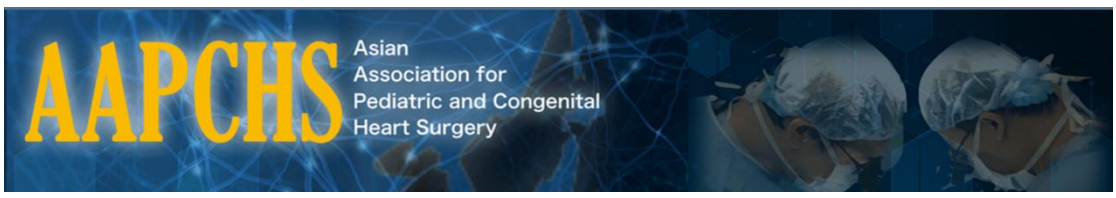
The 4th Asian Associations for Pediatric and Congenital Heart Surgery Annual Meeting, Korea (AAPCHS 2024)

Meeting Abstracts



Content

(1) Oral Scientific Session

1. Incidence and predictive factors for vocal cord palsy after aortic arch surgery in pediatric patients

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Abstract:

Background: Pediatric patients with post-cardiac surgery vocal cord palsy (VCP) typically present with stridor, weak cry, and sometimes aspiration. It is also known to be under-reported due to undetected vocal cord palsy. Aortic arch surgery is known to be particularly susceptible to VCP from damage to the recurrent laryngeal nerve. We reviewed incidence, risk factors, and recovery rate of VCP after aortic arch surgery since 2020 when we began to send every patient who showed any suspicious symptoms or signs of VCP to the laryngoscopy exam.

Methods: We retrospectively reviewed pediatric patients who had aortic arch surgery from Jan 2020 to Dec 2023. The incidence of vocal fold palsy and patient's follow-up data were analyzed. Peri-operative variables that may influence the incidence of vocal cord palsy and recovery were statistically analyzed, and multivariate analysis was done to evaluate risk factors for VCP.

Results: A total of 61 patients were eligible for analysis. The procedures performed were coartoplasty (n=41), Norwood procedure (n=11), interrupted aortic arch (IAA) repair (n=7), vascular ring repair (n=2). VCP was present in 12 (19.6%) patients, with 7 patients from coartoplasty (31%), and 5 patients from IAA repair (71%). Repair of IAA (OR: 12.14 CI: 1.95-75.74, p=0.008) and preoperative intubation (OR: 5.46 CI 1.4-20.9, p=0.026) were related with postop VCP in univariate analysis. Sub-group analysis among non-Norwood patients revealed that the number of intubations performed was also related to postop VCP (p=0.006). Among VCP patients, 2 patients

showed confirmed recovery with a median of 4.5 months, 3 patients had persistent palsy after a year, while others were lost on follow-up (n=5) or still under follow-up with symptoms (n=2).

Conclusions: Our data show that pre-operative intubation and IAA repair may be a risk factor for vocal fold palsy in pediatric patients with aortic arch surgery.

Keywords: Vocal cord palsy, pediatric heart surgery, aortic arch surgery

2. A longitudinal observation of atrioventricular valve failure in Fontan palliation for functional single ventricle with common atrioventricular valve

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Abstract:

Background: Patients with functional single ventricle (FSV) have a high incidence of atrioventricular valve regurgitation, which increases the management difficulty of single ventricle palliation and affects the survival of these patients. The probability of common atrioventricular valve (CAVV) failure is high, but there are few reports on valve failure in patients with FSV and CAVV. This study aims to clarify the cumulative incidence of atrioventricular valve failure and atrioventricular valve intervention in patients with FSV and CAVV undergoing Fontan palliation at our center, and to explore its impact on Fontan failure.

Methods: We retrospectively reviewed the clinical data of patients with FSV and CAVV who underwent Fontan palliation at Guangdong Provincial People's Hospital from 2004 to 2021. We analyzed the cumulative incidence of CAVV failure and atrioventricular valve intervention, as well as the survival rate free from Fontan failure. We also examined the factors associated with atrioventricular valve failure and survival.

Results: A total of 110 patients with FSV and CAVV were identified. The cumulative incidence of CAVV failure at 5, 10, and 20 years after birth in this cohort was 20.5%,

33.7%, and 64.4%, respectively. During the follow-up period, a total of 38 valve interventions were performed in 32 patients, including 23 valve repairs and 15 valve replacements, with no identified risk factors related to atrioventricular valve failure. The survival rates free from Fontan circulatory failure at 1, 5, and 10 years after Fontan surgery were 90%, 85%, and 71%, respectively. Multivariable Cox regression analysis showed that CAVV failure (HR: 2.35 [1.055, 5.239], p=0.037) and complete pulmonary vein anomaly (HR: 2.788 [1.268, 6.13], p=0.011) were independent risk factors for Fontan failure. In patients without atrioventricular valve failure, the survival rates free from Fontan circulatory failure at 1, 5, and 10 years were 91.1%, 88.6%, and 83%, respectively, while in patients with atrioventricular valve failure, the rates were 88.9%, 76.7%, and 58.7% (p=0.012).

Conclusions: In conclusion, patients with FSV and CAVV have a high incidence of atrioventricular valve failure. Increasing age at follow-up is the only factor affecting atrioventricular valve failure, which in turn reduces the survival rate free from Fontan failure in these patients.

