.403). The Bentall group's cardiopulmonary bypass time (240.2 ± 59.8min vs. 218.8 ± 68.4min, P = 0.011) and aortic clamp time (181.3 ± 45.6min vs. 150.6 ± 47.9min, P = 0.000) were significantly longer than those in the DJW group. There was no difference between the operation time and the deep hypothermia circulatory time between the two groups. The mean follow-up was 11.7 ± 6.4 months. Seven and two follow-up deaths occurred in the DJW group and the Bentall group, respectively (no difference in survival rate, Log-rank method P = 0.855), and the cause of death was not related to the aortic root. The degree of aortic regurgitation after DJW was 0.7 ± 0.5, which was significantly lower than that before surgery (P = 0.000). Conclusion: Compared with Bentall surgery, DJW method is a safe and effective method for the repair of acute type A aortic dissection roots, which can obtain good perioperative and early curative effects.

Plenary 4

March 25, 2022 15:30-16:30 / Track 1

A-PL2-3 Midterm outcome of acute type A aortic dissection with carotid artery dissection

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An outcome of acute type A aortic dissection (AAAD) was having improved recently. However, the prognosis for AAAD with cerebral complications was poor. In this study, the morphological characteristics of carotid artery dissection due to AAAD were investigated based on the cases in our institution.Material and MethodsBetween April 2017 and April 2021, 100 patients with AAAD were analyzed. A preoperative cardiac arrest and nothing of preoperative contrast-enhanced computed tomography (CT) were excluded. There patients were divided into "stroke group" as 10 cases and "non stroke group" as 76 cases according to perioperative stroke. In the preoperative CT, aortic arch vessel were evaluated the presence or absence of artery dissection and the condition of the false lumen. The state of the false lumen was classified into four types. Type 1 was patent false lumen. Type 2a was thrombosed false lumen with true lumen stenosis less than 50%. Type 2b was thrombosed false lumen with true lumen stenosis less than 99%. Type 2c was thrombosed false lumen with true lumen complete obstruction.ResultsThe carotid dissection, the bilateral carotid dissection and the bilateral carotid dissection with thrombosed false lumen was significant difference. By the univariate analysis, type 2a and type 2c right common carotid artery and type 2a and 2b proximal left common carotid artery and type 2a and 2b distal left common carotid artery were significant risk factor. By the multivariate analysis, type 2c right common carotid artery and type 2b proximal left common carotid artery were significant risk factor.ConclusionThe mid-term outcome of AAAD with carotid artery dissection was acceptable. The risk factor of postoperative cerebral infarction was preoperative bilateral carotid artery dissection and bilateral carotid artery dissection with thrombosed false lumen. In the future, surgical intervention for cases with risk factors was considered necessary.

A-PL2-4 Surgical results in patient with common carotid artery static obstruction secondary to acute type A aortic dissection

Yosuke Inoue, HItoshi Matsuda, Shigeki Koizumi, Koki Yokawa, Kenta Masada, Yoshimasa Seike, Hiroaki Sasaki
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BackgroundTreatment for acute type A dissection with cerebral malperfusion is still challenging, especially in patients complicated with common carotid artery (CCA) static obstruction.The aim of this study is to investigate early outcomes of patients with CCA static obstruction secondary to acute type A aortic dissection.Patients and MethodsIn last 23 years, 822 patients underwent emergency surgery for acute type A dissection. Among them, 28 patients (67.4 ± 15.5-year-old, 12 male) whose preoperative common carotid artery presented static obstruction detected by CT angiography were retrospectively evaluated. Right CCA occluded in 26, left CCA occluded in 2 patients.Initial neurological symptom at onset was syncope in 14, hemiparesis in 13, and asymptomatic in 1 patient, respectively. Seventeen patients also presented disturbance of consciousness on hospital arrival and 4 patients deteriorated cardiac arrest after arrival requiring cardio-pulmonary resuscitation (CPR).ResultsIn-hospital mortality was 25% (7/28). All patients requiring preoperative CPR died. Eleven patients (40%) presented permanent neurologic deficit, among them 3 patients required postoperative craniotomy due to intracranial bleeding. Eighteen patients (64%) obtained ambulatory status at discharge.In univariable analysis, preoperative shock ($P = 0.02$) and CPR ($P < 0.001$) became strong risk factor for in-hospital mortality. Preoperative neurological symptom including symptom at onset, disturbance of consciousness, coma on arrival didn't become risk factor for in-hospital mortality and ambulatory status at discharge.ConclusionIn patients with acute type A dissection complicated unilateral CCA static obstruction, preoperative vital condition was most important key to save the patient's life. Type of neurological symptom at onset, severity of symptom on arrival didn't became risk factor for neither hospital mortality and ambulatory status at discharge.

Plenary 4

March 25, 2022 15:30-16:30 / Track 1

A-PL2-5 Early reperfusion strategy for treatment of malperfusion accompanied with type A acute aortic dissection

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Cardiovascular center, Yokohama City University Medical Center

[Background] In-hospital mortality of type A acute aortic dissection (TAAAD) with organ malperfusion is still high. We have performed "Early reperfusion (ER) strategy" which means treatment of malperfusion precedes the central aortic repair (CR) in patients with TAAAD with organ malperfusion. [Patients] 157 patients with TAAAD followed by organ malperfusion in our center from Jan. 2006 to Oct. 2021 were enrolled in this study. Mean age was 64 ± 12 years old, and proportion of Male/Female was 97/62. Malperfusion in coronary artery was occurred in 38 patients, in visceral organs in 24, in brain in 54, in lower extremities in 64, and in spine in 9. ER in coronary artery: preoperative emergent coronary angiography and the stent or micro-guidewire placement which aims TIMI-3 grade reperfusion, ER in visceral artery: manual arterial perfusion with 8-French size plastic tube via the branch of superior mesenteric artery until central repair is completed, ER in carotid artery: direct surgical fenestration or extracorporeal perfusion via carotid artery directly, ER in femoral artery: external shunt formation using 2 sheaths which connect brachial artery and ischemic femoral artery. [Results] Central repair was performed in 130 patients with 10% in-hospital mortality. ER was also executed prior to CR in 40 cases of 130, and the mortality was only 2.5% (1 case). ER in coronary artery made mortality decrease to 0% (0/12) from 38% (5/13) with significant difference(P=0.04). ER in visceral artery could obtain low mortality of 5.9% (1/17), and ER in carotid artery also had 0% (0/3) mortality. Significant lower difference of mortality was evident in patients treated of ER (3.1%, P=0.024) compared to in those without ER (28.2%). [Conclusion] Our ER strategy is feasible and improved the outcome of CR in patients with TAAAD associated with organ malperfusion.