Keywords: Functional single ventricle, common atrioventricular valve, atrioventricular valve failure, Fontan failure

3. Application of day surgery in the treatment of patent ductus arteriosus with Da Vinci robot surgery in children

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Abstract:

Background: Robot-assisted thoracoscope surgery for the treatment of patent ductus arteriosus (PDA) has been reported to be feasible in children. Day surgery management is a favorable alternative to a classic inpatient setting. This study aims to assess the feasibility and safety of day surgery management robot-assisted PDA ligation.

Methods: Clinical data were retrospectively reviewed for children who underwent Da Vinci robotic surgery for PDA from August 2020 to December 2023. Patients were divided into day surgery and non-day surgery groups based on whether they had completed discharge within 24 hours. Clinical features, perioperative complications, prognosis, and satisfaction of treatment were compared between the two groups. A total of 276 children were included in this study.

Results: The median age was 34 (6-154) months; the median weight was 13.5 (6.2-63.2) kilograms; the median operation time was 45 minutes, ranging from 23 to 90 minutes. One hundred and thirty-five patients underwent day surgery and 141 patients underwent non-day surgery. There was no statistically significant difference between the two groups in age, weight, and perioperative complications (P>0.05). However, the length of hospital stay in the day surgery group was significantly shorter (1±0 days vs. 2.5±0.39 days, P<0.001), and the hospitalization cost was also significantly lower (5.08±0.11 million yuan vs. 5.35±0.39 million yuan, P<0.001). Both groups were satisfied with the treatment results, and there was no difference in satisfaction rates between the two groups (P>0.05).

Conclusions: The day surgery management model of Da Vinci robot surgery for pediatric PDA is safe, feasible, and significantly reduces the length of hospital stay and treatment costs, without increasing postoperative complications.

Keywords: Day surgery, Da Vinci robot surgery, patent ductus arteriosus, children

4. The effects of fenestration on long-term outcomes of extracardiac Fontan operation

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Abstract:

Background: The debate on maintaining fenestration during Fontan operation revolves around its impact on late perioperative morbidity. While fenestration helps reduce

congestion, lowering the risk of hepatic and lymphatic dysfunction, it presents drawbacks such as decreased oxygen saturation, the potential for paradoxical embolism, and induced exercise intolerance. This study aims to analyze the long-term effects of fenestration on Fontan operation outcomes.

Methods: Patients undergoing Fontan operation at a single center from 1994 to 2022 were included, excluding those with lateral tunnel Fontan operations or conversion to extracardiac Fontan. Fenestration was routinely performed and maintained for over 9 months (F group) or closed within 9 months (NF group). Kaplan-Meier analysis and liver cirrhosis were assessed via computed tomography scans.

Results: Among 153 patients, 140 patients (91.5%) underwent fenestration during Fontan operation. The F group (n=94, 61.4%) had fenestration open for an average of 60.5 months, while the NF group (n=59, 38.6%) closed fenestration at an average of 2.9 months. The 20-year survival was 98.8% in the F group and 87.6% in the NF group (P=0.005). Exercise test results at 15 years showed no significant difference in maximal VO2 between the groups (F group: 26.4ml/m², NF group: 25.4ml/m², p=0.442). Freedom from death or liver cirrhosis at 20 years favored the F group (97.6%) over the NF group (74.9%, p<0.001).

Conclusions: Prolonged fenestration does not significantly impact exercise intolerance but may offer protection against long-term death or liver cirrhosis during Fontan operation.

Keywords: Fontan operation, Fenestration

5. Short-term outcomes of adjustable annular bridging technique for common atrioventricular valve regurgitation in patients with single ventricle

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Abstract:

Background: Common atrioventricular valve (CAVV) regurgitation is associated with

worse prognosis in patients undergoing staged Fontan operation. Various techniques have been previously described; however, CAVV repair remains technically challenging. This study aimed to investigate the short-term outcomes of the adjustable annular bridging technique in patients with CAVV regurgitation.

Methods: Retrospective chart review was performed on single-ventricle patients who had CAVV repair from January 2010 to July 2023. For adjustable annular bridging technique, an ePTFE vascular suture was applied to fix the length of the anteroposterior dimension against the atrial dilatation. Using the tourniquet, the size of the valve orifice was adjusted by guidance of a regurgitation test. We defined patients who underwent the adjustable annular bridging technique (± combined with other techniques) as Group A, and valve repair without adjustable annular bridging as Group C. Patients who previously had a valve repair other than adjustable annular bridging were also included. The severity of regurgitation was rated by echocardiography as none=0, mild=1, moderate=2, severe=3.

Results: Forty-six patients (Group A: n=17(37%); Group C: n=29(63%)) underwent valvuloplasty for CAVV regurgitation. Median age was 11.5 (IQR, 7-34) months. The severity of CAVV regurgitation was unchanged in Group A (-0.11±0.85) but worsened in Group C (0.75±0.78) (P=0.001). As a result, the severity of regurgitation grade at the latest follow-up was 1.41±0.21 in Group A and 1.96±0.16 in Group C (p=0.042). In total, 21 valve re-interventions (18 CAVV plasty and 3 valve replacements) were performed in 15 out of 46 patients (33%). Re-intervention was more required in Group C compared to Group A (13 patients (44%) vs. 2 patients (12%), p=0.021).

Conclusions: Adjustable annular bridging technique vs. conventional repair resulted in favorable short-term outcomes by maintaining CAVV competence.

Keywords: Congenital heart disease, Surgery, Single ventricle, Common atrioventricular repair

6. Percutaneous perventricular device closure of ventricular septal defect: the mid-term outcomes

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Abstract:

Background: As an alternative to open heart repair, perventricular device closure provides minimally invasive treatment for doubly committed subarterial ventricular septal defects. However, unlike percutaneous transcatheter access, mini-thoracotomy is still needed. This report describes the percutaneous perventricular device closure technique and its mid-term results.

Methods: 76 patients who had isolated doubly committed subarterial ventricular septal defects underwent percutaneous perventricular device closure. By puncture of the chest wall and subsequently the infundibulum of the right ventricle under continuous guidance of transesophageal echocardiography, the guidewire and the delivery sheath were advanced into the heart to complete the perventricular closure. Patients' perioperative and postoperative data were retrospectively collected, and closure outcomes and possible complications were evaluated.

Results: Closure was successful in 75 patients (98.7%). During the median follow-up time of 54.3 months, no deaths, residual shunting, new valve regurgitation, or arrhythmias occurred. One patient had pericardial effusion and tamponade, and the procedure was converted to mini-thoracotomy perventricular device closure. The mean hospital stay was 3.4 ± 1.7 days, and only 2 patients required a blood transfusion (2.6%).

Conclusions: Percutaneous perventricular device closure of isolated doubly committed subarterial ventricular septal defects appeared to be safe and efficacious, with promising mid-term outcomes. Larger studies and long-term follow-up are needed for further evaluation.

Keywords: Percutaneous, Device closure, Doubly-committed VSD

7 Biventricular repair of double-outlet right ventricle with noncommitted ventricular septal defect using intraventricular conduit

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Abstract:

Background: In cases of double-outlet right ventricle (DORV) with a non-committed ventricular septal defect (ncVSD), biventricular repair stands as the preferred approach. Nonetheless, current surgical methodologies are intricate and associated with significant risks of mortality and morbidity. In response, we've introduced a tailored approach utilizing an intraventricular conduit to link the VSD with the aorta, specifically designed for patients aged two years and older.

Methods: Between May 2006 and December 2023, thirty-five patients (aged 2-23 years; median, 5.1) diagnosed with DORV and ncVSD underwent biventricular repair with intraventricular conduit. A 16-mm or 19-mm polytetrafluoroethylene (Gore-Tex; WL Gore & Associates, Flagstaff, Ariz) conduit was utilized to reroute the VSD to the aorta. Additionally, VSD enlargement and resection of hypertrophic muscular bands in the bilateral conus were performed when indicated. Follow-up evaluations were conducted for all patients, with a median duration of 120 months (range, 8-200 months).

Results: During the follow-up period, three patients expired. One patient died during hospitalization, another patient at 8 months post-operation, and a third at 10 years post-operation due to infective endocarditis, resulting in a mortality rate of 7.8%. Across all patients, except one (3.3%), the peak pressure gradient across the left ventricular outflow tract remained below 30 mm Hg. Notably, in the latter case, this gradient increased from 16 mm Hg shortly after the operation to 50 mm Hg at the 7-year follow-up. The peak pressure gradient across the right ventricular outflow tract varied from 6 to 30 mm Hg among all patients. Additionally, one patient exhibited moderate mitral regurgitation classified as New York Heart Association class II.

Conclusions: Our analysis suggests that biventricular repair with an intraventricular conduit represents a feasible and secure intervention for patients aged over 2 years afflicted with DORV and ncVSD.

Keywords: Biventricular repair, double-outlet right ventricle, intraventricular conduit, noncommitted ventricular septal defect

8. Effect of vertical vein division on pulmonary vein stenosis after total anomalous pulmonary venous return

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Abstract:

Background: The approach to managing the vertical vein in total anomalous pulmonary venous return (TAPVR) repair remains unclear. This study aims to identify the risk factors for pulmonary vein stenosis following TAPVR repair, with a particular focus on the impact of vertical vein division on pulmonary vein stenosis.

Methods: This study is a retrospective single-center study, which included patients who underwent TAPVR repair from January 2000 to December 2023. Patients with complex congenital heart defects were excluded. Early outcomes were evaluated and perioperative factors associated with pulmonary vein stenosis were analyzed using a multivariate logistic regression model.

Results: A total of 114 patients were included. Mean age at the operation was 62.0±208.2 days, and mean follow-up duration was 107.3±80.5 months. There were 7 cases (6.1%) of early mortality within 30 days and 4 cases (3.5%) of late mortality. Pulmonary vein stenosis occurred after TAPVR repair in 10 patients (8.8%). Univariate analyses demonstrated that the body weight at the time of surgery ($p = 0.014$), the body surface area (BSA) at the time of surgery ($p < 0.001$), the presence of pulmonary hypertension at the time of surgery ($p = 0.047$), and the type of procedure performed on the vertical vein ($p = 0.038$) were associated with the occurrence of postoperative pulmonary vein stenosis.

Conclusions: The procedure performed on the vertical vein can influence the development of pulmonary vein stenosis following TAPVR repair, with the division of the vertical vein potentially serving as a protective factor.

Keywords: Total anomalous pulmonary venous return, pulmonary vein stenosis, vertical vein, postoperative outcomes

9. Outcomes of ventricular septal defect enlargement during biventricular repair

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Abstract:

Background: This study aimed to investigate complications and clinical outcomes after ventricular septal defect (VSD) enlargement during biventricular repair in various congenital heart diseases.

Methods: Between November 2003 and February 2024, patients who underwent VSD enlargement during biventricular repair were included and analyzed. Postoperative complications included ventricular dysfunction (EF<55%), reoperations for left ventricular outflow tract obstruction, and complete atrioventricular block. Recent cases refer to the latest half of the study population. The Kaplan-Meier survival curve analysis was used for survival analysis, and complication-free survival curves were compared using the long-rank test.