A-PL2-6 Selective reperfusion first is rational for patients with mesenteric malperfusion in acute type A aortic dissection

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Objective: Preoperative mesenteric malperfusion (MM) is a complex and lethal complication in acute type A aortic dissection (aTAAD), treatment strategy is still controversy. We retrospective reviewed our aTAAD patients with MM and constructed a selective reperfusion first strategy (SR) to guide therapy.Methods: A two-step retrospective analysis was constructed based on the different clinical strategy for MM from two stages: First, from January 2011 to December 2019, 1060 patients diagnosed as aTAAD were enrolled. Among them, 47 patients suffered MM and central repair first were applied for all (Central group). A clinical management triad was concluded through comparison study between MM resistant and resolve group after central repair. This selective reperfusion first strategy was used for guiding therapy for 245 patients from January to December in 2020 (Reperfusion group).Results: Pre-MM presented as a rate of 4.4% in Central group and 2.9% in Reperfusion group. Higher rate of abdominal pain presented as the primary symptom in MM patients, and MM patients presented concomitant with other organs malperfusion. MM group had higher 30 day-mortality (19.1% vs 13.8%, p=0.388), and patients who mesenteric malperfusion couldn't resolve after central repair had a significant higher rate of mortality (88.9% vs 8.1%, p<0.001). After using SR to guide treatment choice, 4 patients received mesenteric perfusion first before central repair, the final survival rate was 75%.Conclusions: Mesenteric malperfusion without resolve after central repair was the strong risk factor. Lac>7.85, bloody stool were meaningful signs of mesenteric malperfusion difficulty to recover. Our initial experiences showed selective reperfusion first strategy could be a useful and effective guiding system for acute type A aortic dissection complicated with mesenteric malperfusion.

RHICS: Session I

March 25, 2022 16:40-18:20 / Track 1

RHICS1-3 Correlation between hemolysis and von Willebrand factor degradation in patients with VAD

Ryuichi Taketomi[1)], Ko Sakatsume[2)], Konosuke Sasaki[1)], Kota Itagaki[1)], Masayuki Otani[1)], Kay Maeda[1)], Koki Ito[1)], Yusuke Suzuki[1)], Tomoyuki Suzuki[1)], Shintaro Katahira[1)], Goro Takahashi[1)], Kiichiro Kumagai[1)], Yoshikatsu Saiki[1)]

1) Division of Cardiovascular Surgery, Tohoku University Graduate School of Medicine, 2) Division of Cardiovascular Surgery, Aomori Prefectural Central Hospital

(Background)Patients with ventricular assist devices (VADs) are vulnerable to specific complications caused by high shear stress in the pump. Hemolysis following a destruction of red blood cells has long been recognized. Additionally, bleeding complications through a degradation of von Willebrand factor (vWF) has been reported recently. However, it is may not be practical to precisely quantify the degree of vWF degradation at virtually all hospital; thus, prediction of bleeding tendency remains difficult. In this study, we attempted to clarify the relationship between lactate dehydrogenase (LDH) and VWF large multimer index (INDEX), which quantifies the retention rate of vWF large multimers, and examined whether it is possible to predict bleeding tendency from hemolysis.(Patient and methods)Among the patients receiving VAD at our hospital since 2014, 56 patients who agreed to participate this study were included.(Result)14 patients developed bleeding complications. INDEX was significantly lower in the bleeding group compared with the nonbleeding group (25.7 ± 12.5 versus 51.2 ± 27.0, p=0.0025). On the other hand, LDH was not significantly different between the groups (306.3 ± 132.5 versus 354.2 ± 149.0, p=0.2300). Correlation analysis between INDEX and LDH demonstrated statistically no correlation at r=-0.192 (p=0.0838).(Conclusions) In this study, INDEX was significantly lower in the bleeding group. On the other hand, LDH was not significantly different between the bleeding and nonbleeding groups, and there was no statistical correlation between Index and LDH. This may be because the sensitivity of vWF to shear stress varies among individuals and is not equal to the sensitivity of red blood cells to shear stress. This study suggests that it is difficult to predict bleeding tendency from LDH, which is one of the indicators for hemolysis, and that quantification of vWF retention rate using INDEX is still valid to differentiate bleeding tendency.

RHICS1-5 Management and outcomes of patients in refractory acute decompensated cardiogenic shock with mechanical circulatory support (MCS)

Jeko Madjarov

Sanger Heart and Vascular Institute, Atrium Health, Wake Forest School Of Medicine

Objective: Despite advances in surgical techniques, preoperative cardiogenic shock continues to have high mortality. The aims of the study were to assess the characteristics and clinical outcomes of pre- and peri-operative use of Impella with or without ECMO (Extracorporeal Membrane Oxygenation) - ECPELLA in patients with end stage acute cardiogenic shock. Methods: The study-reviewed patients, who needed surgical procedure or percutaneous intervention. We enrolled 49 patients with ECPELLA (group 1). 194 patients treated with Impella alone (group 2). Additionally, we evaluated patients with surgical direct/transaortic insertion of MCS (20 patients) and compared it with percutaneous implantation.The primary outcome was mortality within 30 days. Secondary outcomes included duration of support, hemolysis, bleeding, inotropic score, and cardiac recovery.Results: All groups demonstrated similar baseline characteristics. Thirty-day mortality was lower in the group 1 (14.6%) compared to 32.14% in-group 2. Implantation of Impella 5.5 resulted in better survival than Impella 3.5 (87.23% versus 72%). The Impella 5.5 provided 5-6 L/min of flow for duration of 7.7+2.9 days (range, 4.3-14.2). Inotropic support was higher with Impella 3.5 compared to Impella 5.5. There were no significant differences between hemolysis and bleeding. For the efficacy endpoint, recovery of the heart function was obtained in 93% of the patients in Group 1, 84% and 67% in Group 2 with Impella 5.5 and 3.5 respectively.Interestingly, surgical direct/transaortic insertion of Impella or (ECPELLA) was associated with better survival (90%) compared to percutaneous administration (72%).Conclusions: The use of mechanical circulatory support in end-stage of cardiogenic shock is safe and feasible. This study supports early use of MCS, including ECPELLA as a peri-operative strategy for patients in cardiogenic shock with impeding multi organ failure. Both devices can be rapidly inserted, which yielded favorable outcomes. The timing and degree of MCS implementation was associated with improved outcome.

RHICS1-7 Association between blood type of heart transplant candidates and their survival outcomes after transplant registration in Japan

Masahiko Ando, Osamu Kinoshita, Daisuke Ishii, Sadayuki Moriyama, Hiroyuki Kaneko, Takayuki Gyoten, Hyoe Komae, Shogo Shimada, Mitsutoshi Kimura, Haruo Yamauchi, Minoru Ono

Cardiac Surgery, The University of Tokyo Hospital

Objective) In western countries, some report worse heart-transplant (HT) outcomes in blood type O. This is because while O organs can go to any blood type, non-O organs may not be allocated to O recipients, imposing longer waiting time in O candidates. In Japan, where nearly-all HT is identical, such a discrepancy should not exist. We aim to clarify the association between HT candidates' blood type and their outcomes.Methods) From April 2003 to October 2021, we registered 545 candidates for HT. We excluded those younger than 18 and those transferred to other facilities before HT. Finally, we included 431 candidates and created four groups by blood type and survival outcomes were compared.Results) Blood-type distribution was similar to Japanese population (A: 164 (38.1%), AB: 32 (7.4%), B: 91 (21.1%), O: 144 (33.4%)). Age was oldest in AB (44 vs 49 vs 44 vs 41, p=0.022). Ischemic cardiomyopathy was most frequently seen in AB (17.1 vs 28.1 vs 13.2 vs 5.6%, p=0.001). More than 80% of candidates required left ventricular assist device. During median follow-up of 3.7 years after registration, 127 candidates (A: 42, AB: 11, B: 23, O: 51) underwent HT (all but two were identical). While the incidence of HT was highest in AB (p=0.007), that of pre-HT death was also highest in AB (p=0.025) and over-all survival after registration was lowest in AB (p=0.017). Among those transplanted, median waiting time was shortest in AB and longest in B (3.7 vs 2.0 vs 4.7 vs 4.0 years, p<0.001). Once transplanted, there was no survival difference by blood type (p=0.806).Conclusions) In Japan, there could be a waiting-time and survival discrepancy by blood types, among HT candidates. Our findings should facilitate prospective nationwide studies to reveal why the incidence of identical HT is so different by blood type.

RHICS1-8 Orthotopic Heart Transplantation in patients refusing blood transfusion

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[Purpose]Surgical management of advanced heart failure in patients refusing blood transfusion (RBT) such as Jehovah's witnesses (JW) is challenging. Such patient population are often prohibited from heart transplantation at many institution. We have extensive experiences for RBT patients in cardiac surgery. In this study, we reviewed clinical outcomes of RBT patients undergoing orthotopic heart transplantation (OHTx) in our institution.[Methods]From Jan 2014 to August 2021, patients undergoing OHTx were retrospectively reviewed. We utilized the perioperative optimization protocol established by us for RBT patients, including preoperative hemoglobin optimization with IV iron and erythropoietin, meticulous surgical maneuver, minimized blood lab testing.[Results]Consecutive 296 patients undewent OHTx in the study period, and 23 patients (7.8 %) were identified as the cohort (RBT group). The mean age was 53.4 +/- 13.6 years old. There were 18 male (78 %) patients. Four patients (17 %) had a history of previous cardiac surgery. Intraoperative nadir hematocrit during cardiopulmonary bypass was 28.7 +/- 6.0 %. Preoperative hemoglobin, postoperative hemoglobin at day 0, nadir and discharge were 12.2 +/- 1.4, 10.9 +/- 2.3, 8.9 +/- 2.3, 10.6 +/- 1.9 g/dl. The mean aortic cross-clamp time was 125.8 +/- 23.5 minutes. The mean Donor heart's ischemic time was 218.6 +/- 50.1 minutes. One patient had a primary graft dysfunction requiring ECMO support and eventually recovered and discharged without any blood transfusion. The mean length of hospital stay was 27.5 +/- 14.7 days, and there was one (1/23; 4.3 %) In-Hospital mortality. The 1-year survival rate was 90.9 %.[Conclusions]The outcomes of patients refusing blood transfusing undergoing orthotopic heart transplantation was acceptable. We demonstrated that our perioperative optimization protocol was efficient and OHTx could be performed safely for selected RBT patients.

RHICS: Session III

March 25, 2022 19:20-19:50 / Track 1

RHICS3-1 Congenital Mitral stenosis

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Congenital malformations of the mitral valve may be encountered in isolation or in isolation with other congenital heart defects. This abnormality causes mitral stenosis, regurgitation, or a combination of both. The pathology and description show following table.In considering surgical options, the mitral valve must be fully investigated preoperatively and intraoperatively to determine how it can be repaired rather than replaced. There are several reports on the survival rate after mitral valve replacement is not as good as after repair, but no definite conclusion has been concluded. Therefore, there are no reports that randomly compare the two procedures, and it is generally recognized that repair is preferable to replacement in small patients for growth reasons and valve size selection.Therefore, in neonates and early infants, a staged strategy of left ventricular and mitral valve recruitment may be used in anticipation of growth. This is done by adjusting the atrial septal defect and performing surgery such as left ventricular outflow tract repair to allow for growth. This technique is often the treatment of choice, especially for stenotic lesions of the mitral valve. The concept of MV repair in early infant is primarily aimed at growth of the patient to an age when, if necessary, an adult-sized prosthesis can be implanted. We believe that reconstruction allows continuous somatic and valve growth, delays or eliminates the need for future valve replacement.

P-PL1-1 Autologous pulmonary artery patch aortoplasty for arch anomaly

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Background: Autologous pulmonary artery (PA) patch has been reported as a useful material for aortic arch reconstruction. We present the early and midterm results of PA patch aortoplasty in five patients.Patients: The PA patch was used for reconstruction of the aortic arch or ascending aorta in 5 pattens (interrupted aortic arch / ventricular septal defect 3, double outlet right ventricle / coarctation of aorta 1, coarctation of aorta / ventricular septal defect 1) in our institution from 2016 to 2021. Age at operation was 14 days to 1 years. Four patients had previously undergone bilateral pulmonary artery banding, and one patient had undergone arterial duct stenting before arch reconstruction.Results: Autologous PA wall was harvested from the anterior wall of the main pulmonary artery trunk, used as a patch in 4 (minor curvature of the arch 2, ascending aorta 2) and as a tube graft in 1 (aortic arch). Follow-up period was 11 - 43 months. No hospital and late mortality occurred, no reoperation and catheter intervention for aortic arch was required. One patient required catheter intervention for pulmonary artery stenosis. Latest angiography and computed tomography after discharge revealed no significant re-stenosis and aneurysmal dilatation at the site of PA patch implantation and no bronchial obstruction.Conclusion: Although PA patch has limitation in size, autologous PA patch aortoplaty permits complete relief of arch obstruction and reduces the risk of tracheobronchial compression in various situations with satisfactory early and mid-term outcomes. Careful follow-up especially for re-stenosis / dilatation of the aorta and pulmonary valve function is necessary.