Results: A total of 24 patients were included. The median age and body weight at operation were 11.8 months (Interquartile range [IQR], 5.8-18.6 months) and 8.3 kg (IQR, 7.3-9.4 kg), respectively. There were 15 males (62.5%). Types of operations included Rastelli operation in 9 patients (37.5%), intraventricular baffling in 11 patients (45.8%), and Yasui operation in 4 patients (16.7%). The median follow-up duration was 2.8 years (IQR, 1.1-6.0 years). The overall survival rate was 79.9% at 7 years. The

complication-free survival rate was 73.5% at 7 years. Complication-free survival rate was significantly high in recent cases compared to former cases (P= 0.035).

Conclusions: VSD enlargement during biventricular repair produced a considerable complication rate, of which incidence was significantly lowered in recent cases.

Keywords: VSD enlargement, biventricular repair, congenital heart disease

10. Surgical repair of common atrioventricular valve defect with complex leaflet arrangement

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Abstract:

Background: Biventricular repair of Common Atrioventricular valve with complex leaflet arrangement is difficult and often results in residual lesions requiring recurrent surgeries. Surgical techniques in such cases are not standardized. Various surgical techniques employed in such cases are described with early and midterm outcomes on follow up.

Methods: Between 2014 and 2023, a total of 78 children underwent biventricular repair for common atrioventricular valve defect. Of these, 69 cases were complete atrioventricular canal defects while 9 children had additional cardiac defects. Among these 78 children, 14 children were found to have complex leaflet arrangement characterized by deficient leaflets, multiple leaflets, multiple clefts, double orifices following correction, single papillary muscle in the left ventricle, and left ventricular outflow obstruction due to abnormal leaflets.

Results: Overall perioperative mortality in this cohort of 78 patients was 2.6%. In 14 children with complex leaflet arrangement, various surgical techniques like leaflet augmentation, multiple cleft closure, leaflet amalgamation, partial cleft closure, papillary muscle splitting, and leaflet reorientation were employed. 12 children at discharge had mild or less residual mitral regurgitation, while 2 children had moderate

regurgitation. Partial cleft closure with papillary muscle splitting was associated with progression of mitral regurgitation on follow up.

Conclusions: Systematic and tailored surgical approaches depending on the anatomy of complex leaflet arrangement in common atrioventricular defect can yield gratifying results. Long-term follow-up is required to assess the stability of these techniques.

Keywords: Atrioventricular defect, complete AV canal, regurgitation

11. Outcomes of total cavopulmonary connection in the treatment of functional single ventricle with heterotaxy syndrome: a propensity score matching study

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Abstract:

Background: Functional single ventricle (FSV) is a complex congenital heart disease that presents significant challenges in surgical treatment, often precluding biventricular repair. Total cavopulmonary connection (TCPC) has become the definitive treatment for most patients. Patients with FSV and heterotaxy syndrome (HS) often present with extensive intra- and extracardiac anatomical anomalies, including common atrioventricular valve, systemic or pulmonary venous abnormalities, asplenia, and ciliary dyskinesia. This study aims to retrospectively analyze the data of FSV patients with and without HS, comparing outcomes with matched non-HS patients from the same surgical period.

Methods: A retrospective analysis was conducted on the patients with functional single ventricle and HS who underwent TCPC (HS group) at Guangdong Provincial People's Hospital between 2004 and 2021. Early and late postoperative outcomes were compared with matched non-HS patients (non-HS group).

Results: 55 patients were collected in the HS group, including 42 males and 13 females, with a median age of 6.0 years and a median weight of 17.0 kg. Postoperative complications included infections in 27 patients, liver function damage in 19 patients, and acute kidney injury in 11 patients. The 1-year survival rate was 87.2%, the 5-year survival rate was 85.3%, and the 10-year survival rate was 74.3%. Multivariate Cox regression analysis identified asplenia as a risk factor for mortality.

Conclusions: Compared to the non-HS group, those with HS had longer surgical and mechanical ventilation times, higher infection rates, and a 12.9% lower 10-year survival rate. Asplenia is an independent risk factor for mortality in these patients.

Keywords: Total cavopulmonary connection, functional single ventricle, heterotaxy syndrome, survival rate

12. Association between preoperative iron status with adverse outcomes in pediatric congenital heart disease

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Abstract:

Background: The precise relationship between iron status and postoperative adverse outcomes in pediatric patients with congenital heart disease (CHD) remains largely uncertain. Our objective was to examine the preoperative iron status and its correlation with adverse outcomes in pediatric patients with CHD.

Methods: We conducted a retrospective study involving 8065 pediatric patients from Pediatric Cardiac Surgery Center, Fuwai Hospital. We utilized restricted cubic splines

to investigate the association between ferritin levels and outcomes. A multivariate logistic regression model was employed to validate the relationships between preoperative iron status and postoperative adverse outcomes.

Results: Among pediatric CHD patients, 23.0% had iron deficiency, 12.0% had anemia, and 7.0% had iron deficiency anemia. Cyanotic CHD patients had a higher prevalence of iron deficiency but a lower incidence of anemia compared to acyanotic patients. A right-skewed U-shaped relationship was observed between ferritin levels and both death and composite adverse events. High ferritin levels (>100 ng/mL) were significantly associated with a higher risk of death and adverse events.