Genaral Plenary

March 25, 2022 9:00-10:00 / Track 2

P-PL1-2 11-Years Paediatric ECMO Experience and Program Development in a Tertiary-Care Institution

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OBJECTIVE:Extracorporeal Membrane oxygenation (ECMO) has become an established treatment modality for refractory cardiac and/or respiratory failure. Although paediatric ECMO is mostly embedded in pediatric cardiac surgery (CHS) programs as key performance indicator, ECMO program-development requires multidisciplinary team (MDT) involvement.
METHODS:ECMO services were established at a tertiary-care CHS program. Procedures and protocols were developed in adherence to ELSO guidelines. ECMO-program initiators received training in overseas ECMO centres. ECMO nurse-technicians were trained locally; they attend ECMO-training in every 6 months and undergo competency recertification in 2-year intervals. ECMO-MDT comprised of paediatric critical care physicians and nursing, respiratory physicians and technicians, perfusionists, paediatric cardiology and cardiac surgery teams.
PATIENTS :11 years (January-2009 to December-2019) of paediatric ECMO experience is presented. There were total of 60 ECMO runs (VA-54, VV-4, VA converting to VV-1 and VAV-1) for 17 neonates and 43 paediatric patients (Median age: 2.92 Years, Range: 1month-18years). Chronologically, three types of ECMO consoles were utilized: Levitronix(50), Medos(3), Bio-Pump(7).
RESULTS:Indications for ECMO were : Cardiac related: Post-cardiotomy (28; in association with 800 pediatric cardiac surgeries = 3.5%; Non-surgical cardiac (20): Myocarditis(9); Cardiac arrest - in-hospital(5), out-of-hospital(2); Cardiomyopathy(2); SVT(1); Septic shock(1). Respiratory related (12): ARDS(4); Type-1 respiratory failure(1); Ventilator associated pneumonia following drowning(1); Meconium aspiration syndrome(4); and Congenital diaphragmatic hernia with pulmonary hypoplasia(2). Survival outcomes for post-cardiotomy: 53.6% (15/28); Non-surgical cardiac: 45% (9/20) and Respiratory: 83.33% (10/12).
CONCLUSION:Paediatric ECMO service was successfully established with formal training of program initiators and continuing training of ECMO-technicians and allied health team in the setting of a tertiary-care CHS program. Team-experience based on ongoing training and gained from widening indications resulted in improved results, especially in non-post-cardiotomy patients.

P-PL1-3 Improvement and development of Nuss procedure - the problem of succeeding surgeons

Yasushi Kasagi, Machiko Kasagi
Thoracic surgery, Matsuyama Cardiovascular Medical Center

[Introduction] We have further improved the Nuss procedure for the surgical treatment of pectus excavatum, and report that favorable outcomes have been obtained by applying the improved method.[Method] We performed 1075 Nuss procedures with our newly improved technique during the period from July 2000 to April 2021. Compared to our previously conducted sternal turn-over and sterno-costal elevation methods, our further developed technique left less surgical scars on the chest, which has demonstrated more assured improvement in pectus excavatum.The rate of infection, which was initially found to be 2.5%, dropped to 0% by preoperative medication. No necrosis due to heart strain was not found. The patients aged between 3 and 68 with average 25.7 y/o, consisted of 866 males and 189 females. The number of bars used were 1 bar in 261, 2 bars in 700 and 3 bars in 114 cases. [Conclusion] Based on Nuss procedure, we have established our uniquely improved technique for pectus excavatum treatment through various changes. As we are old now, we are seeking our successors who take over the technique, being aware that there are some technical difficulties.

Genaral Plenary

March 25, 2022 9:00-10:00 / Track 2

P-PL1-4 Truncal Valve Leaflet Reconstruction With Autologous Pericardium In a Neonate; One Year Follow-up And the Following Operation

Yuji Nakamura, Akio Ikai, Keiichi Hirose, Maiko Tachi, Hiroki Ito, Motonori Ishidou, Daisuke Toritsuka, Kisaburo Sakamoto

Cardiovascular surgery, Mt.Fuji Shizuoka Children's Hospital

Introduction: Truncal valve (TrV) repair sparing native leaflets is a desirable therapy for TrV insufficiency. However, especially in neonates, it is still challenging because leaflet tissues are often severely dysplastic and fragile. Recently, excellent short-term results of three-leaflet reconstruction using autologous pericardium were reported, however, only in children. We report the case of successful surgical correction with three-leaflet TrV reconstruction using autologous pericardium for severe truncal valve insufficiency in a neonate and its outcomes one year after.Case: A boy was postnatally diagnosed with persistent truncus arteriosus type2 accompanied with severe TrV regurgitation and moderate stenosis, and had uncontrollable heart failure. We performed emergent TrV repair with three-leaflet TrV reconstruction, ventricular septal defect closure, and right ventricular outflow reconstruction on the second day of life. The TrV annulus diameter was 13-mm intra-operatively and the new three-leaflets were trimmed from the glutaraldehyde-treated autologous pericardium using our original template of 13-mm annular size. His post-operative haemodynamics was stable, and he gained weight constantly without significant heart failure. The neoaortic valve (neoAV) regurgitation gradually progressed to be severe along with the dilatation of neoAV annulus, then he subsequently underwent mechanical neoAV replacement using a 16-mm ATS-Advanced Performance 360 valve one year after. The operation could be safely performed after the fashion of the Konno operation, which was probably because the neoAV annulus was not plicated at the first operation and remained large. His post-operative hemodynamics was stable and discharged without significant heart failure.

P-PL2-2 For good hemodynamics after Fontan operation – the role of intra-extra TCPC

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Cardiovascular Surgery, Mt.Fuji Shizuoka Children's Hospital

BackgroundCurrently, the extracardiac conduit total cavopulmonary connection (eTCPC) is the most widely used for Fontan modification worldwide. Nevertheless, there have been some cases that are difficult for performing eTCPC because of their anatomical complexity such as apico-caval juxtaposition. For such cases, in 2002 we introduced the intra-extra cardiac total cavopulmonary connection (ieTCPC).MethodsWe reviewed our 20-year single-center experience with 316 TCPC patients to compare eTCPC (n=277) and ieTCPC (n=39) in terms of mortality and morbidity. ieTCPC was indicated for the cases in which there was concern that the TCPC conduit would be too curved for ordinary eTCPC.ResultsEarly death occurred in one patient and late death occurred in 15 patients. The actuarial survival rate in the eTCPC group and the ieTCPC group at 10 years were 95.1% and 100.0%. There was no significant difference in actuarial survival between eTCPC and ieTCPC patients. In the multivariate analysis, preoperative SVC pressure and preoperative SaO2 were found to be the independent predictor for postoperative mortality. There was also no significant difference in actuarial rate of freedom from late-occurring complications between eTCPC and ieTCPC groups. In the multivariate analysis, dominant right ventricle and preoperative SVC pressure were independent predictors for late-occurring complications.ConclusionsThe clinical outcomes in patients who undergo eTCPC and ieTCPC appear to be excellent, with low mortality and morbidity rates in the mid-term. ieTCPC may a good option for TCPC cases with anatomical complexity such as apico-caval juxtaposition and separated hepatic vein drainage.

Targeted Plenary

March 25, 2022 13:00-14:30 / Track 2

P-PL2-3 Recent approach and results for PVO in univentricular repair

Naoki Yoshimura, Masaya Aoki, Akihiko Higashida, So Motono, Shigeki Yokoyama, Toshio Doi, Kazuaki Fukahara

University of Toyama

Background: Repair of TAPVC in neonates with single ventricular physiology is still challenging. Timing of initial surgery and techniques for PVO release are controversial. We have performed primary sutureless repair of PVO in the neonatal period as a procedure of choice. In the present study, we summarized our experiences to clarify the adequacy of our strategy.Patients: Since 2005, fifteen patients including 9 neonates with single ventricular physiology underwent surgical repair of TAPVC at our hospital. Median age at operation was 55 days, and median body weight was 3.29kg.Results: Before 2007, three patients underwent conventional repair. Two survivors suffered from postoperative PVO and required sutureless repair. Since 2007, twelve infants underwent primary sutureless repair of TAPVC. One patient with preoperative necrotizing enterocolitis died of septic shock 2 days after the operation. There were two interstage mortalities before Glenn operation. One patient died of severe AV valve regurgitation and another died of congenital biliary atresia. One patient with asplenia and HLHS died of LOS after Glenn operation. Five patients have completed Fontan operation. There were 2 patients who suffered from PVO after primary sutureless repair. They underwent redo sutureless repair with good results.Conclusions: Primary sutureless repair may improve the prognosis of high-risk patients, such as TAPVC associated with single ventricular physiology. It is important to release PVO in the early neonatal period for patients with single ventricular physiology to make good Glenn and Fontan circulation.

P-PL2-4 Dynamic Contrast-enhanced Magnetic Resonance Lymphangiography: Novel and Informative Approach to Lymphatic Disorders in Fontan Circulation

Keisuke Sato
Department of Cardiology, Shizuoka Children's Hospital

After Fontan surgery, patients are exposed to increased venous pressure. In the long term, increased venous pressure tends to cause a variety of lymphatic problems, such as pleural effusion, chylothorax, plastic bronchitis, and protein-losing enteropathy. Lymphatic problems associated with Fontan operation have been considered difficult to treat and poor in prognosis. However, with the recent advent of thoracic duct embolization and lymphovenous anastomosis, the range of treatment has expanded.Advances in treatment techniques have required advances in diagnostic imaging. Dynamic contrast-enhanced magnetic resonance lymphangiography (DCMRL) is one of the imaging modalities that have attracted the most attention. DCMRL is a procedure in which gadolinium contrast is injected through a punctured inguinal lymph node to provide a dynamic image of the flow through the central lymphatic system. DCMRL provides information about the morphology, flow, and leakage of the central lymphatic system with good resolution. To perform DCMRL, two problems must be overcome: 1) the operator must be skilled in ultrasound-guided lymph node puncture, and 2) the position of the puncture needle must be kept from being shifted. However, with practice and ingenuity, these problems can be overcome. However, with practice and innovation, it is possible to overcome these problems. Central lymphatic vessels are not the only sites that can be assessed by DCMRL. Recently, it has become possible to evaluate the lymphatic vessels from the gastrointestinal tract to the liver by puncturing the liver in order to clarify the mechanism of protein-losing enteropathy.In the future, the DCMRL will be a powerful tool for solving lymphatic problems after Fontan operation, from diseases related to the central lymphatic vessels, such as chylothorax and plastic bronchitis, to protein-losing enteropathy related to the lymphatic vessels from the gastrointestinal tract to the liver.

P-PL3-1 Modified aortic root translocation for congenitally corrected transposition of the great arteries, ventricular septal defect, and pulmonary stenosis

Hajime Sakurai, Toshimich Nonaka, Takahisa Sakurai, Hideyuki Okawa, Mika Noda, Kenji Sato, Aoi Kato, Genki Maeno

Department of Cardiovascular Surgery, Japan Community Healthcare Organization Chukyo Hospital

[Introduction] Several surgical options have been available for patients with congenitally corrected transposition of the great arteries (ccTGA), ventricular septal defect (VSD), and pulmonary stenosis (PS). Herein, we report the case of a patient who underwent modified aortic translocation combined with an atrial switch operation.[Clinical summary] The patient was prenatally diagnosed with ccTGA, VSD, and PS and was born at our hospital. Echocardiography revealed mild tricuspid regurgitation, pulmonary valve and subvalvular stenosis, and a relatively small VSD. Catheterization data at 3 months of age showed equal systolic pressure between the morphologic right and left ventricles. The three-dimensional (3D) model of the patient's heart was created using computed tomography scan data to select a suitable surgical strategy. At 4 years of age, the patient underwent surgical repair. After median sternotomy, cardiopulmonary bypass was commenced with bicaval cannulation. After achieving cardioplegic arrest, both the great arteries were transected at just above the sinotubular junction. Then, right and left coronary buttons were created and mobilized. The aortic root was harvested from the right ventricle, and the pulmonary valve ring and superior border of the VSD were incised. The aortic root was sutured to the posterior wall of the pulmonary ring without rotation. The VSD was closed using the anterior wall of the right ventricle without a prosthetic patch. Senning procedure was then performed using an autologous pericardial patch. Using a bovine jugular vein graft, the right ventricular outflow tract was reconstructed. The delayed sternal closure was performed on the second postoperative day. The patient was discharged on the 23rd postoperative day with good ventricular function and normal sinus rhythm.[Conclusions] Although our modified procedure is complicated, this is a procedure of choice for these anatomical combinations. The 3D heart model is useful for avoiding damage to the conduction system.

P-PL3-2 Standardized operative technique and outcomes of neonatal single-stage aortic arch repair and complex arterial switch operation.

Laszlo Kiraly[1,2,3], Bassem Mora[2]

1) CTVS, National University Hospital Singapore, 2) Pediatric Cardiac Surgery, Sheikh Khalifa Medical City, Cardiac Sciences, Abu Dhabi, UAE, 3) Department of Public Health, Semmelweis University, Budapest, Hungary

Objective. Single-stage aortic arch (AAR) repair and complex arterial switch operation (ASO) poses procedural difficulties and still carries a high-risk according to international databases. A standardized and strategic operative technique can contribute to reduce morbidity/mortality. Methods. Patient data, diagnostic details, operative details and midterm outcomes were analyzed from institutional database. Preoperative CT-angiography and 3D-modelling became standard in clarifying the anatomy. Operative technique comprised of transverse AAR with division of the great arteries and patch augmentation of the hypoplastic arch on moderately hypothermic selective cerebral and myocardial perfusion (beating heart), followed by ASO and repair of the intracardiac defects (ASD, VSD closure). The VSD was typically closed via the LVOT. Procedural characteristics were compared with clinical data of patients undergoing AAR without ASO (N:116); and ASO characteristics were assessed with a group of patients undergoing ASO without arch repair (N:179).Results. 27 neonates (medians, age: 7.5/3-25days; weight: 2.75/2.2-3.3kg; M/F:20/7) underwent AAR/ASO for Taussig-Bing anomaly and hypoplastic transverse arch/preductal coarctation. All patients had PDA-dependent lower-body perfusion preoperatively. During AAR, selective myocardial perfusion was applied for a median 28/19-44mins. Patch augmentation of the arch corrected the significant mismatch between the great arteries. Straddling RAVV(3), double straddling(2) was addressed by chord repositioning and VSD augmentation. In comparison with ASO-group without AAR, a higher prevalence of double-loop and/or Cx-from-RCA coronary pattern was noted (NS). No mortality, major morbidity occurred. No reoperation was necessary in the midterm follow-up.Conclusion. Preoperative advanced imaging was instrumental for planning for the complex operations. Patch augmentation of the hypoplastic transverse arch mediated the mismatch between the neo-aortic root and ascending aorta. Standardized selective myocardial perfusion technique reduced the period of myocardial ischaemia, and thus allowed focusing on the intracardiac repair and coronary transfer. Midterm results are encouraging for the optimal alignment and growth of the reconstructed aortic arch.