Conclusions: Iron deficiency and anemia remain prevalent challenges among children with CHD. The imbalance in preoperative iron levels, including both deficiency and excessive iron load, has been found to significantly correlate with adverse outcomes in pediatric CHD patients.

Keywords: Pediatrics, congenital heart disease, iron status, outcome

13. Current panorama and future perspectives of congenital heart disease treatment in China: a comprehensive analysis of multiple nationwide databases

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Abstract:

Background: China has the largest number of individuals with congenital heart disease (CHD) in the world and many experienced pediatric cardiac surgeons (although their number is insufficient). Understanding the current outcomes and patterns of CHD management in China could provide valuable insights.

Methods: We combined multiple nationwide databases to systematically analyze the current status of congenital heart disease treatment in China, including the White Book of Chinese Cardiovascular Surgery and Extracorporeal Circulation, the Hospital Quality Monitoring System initiated by the National Commission of the People's Republic of China, China Heart Transplant Registry, and the China Statistical Yearbook initiated by the National Bureau of Statistics of China.

Results: The overall outcomes of CHD treatment in China are satisfactory, with in-hospital mortality ranging from 0.8% to 1.0%. For mild CHD, in-hospital mortality is 0.5% after surgery and 0.1% after interventional treatment, whereas for complex CHD, in-hospital mortality ranges from 2.5% to 3.8%. Mitral valve disease and pediatric end-stage heart failure remain challenging to manage. The lack of cohesive pediatric cardiology teams poses a major challenge, as adult or pediatric cardiac surgeons usually care for patients in most centers. Additionally, insufficient collaboration between hospitals leads to inadequate treatment for patients with coexisting conditions.

Conclusions: Favorable outcomes of CHD treatment have been achieved in China; however, several aspects could be improved. Despite progress, challenges remain in managing mitral valve disease and pediatric end-stage heart failure. A training program to establish cohesive pediatric cardiology teams and increased collaboration between hospitals are essential to further enhance CHD treatment outcomes.

Keywords: Congenital heart disease, current treatment outcomes, mortality, databases

14. Congenital heart disease patients with left-to-right shunts: single center experience within a developing country

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Abstract:

Background: This study aims to describe the characteristics of patients with left-to-right

shunt congenital heart diseases and the early outcomes after surgery, such as length of stay and pulmonary hypertension events, in low-to-middle-income countries.

Methods: We retrospectively reviewed congenital heart diseases in pediatric patients with left-to-right shunts (such as atrial septal defect [ASD], ventricular septal defect [VSD], atrioventricular septal defect [AVSD], and patent ductus arteriosus [PDA]) who underwent surgical procedures at Jakarta Heart Center from 2021 to 2023. The patients transferred to other hospitals were excluded from this study.

Results: A total of 399 cases of left-to-right shunt congenital heart disease were included. There were two recorded mortality cases. The mean age at the time of surgery was 3.51 years. VSD cases comprised 67.4%, ASD 16.8%, PDA 12.5%, and AVSD 3.3%, with 9% associated with Down syndrome. Among them, 349 underwent cardiopulmonary bypass (mean CPB time of 51 minutes, mean cross-clamp time of 27 minutes). The average length of hospital stay was 5 days (mean ICU stay: 2 days, mean ventilator use: 1 day). Pulmonary hypertension events were encountered in 12.8% of cases.

Conclusions: This study, conducted in a developing country, treated various CHDs characterized by left-to-right shunts, with VSD being the most prevalent. The lower mortality rate in our study is due to careful case selection despite resource limitations and effective teamwork. Further data collection and prospective investigations are necessary to gain a deeper understanding of the specific conditions affecting patients in developing countries.

Keywords: Congenital heart disease, ASD, VSD, AVSD, PDA, developing country

(2) Case Report Sessions

1. Biventricular repair in complex common atrioventricular defect presenting in adulthood

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Abstract:

Background: Complex congenital heart surgery requires extensive preoperative planning to determine the optimal surgical approach.

Methods: A 28-year-old female, 53 kg, was referred with a resting saturation of 70% and Hemoglobin of 20.1 gm/dl. The patient had undergone a 5mm shunt to the right pulmonary artery in childhood. Echocardiography revealed a common atrium with inferior vena cava interruption and hepatic vein draining toward the left atrium. The patient had a type C Rastelli common atrioventricular valve with moderate regurgitation, and the aorta arising completely from the right ventricle. Contrast CT of the heart revealed disconnected pulmonary arteries with the main pulmonary artery continuing as the right pulmonary artery with a small shunt draining to it.

Results: Comprehensive preoperative evaluation with 3D reconstruction was done to assess the extent of routing required for biventricular conversion with a residual right ventricular cavity after correction. The patient underwent biventricular correction with two-patch repair of the common atrioventricular valve, routing aorta to the left ventricle, routing the hepatic vein to the right atrium, unifocalizing the branch pulmonary arteries, and establishing a right ventricular outflow pathway with a conduit. The patient was extubated in 24 hours and discharged with a resting saturation of 95%.

Conclusions: Advanced procedural planning with 3D reconstruction and virtual imaging enhances decision-making and precise surgical execution in complex congenital heart defects.

Keywords: Atrioventricular defect, Double outlet right ventricle

2. Conversion from dextrocardia to levocardia for rastelli operation in a patient with truncus arteriosus, double aortic arch, and dextrocardia

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Abstract:

Background: To describe the surgical techniques for converting patients with dextrocardia to levocardia.