P-PL3-5 Half-Turned Truncal Switch procedure

Masaaki Yamagishi
Department of Pediatric Cardiovascular Surgery, Kyoto Prefectural University of Medicine

The half-turned truncal switch operation is suitable for TGA or TGA type DORV with antero-posterior relationship of the great arteries, and mild to moderate pulmonary stenosis. The aorta is transected about 5 millimeters above the coronary orifices. The pulmonary artery is also divided horizontally just before the bifurcation. The anterior wall of the right ventricular outflow tract beneath the aortic annulus is incised horizontally. The incision line is placed a few millimeters away from the aortic annulus. The infundibular septum is incised transversely. If the VSD is located at subarterial position, the incision line may extend to the VSD edge. The mid-line of the mitral-pulmonary fibrous continuity is incised. The truncal block, including both semilunar valves, is resected. The truncal block is half-turned horizontally, so that the aortic valve is located on the left ventricular opening. The width of the superior margin of the VSD patch is adjusted to the required length for aortic annular augmentation. The position of the truncal block should be carefully adjusted so that the coronary cuff faces the opposite aortic wall defect. In order to prevent coronary distortion, the aortic valve should be anastomosed at a slightly higher position around the left coronary artery. On the posterior aspect, the aortic valve is anastomosed to the mitral annulus. The superior margin of the VSD patch is trimmed, and the stump of the infundibular septum is anastomosed to the superior margin of the VSD patch. After anterior translocation of the pulmonary bifurcation, the posteriorly translocated ascending aorta is reconstructed. The pulmonary valve is anastomosed to the right ventricular outflow tract. The anteriorly translocated pulmonary bifurcation is anastomosed to the distal stump of the pulmonary trunk without any supply material.

T-PL1-3 Lung cancer surgery using transplant technique

Hiroshi Date
Department of Thoracic Surgery, Kyoto University

Pneumonectomy as a salvage surgery after definitive chemoradiotherapy and/or immunotherapy for lung cancer is known to be associated with high rate of operative death. Broncho-vascular plasty is well accepted procedure which can avoid pneumonectomy with better oncological outcome. However, pneumonectomy is usually employed if the tumor invasion is extensive considering that excessive tension on airway anastomosis is known to be the major risk factor of anastomotic dehiscence after extended airway resection. Ex-vivo sleeve lobectomy and auto-transplantation of the remaining lobe is an option to avoid pneumonectomy.In brief, pericardium is widely opened and pneumonectomy is performed. On the back table, ex-vivo sleeve lobectomy is performed and free surgical margins are confirmed by quick frozen examination. The remaining lobe is flushed with cold preservation solution while it is ventilated. The reimplantation of the lobe is performed using a similar technique of living-donor lobar lung transplantation. Vascular extension is employed if necessary to avoid extensive tension on the airway anastomosis.We have applied auto-transplantation technique in 8 cases (6 males and 2 females). The age raged 55 to 73 years with an average of 61 years. Diagnoses were 4 lung cancers, pulmonary artery sarcoma, metastatic renal cell carcinoma, pneumonectomy like syndrome and bronchial fistula. Three cases required cardiopulmonary support including conventional cardiopulmonary bypass (n = 2) and ECMO (n = 1). No anastomotic complication was encountered and satisfactory airway healing was obtained. All patients were discharged without requiring oxygen inhalation.Auto-transplantation is a viable technique to avoid pneumonectomy.

Plennary Thoracic 1

March 25, 2022 9:00-10:00 / Track 3

T-PL1-4 Update in Lung Transplantation 2022

Shaf Keshavjee
Toronto Lung Transplant Program, University Health Network

The field of lung transplantation (LTx) continues to advance at a rapid pace. Of all organ transplantation, LTx shows the most significant growth worldwide. This is the result of a combination of advances in the field that have improved donor lung utilization and made LTx more possible with improved outcomes.We have over 14 years experience with the Toronto Ex vivo Lung Perfusion (EVLP) Technique and have completed over 800 clinical cases. This has fully doubled the number of LTx/yr performed in our center with excellent results in all outcome measures: donor utilization, primary graft function ICU and hospital length of stay, airway healing, and short- and long-term survival. This concept has been adopted by other centers around the world and by third party providers. We have also worked to develop electric drones to deliver organs. We delivered the first lung in the world by drone for clinical transplantation last year and will continue to work to develop more efficient systems for organ delivery. Our recent clinical use of 100C lung preservation represents a truly radical transformation in the field of clinical LTx that will increase the number of lungs transplanted and will make transplantation a more attractive career for future generations of thoracic surgeons.COVID-19 of course imposed many challenges on the field of lung transplantation. While early results of lung transplant for COVID appear satisfactory, many challenges and questions remain. The science of lung transplantation continues to evolve and novel practices that are being translated to the bedside are radically changing the opportunities to save lives of patients with end stage lung disease.

T-O1-2 Traditional underwater seal versus digital chest drainage following pulmonary resection.

Francis Cheung, Naveed Alam, Gavin Wright
Cardiothoracic Surgery, St Vincent's Hospital Melbourne

BackgroundThe evacuation of air and fluid from the pleural space is vital following pulmonary resection. Traditional underwater sealed drains are increasingly replaced by digital chest drainage systems, but current evidence comparing these systems is still evolving. Whilst digital drains can objectively reduce inter-observer variability and allow for earlier chest tube removal, whether this translates to improved clinical outcomes remains uncertain. This study aims to compare the two drainage systems and analyse their impact on duration of chest tube drainage and hospital length of stay.MethodsA total of 102 patients undergoing pulmonary resection were analysed in this retrospective cohort study. Multiple linear regression was used to compare traditional underwater seal and digital chest drainage in terms of post-operative chest tube drainage duration, hospital length of stay, number of post-operative chest x-rays, chest tube reinsertion and readmission for pneumothorax.ResultsA statistically significant difference between traditional underwater seal (n = 51) and digital chest drainage (n=51) groups was not found when comparing duration of chest tube drainage (26.3 vs 26.1 hours, p = 0.2), hospital length of stay (4 vs 3 days, p = 0.09) and number of post-operative chest x-rays (3 vs 2 x-rays, p = 0.4). There was also no significant difference in rate of complications, chest drain reinsertion or hospital readmission for pneumothorax between groups.ConclusionThe use of digital chest drainage resulted in similar chest tube drainage duration and hospital length of stay when compared with traditional underwater sealed drainage following pulmonary resection.

Lung cancer 1

March 25, 2022 13:00-13:50 / Track 3

T-O1-3 Electormagnetic Bronchoscopy Guided Microwave Ablation Combined with Thoracoscopic Surgery for Synchronous Multiple Primary Lung Cancer

Feichao Bao
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Objectives: For patients with synchronous multiple primary lung cancer (SMPLC), surgical resection alone sometimes proves to be impractical. Local treatments like thermal ablation including radiofrequency ablation (RFA) and microwave ablation (MWA) are recommended as alternative treatments for these patients. MWA navigated by ENB has been limitedly studied, in this study, we aimed to evaluate the safety and feasibility of MWA under ENB guidance in patients with SMPLC which cannot be completely resected.Methods: From June 2019 to December 2020, preliminary attempts of ENB guided MWA were accomplished in ten patients with SMPLC which were difficult to resect at the same time. All lesions for ENB guided MWA were regarded as not suitable for CT guided treatment because of its location. The power and duration of MWA were based on lesion size and location on pre-operative CT scan. When MWA was finished, thoracoscopic resections were performed following ENB guided MWA. The feasibility, safety, local efficacy of treatments was evaluated.Results: All lesions planned for MWA treatment in 10 patients were technically reached via ENB and received MWA treatment uneventfully. Biopsy of 8 lesions showed malignancy, while other two lesions showed negative pathologic results. These ten patients received simultaneous resections by thoracoscopic surgery for 13 concomitant pulmonary nodules: 6 by wedge resection, 4 by segmentectomy and 3 by lobectomy. CT scan by the first postoperative week showed complete ablation for 7 nodules indicated for ENB guided MWA, and incomplete ablation for 3 other nodules. Three patients had mild complications after the procedure and recovered shortly after treatment. Conclusion: ENB guided MWA is safe, feasible and useful for patients with SMPLC when combined with thoracoscopic resection.

T-O1-5 Prognostic effect of ground glass opacity - presence in the same predominant subtype of lung adenocarcinoma

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Purpose We evaluated the prognostic effect of ground glass opacity (GGO) - presence in lung adenocarcinoma (LUAD) and its independency from predominant subtype.

Methods We retrospectively reviewed 949 and 273 patients who underwent surgery for cStage IA LUAD of grade 2 (acinar and papillary) and 3 (micropapillary and solid) predominant subtype, respectively. LUAD were classified into part-solid nodule (PSN) and pure solid nodule (SN). Clinicopathologic features of PSN and SN were compared in grade 2 and 3 LUAD, separately. The inverse-probability treatment weight (IPTW) methods were used for balanced analysis, and age, sex, surgical extent, total tumor size, and invasive component size were included in the model.

Results In grade 2 and 3 LUAD, 504 (53.1%) and 445 (46.9%), and 66 (23.2%) and 207 (76.8%), were PNS and SN, respectively. After IPTW adjustment, all variables were well balanced. In grade 2, the prevalence of vascular and lymphatic invasion, spread through air spaces, and lymph node metastasis were lower in PSN. In grade 3, prevalence of lymphatic invasion and lymph node metastasis were lower in PSN. In both grade 2 and 3, the 5-year recurrence-free survival of PSN was better ($p < .001$ and .009). In multivariable analysis, the radiologically pure-solid feature was associated with an increased risk of recurrence in grade 2 (HR = 3.625; 95% CI: 1.978-6.643) and 3 (HR = 3.050; 95% CI: 1.410-6.601), both.

Conclusion The presence of GGO was associated with a better prognosis in cStage IA LUAD. Its prognostic effects were consistent regardless of its subtype.

Lung cancer 1

March 25, 2022 13:00-13:50 / Track 3

T-O1-6 Safety and prognosis of complex segmentectomy in non-small cell lung cancer

Yuichiro Onuki, Hirochika Matsubara, Tsuyoshi Uchida, Aya Sugimura, Daisuke Sato, Harunobu Sasanuma, Mamoru Muto, Ryunosuke Koizumi, Hiroyuki Nakajima
Division of General Thoracic Surgery, Department of surgery, Yamanashi University, Yamanashi, Japan

Background: Based on the results of the JOCG0802/WJOG4607 trial, segmentectomy for peripheral non-small cell lung cancer (NSCLC) with a diameter of 2 cm or less is expected to be one of the standard surgical procedures. The aim of this study is to evaluate the adequacy of complex segmentectomy for NSCLC.
Method: We retrospectively analyzed patients who underwent segmentectomy for NSCLC between January 2004 and December 2020 at our institution. Segmentectomy was categorized into simple (bilateral segment 6, left superior or lingular segment) and complex (the other segment) segmentectomy. Data on perioperative morbidity and patient outcomes were analyzed.
Results: A total of 98 patients (Complex:n=34, Simple:n=64) were included. Patient characteristics and baseline clinicopathological factors were well-balanced. The incidence of perioperative complications was not different between the two groups (Complex: 17.6% vs. Simple: 20.3%, P=.961); hospital length of stay (12.4 vs. 12.0 days, P=.749) and duration of drainage (2.4 vs. 2.9 days, P=.469) were similar. Overall 30-day and 90-day mortality were 0% in both groups. Median follow-up period was 34.5 months (interquartile range, 25-74 months). For the period of analysis, recurrence was 5.9% (n=2) and 3.1% (n=2) in the Complex and Simple groups, respectively. In log-rank tests, there were no significant differences in 5-year overall survival (Complex: 84.6% vs. Simple: 77.2%, P=.747) and recurrence free survival (Complex: 93.7% vs. Simple: 95.5%, P=.620).
Conclusion: Complex segmentectomy was comparable to simple segmentectomy in terms of safety and prognosis. Thus, complex segmentectomy will also play a part in the standard surgical procedure for NSCLC.

T-O2-1 Minimally invasive esophagectomy: how I do it?

Simon Law
The University of Hong Kong

Many variations in esophagectomy techniques exist. Our Preferred approach is VATS esophagectomy with total 2-field lymphadenectomy followed by laparoscopic gastric mobilization and cervical esophagogastrostomy. VATS is performed in the left lateral position. Lymphadenectomy is aided by combined intraoperative intermittent and continuous recurrent laryngeal nerve monitoring. In our robotic-assisted approach, the patient is placed on a semi-prone position; artificial pneumothorax to 8mmHg is used to ease pulmonary collapse. Our preferred reconstructive organ is a gastroplasty. Fluorescence angiography is performed as a routine to assess gastric perfusion. The esophago-gastrostomy is carried out using a hand-sewn approach with a monofilament suture. Other variations include intrathoracic anastomosis for selected patients, especially in those with esophago-gastric junction cancer, in whom the anastomosis is either performed using a circular stapler or linear stapler. Sometimes, retrosternal route is used instead of orthotopic route for placement of the conduit.