Methods: The infant patient was diagnosed with situs solitus dextrocardia, atrial-ventricular concordance, truncus arteriosus type I, and right-dominant double aortic arch. The patient received palliative surgery in another hospital, and was referred to our hospital at the age of 4 months. The main pulmonary artery was located left-sided, with dextrocardia causing the right ventricle to be located posteriorly. To overcome the difficulty, we decided to convert the dextrocardia to levocardia as the first step.

Results: After surgery, imaging confirmed the achievement of levocardia. The Rastelli operation was performed two months later. The patient recovered well, with no need for oxygen or respiratory support after 2.5 years of follow-up.

Conclusions: The surgical procedure successfully converted dextrocardia to levocardia. The technique involved right atrial free wall patch augmentation and transection and anastomosis of the aorta after heart rotation. After the apical switch operation, the Rastelli operation could be performed as usual.

Keywords: Dextrocardia, levocardia, truncus arteriosus, Rastelli operation

3. A seventeen-year-old boy with left-dominant unbalanced AVSD, TOF, and Trisomy 21, who successfully underwent a biventricular conversion: case report

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Abstract:

Background: A case with unbalanced AVSD combined with trisomy 21 presents a significant challenge for optimal management strategies. This report describes a 17-year-old boy with left-dominant unbalanced AVSD, TOF, and trisomy 21, who successfully underwent biventricular conversion.

Methods: The patient, diagnosed with these lesions at birth, underwent a modified BT shunt at age 5 months. He had a small right ventricle (RVEDV: 29% of normal) and no possibility of a good Fontan outcome. At age 10, he developed infective endocarditis and severe CAVV regurgitation and underwent urgent repair. At age 16, he presented with brain abscess, cyanosis, and heart failure. Re-evaluation revealed failed BDG, growing right ventricle (RVEDV: 113% of normal), and moderate CAVV regurgitation. He underwent a two-patch repair of AVSD, re-RVOTR, take-down of BDG, and SVC reconstruction.

Results: Delayed sternal closure was performed, and the patient recovered with mildly reduced left ventricular function and mild regurgitation. He remains functional without cyanosis.

Conclusions: This case suggests the importance of re-evaluation and the potential for ventricular growth with subsequent biventricular conversion.

Keywords: Unbalanced AVSD, TOF, Trisomy 21, biventricular conversion

4. Successful implantation of melody valve in mitral position in an infant: a first case report from Korea

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Abstract:

Background: Mitral valve replacement (MVR) in infants with irreparable mitral valves presents significant clinical challenges, often necessitating frequent reinterventions. Recent data supporting the use of a bovine jugular vein graft (Melody® valve) for MVR have been promising. This report discusses the first use of the Melody® valve for MVR in an infant in Korea, following the failure of a mechanical valve.

Methods: An 8-month-old female, post-surgery for a complete atrioventricular septal defect, was diagnosed with prosthetic valve failure and persistent subdural hemorrhage. The Melody® valve was successfully implanted via an inter-atrial approach. Postoperative imaging showed minimal mitral regurgitation and mild mitral stenosis.

Results: The patient recovered well and was discharged in two months with clopidogrel alone. No progression of hemorrhage was observed, and the patient remained stable.

Conclusions: This successful case highlights the need for policy adaptations to embrace innovative treatments like the Melody® valve for MVR in infants.

Keywords: Mitral valve replacement, melody valve

5. Cone repair for tricuspid valve dysplasia after failed Hetzer repair

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Abstract:

A 66-year-old male patient presented with recently developed Functional Class 2 dyspnea. Thorough diagnostic exam revealed tricuspid dysplasia accompanied by severe tricuspid valve regurgitation and persistent atrial fibrillation. An intervention on the tricuspid valve and a bi-atrial maze operation were planned. After the bi-atrial maze operation was performed, the tricuspid valve was carefully evaluated for deciding the type of repair. Despite short chordae and multiple secondary chordae, as those chordae seemed relievable, the tricuspid valve's annulus was significantly dilated, and the leaflets were well developed, tricuspid valve repair was attempted by performing secondary chordae resection and Hetzer repair; consequently, the anteroposterior (AP) dimension was remarkably reduced, coaptation between the anterior and septal leaflets was enhanced resulting in significantly reduced amount of valve regurgitation without causing inflow stenosis. Intraoperative transesophageal echocardiography showed mild tricuspid regurgitation without stenosis. However, echocardiography at discharge performed seven days postoperatively revealed severe TR and non-coapting tricuspid valve, raising suspicions of Hetzer stitch disruption. On 13 days after initial operation, reoperation was performed. Intraoperatively, the disrupted Hetzer stitch and subsequently detached anterior leaflet from the annulus, resulting in significant

regurgitation due to both the coaptation failure and additional leaking through the detaching leaflet, were observed. Since the annulus was considerably dilated, allowing substantial annular reduction, the tissue of the leaflets was sufficient to form a high coaptation height cone, and securing a couple of well-moving main papillary muscles towards the apex by dividing accessory papillary muscles seemed possible, a cone repair was planned and executed [Video]. Intraoperative transesophageal echocardiography showed minimal leak with inflow mean gradient of 2mmHg, and the echocardiography at discharge showed well-functioning tricuspid valve cone with minimal leak and no stenosis. Electrocardiograms after maze operation consistently showed normal sinus rhythm. The patient was discharged at 20 days after initial operation and 7 days after reoperation with ACE inhibitor, diuretics, and NOAC. An indication for cone repair could be extended beyond the Ebstein's anomaly.