Esophagus

March 25, 2022 14:30-15:40 / Track 3

T-O2-3 Recurrence Index Predicts Prognosis of Patients with pathological T1 Esophageal Squamous Cell Carcinoma

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Background/Objective: The aim was to construct a nomogram to predict the risk of recurrence in patients with pT1 esophageal squamous cell carcinoma (ESCC).Methods:170 patients with pathological T1 (pT1) esophageal cancer (EC) were involved in this study. Logistic proportional hazards models were conducted to find out the risk factor associated with recurrence independently, and those were imported into R library "rms" for analysis. A nomogram is generated based on the contribution weights of variables. Finally, Decision analysis and clinical impact curve were used to determine the optimal decision point.Results: 25 (14.7%) of the 170 patients with pT1 EC exhibited recurrence. Multivariable logistic regression analysis showed that smoking history, tumor invasion and LVSI (lymph-vascular space invasion) were independent risk factors for recurrence. The nomogram had relatively high accuracy (C-index:0.869, 95%CI:0.794-0.914, P<0.0001). The DCA(decision curve analysis) provided the most significant clinical benefit for the entire included population, with score falling just above the total score of 89 in the nomogram.Conclusion: The study introduced a novel model to aid in clinical decisions making for the pT1 ESCC patients, which may also shed light on the evaluation of recurrence risk.

T-O2-4 Risk and prognostic factors for lymph node metastasis and survival in T1-T2 stage esophageal squamous cell carcinoma

Lin Xu, Haoji Yan, Hongtao Tang, Ruixuan Yu, Heng Huang, Kaiyuan Jiang, Dong Tian
Department of Thoracic Surgery, Affiliated Hospital of North Sichuan Medical College

Background: The risk factors of lymph node metastasis (LNM) in T1-T2 stage esophageal squamous cell carcinoma (ESCC) were controversial, and the prognosis for those T1-T2 stage ESCC patients remained unsatisfactory. We aimed to identify the risk factors for LNM and prognostic factors for survival in T1-T2 stage ESCC patients.**Methods**: We reviewed 672 T1-T2 stage ESCC patients after radical esophagectomy and lymph node dissection in the Affiliated Hospital of North Sichuan Medical College from January 2014 to December 2019. The Logistic and Cox regression models were conducted for the independent risk factors of LNM and the prognostic factors, respectively; followed by Nomogram predictive model. Kaplan-Meier method and log-rank test were performed for survival analysis.**Results**: The overall LNM rate was 27.1% (17.8% for T1 and 35.7% for T2 stage). The 1, 3, 5-year survival rates were 89.0%, 74.3% and 66.0%, respectively. G stage (OR: 1.612, 95% CI: 1.245-2.087, $P < 0.001$), T stage (OR: 2.625, 95% CI: 1.823-3.779, $P < 0.001$) and tumor location (OR: 1.423, 95% CI: 1.072-1.888, $P = 0.015$) were statistically different between the groups with or without LNM. Meanwhile, preoperative comorbidity (HR: 1.532, 95% CI: 1.115-2.105, $P = 0.008$), postoperative complication (HR: 1.379, 95% CI: 1.008-1.886, $P = 0.045$), G stage (HR: 1.360, 95% CI: 1.085-1.704, $P = 0.008$), T stage (HR: 1.619, 95% CI: 1.168-2.245, $P = 0.004$) and N stage (HR: 1.828, 95% CI: 1.505-2.220, $P < 0.001$) could influence overall survival statistically. The nomograms could predict the risk of LNM and prognosis well in patients with ESCC.**Conclusions**: Preoperative tumor location, T and G stage are valuable to instruct the dissection of lymph node. Additionally, it is essential to manage the preoperative comorbidity, reduce postoperative complications, and make T and G stages precise to improve the long-term survival of ESCC patients.

Esophagus

March 25, 2022 14:30-15:40 / Track 3

T-O2-5 Short-term and long-term outcome after esophageal cancer surgery

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Background: Esophageal cancer is the illness with few treatment options and high death rate. In Mongolia, esophageal cancer is the 4th leading incidence of overall cancer.Methods:Data collected and processed from patients at the Thoracic Surgery Department (TSD)from 2014-2020. The collected data was screened using the Health Development Center's Total Mortality Fund and the NCCM's Canregmon registration software. s Mathematical modeling, Life table and Kaplan Mayer methods were calculated using SPSS software for survival rate.Results:The study included 211 patients, who have T1-T4 esophageal and esophageal-gastric cancer. 133 (63%) men, 78 (37%) women, the medial age was 60.2 years (39-81) .93 (44.1%) are located in the middle, 15 (7.1%) in the upper esophagus and 56 (25.1%) in the esophago-gastric junction. 77.7% are squamous cell carcinoma, 19.9% are adenocarcinoma and 2.4% are other cell type.Result 1. 30 days complication rateComplication rate was 35.5 % and approximate to the world average.Result 2. 30 days mortality rateA total of 4 hospital mortality in 30-day, accounting for 1.89% of all surgeries and a lower than the average of most researchers.Result 3. 1, 3 and 5-year survivalSurvival rates: 1 year- 77.88%, 3 year- 33.17%, 5year-18.3%, which was approximate to the world average.Conclusion1. The complication rate within 30 days is 35.5 percent, which is approximate to the world average.2. A total of 7 (3.3%) hospital mortality was reported, accounting for 4 (1.89%) hospital mortality within 30 days were lower than the average of most researchers.3. Of the total participant, 77.88 percent had a 1-year survival rate, 33.17 percent had a 3-year survival rate, and 18.3 percent had a 5-year survival rate, which was approximate to the world average.

T-O2-6 Robotic-assisted thoracoscopic enucleation of esophageal mesenchymal tumors and foregut cysts: case series and review of the literature

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Esophageal mesenchymal tumors and foregut cysts are mostly benign lesions of the esophagus. Surgery with tumor enucleation is recommended for the lesion with risk of malignant potential or relief of clinical symptoms. Although robotic-assisted thoracoscopic enucleation of esophageal tumors and cysts were demonstrated in sporadic case-reports, its clinical role remained to be elucidated.
A total of 19 patients who underwent robotic-assisted thoracoscopic enucleation of esophageal tumors and cysts from 2012 to 2019 in evaluated in the current study. The mean tumor/cyst size was 5.5 cm (1.5-22 cm). There were two cases shifting to minimally invasive esophagectomy (10.5%) due to intraoperative pathological confirmation of malignant GISTs with mucosal invasion. Perioperative complication was detected in three cases (15.8%) complications, without 30-day or surgical mortality. No tumor or symptoms recurrence was noted in all of the patients with a mean of 35 months in clinical follow-up.
Robotic-assisted thoracoscopic enucleation of esophageal submucosal benign tumor is technically feasible and effective. Given its advantage in overcoming spatial limitations, it has the potential to become a widely accepted surgical option for such diseases.