Keywords: Tricuspid valve, cone repair, Hetzer repair

6. Application of robot-assisted endoscopic technique in the treatment of patent ductus arteriosus in children

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Abstract:

Background: Robotic surgery is an alternative to traditional and minimally invasive cardiac procedures. The adaptation of robotics in congenital cardiac surgery in children has remained limited, especially in younger infants. We analyzed the early outcomes of our single-center experience in robot-assisted surgical technique for treatment of patent ductus arteriosus (PDA) in children.

Methods: Clinical data of children with PDA who underwent robot-assisted operation using the Da Vinci system were retrospectively analyzed from August 2020 to June 2022. Demographic and preoperative data were collected, including the patient's age, weight, diameter of the PDA, operation time, length of postoperative hospital stays, and

postoperative complications.

Results: There were 158 cases that underwent robotically assisted surgery for PDA ligation. No one was converted to thoracotomy. The age ranged from 6 months to 12.8 years with median age 3.5±2.4 years. The weight ranged from 6.6 kilograms (kg) to 51.6 kg with median weight 15.6 ±7.2 kg. Ninety-three (58.7%) patients were female. Ninety (57%) were younger than 3 years old, which included 9 infants. The PDA diameter was 0.15 cm to 0.71 cm. The operation time was 15-84 minutes long. There was a steady decrease in operation times after the surgeon performed 15 cases. With the improvement of the process, the operation time usually does not exceed 35 minutes. There was no obvious bleeding during the operation. The length of postoperative hospital stays was 1-3 days, with an average of 1.1±0.2 days. Only one case had a residual ductus shunt during early postoperative follow-up. One case experienced recurrent laryngeal nerve injury. Both cases recovered after 3 months of follow-up. The median duration of follow-up was 12 (1-22) months. No other short-term complications occurred during the follow-up period.

Conclusions: Robotic surgical technique for PDA ligation in children is a safe, effective, and reliable surgical method with less trauma, faster recovery, and fewer surgical risks. This approach should be considered as an option in children requiring PDA ligation.

Keywords: Children, faster recovery, less trauma, patent ductus arteriosus, robotic surgical technique

7. Experience of video-assisted thoracoscopic atrial appendage resection for refractory atrial tachycardia originating from atrial appendage in children in single center

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Abstract:

Background: To summarize 10 pediatric cases of video-assisted thoracoscopic atrial

appendage resection in the recent 3 years and to analyze the clinical experience and therapeutic effect of radiofrequency catheter ablation combined with atrial appendage resection in the treatment of atrial tachycardia originating from the atrial appendage.

Methods: 10 patients with refractory atrial tachycardia originating from the atrial appendage were reviewed, who underwent video-assisted thoracoscopic atrial appendage resection in our hospital from April 2021 to March 2024. All cases were recurrent after radiofrequency ablation, including 5 males and 5 females, aged 3-10 years, body weight 15.3-46 kg. 6 cases originated from the left atrial appendage, the other 4 cases originated from the right atrial appendage.

Results: Preoperative echocardiography measured LVEF 43.36 ± 13.02 %, LAD 2.65 ± 0.53 cm, LVDd 4.79 ± 0.93 cm. The cardiothoracic ratio was 0.62 ± 0.06. Pro-BNP 3051 ± 3013pg/ml. All patients underwent video-assisted thoracoscopic atrial appendage resection by endoscopic linear cutter stapler, and all patients immediately turned to sinus rhythm without recurrence. postoperative echocardiography measured LVEF 54.49 ± 20.34 % ($p<0.05$), LAD 2.18 ± 0.29cm ($p<0.05$), LVDd 4.11 ± 0.93cm ($p>0.05$), cardiothoracic ratio 0.53 ± 0.05 ($p<0.05$), Pro-BNP 564.5 ± 496.28pg/ml ($p<0.05$). During the follow-up period of 1 month to 3 years, there were no deaths, no recurrence, and no serious complications.

Conclusions: Atrial appendage resection is an ultimate surgical treatment for refractory atrial tachycardia originating from the atrial appendage. Compared with traditional thoracotomy approach, video-assisted thoracoscopic atrial appendage resection is safe, effective, and less traumatic in children.

Keywords: Atrial tachycardia, atrial appendage resection, video-assisted thoracic surgery, child

8. **A modified technique of pulmonary annular enlargement with valve repair in a patient with TOF**

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Abstract:

Although pulmonary valve annular preservation during total repair can be achieved in a high proportion of patients with TOF, annular enlargement of the pulmonary valve cannot be avoided in some patients with TOF. Annular enlargement with pulmonary valve repair can be considered as a surgical option in highly selected patients who had transversely oriented commissures and marginally small pulmonary valve annulus. In this case, a modified technique of pulmonary annular enlargement with valve repair is presented in a patient with TOF with marginally small pulmonary valve annulus. Long-term follow-up is warranted.

Keywords: TOF, valve repair

9. Upgrade stenting combined with removal of previously implanted stents for pulmonary vein obstruction after total anomalous pulmonary venous connection repair

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Abstract:

Background: Pulmonary vein obstruction (PVO) after the repair of total anomalous pulmonary venous connection (TAPVC) still carries a poor prognosis even after introducing “Sutureless repair.” Then, we performed a novel “upgrade-stenting approach” to treat postsurgical PVO, comprised of PV stenting and repeated dilatation in infancy, followed by surgical stent removal and reimplantation of larger stents. We present preliminary data for three children who underwent this approach and a surgical technique for removing PV stents.

Methods: Three TAPVC patients with postsurgical PVO were treated with the upgrade-stenting approach as follows: 1. Surgical PVO release (at least one sutureless repair)

after neonatal TAPVC repair. 2. PV stenting using small diameter stents when PVO relapses. 3. Repeated stent dilatation until the maximum available size. 4. Surgical stent removal for the development of in-stent PV stenosis. 5. Larger PV stent delivery by catheterization within a few weeks. 6. Repeat sequences 3 to 5 until sufficient PV caliper for age is achieved.

Results: For three PVO patients, stent removal procedures using a low-powered electric cautery were uneventfully completed with three stents each, resulting in significant increases in PV diameters and a decrease in pulmonary artery pressure. However, larger stent delivery by catheter was required for all in four to six weeks after stent removal due to PV restenosis. After delivery of larger stents, the rate of PV catheter intervention was markedly improved, and all three patients grew well.

Conclusions: For TAPVC patients with postsurgical PVO, only surgical removal of the PV stents led to an early relapse of PVO. Although the present data are preliminary, the upgrade-stenting approach has the potential to become the curative treatment for postsurgical PVO.

Keywords: Pulmonary venous obstruction, PV stents, stent removal, total anomalous pulmonary venous connection

(3) Short Oral Sessions

1. Clinical characteristics and early postoperative outcome of pediatric tetralogy of Fallot

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Abstract:

Tetralogy of Fallot is a congenital heart disease that accounts for 7-10% congenital heart anomalies. In low-middle income countries like Indonesia, there are limited resources

in managing this type of patients, therefore would result in more complicated postoperative clinical course. This study aims to report the early postoperative outcome of tetralogy of Fallot in pediatric patient. We conducted a single-institution retrospective review of pediatric patients with tetralogy of Fallot that underwent surgery from January 1, 2020- February 29, 2024. Patient characteristics and clinical outcomes were collected. There were 224 patients with TOF (median age 24 months; range 4-216 months) in the study. 30-day mortality rate was 3.6% (n=8). Early mortality that occurred had various causes, one patient had significant residual pulmonary stenosis requiring reoperation, which she did not survive. Two patients had significant ARDS necessitating use of HFO, (unavailable at our hospital). Two patients died of sepsis and three patients had postoperative low cardiac output syndrome. Early reoperations occur in 2 patients (1%). Majority of patients did not have prolonged ICU and hospital stay. Despite achieving quite low early morbidity and mortality, gap remains compared to developing nations. Improvement of care and resources, including availability of necessary devices such as high-frequency oscillatory ventilation (HFO) and extracorporeal membrane oxygenation (ECMO) are essential to further reduce mortality and morbidity. Long term follow up is needed to assess long term outcome of these patients.

Keywords: Tetralogy of Fallot, postoperative outcome

2. Knowledge and skill transfer for congenital heart surgery: recipient institution's perspective

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Abstract:

Shahid Gangalal National Heart Center (SGNHC) is a leading center for heart surgery in Nepal which performed its first surgery in August 2001. We have established a mutual collaboration with Seoul National University Hospital (SNUH)/ JW Lee Center

for Global Medicine since 2018. The collaboration includes exchange visits by the faculties from SNUH led by Prof Woong-Han Kim to SGNHC and vice versa. Two different teams have visited SNUH, and two different teams have visited SGNHC. First visit by SGNHC team to SNUH was in November 2018. We had online team-based capacity building program via e-learning conducted by professors of SNUH during March-August 2021. Prof Woong-Han Kim led the first visit to SGNHC in July 2022. Another team from SGNHC visited SNUH in April 2023. Second visit from SNUH to SGNHC was in July 2023. After the visit by Prof Kim in 2022, we have fundamentally changed how we operate our cases: 1. Short circuit length with reduced priming volume. 2. Vacuum assisted venous drainage. 3. Small torniquets to snare cannulae. 4. Recirculation line in cardioplegia. 5. Liberal use of mannitol during CPB. 6. Utilizing newer techniques to do hypoplastic arch repair. Between July 2022 and July 2023, our team performed a subtotal of 156 congenital heart surgeries excluding ASDs. We compared those data with data of preceding year. Priming volume in two eras was 750±215 vs 549±265ml ($p<.001$). Mannitol use in two eras was 29±15 vs 122±57ml ($p<.001$). We have achieved fast track extubation and our kids experience less LCOS these days. Our team feels more comfortable handling complex cases in recent years. Knowledge and skill transfer is an essential part to advance the field of medicine as a whole. Our team has benefitted immensely by the collaboration with SNUH to advance the field of congenital heart surgery.

Keywords: Knowledge, skill, priming volume, institutional collaboration

3. Analysis of clinical outcomes of early extubation in neonates after arterial switch operation for transposition of the great Arteries

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Abstract:

To review the clinical data of 29 neonates with transposition of the great arteries who underwent fast-track extubation, and to summarize the clinical experience. A retrospective analysis was conducted on 29 cases of neonates with transposition of the great arteries in our hospital from January 2023 to April 2024. Among them, 19 cases underwent fast-track extubation within 24 hours postoperatively, while the remaining 10 cases, who had extubation time longer than 24 hours, served as the control group (conventional group). The general conditions, postoperative ventilator support time, postoperative management, outcomes, and medical costs were compared. Statistical significance was defined as $P<0.05$. There was no statistical difference in the age at admission between the fast-track extubation group and the conventional group [(0.82±1.86) days vs (0.23±0.40) days, t=0.982, P=0.335]. The fast-track extubation group had a higher body weight compared to the conventional group [(3.66±0.61) kg vs (2.72±0.56) kg, t=2.772, P=0.01]. There was no statistical difference in the age at surgery between the two groups [(2.95±2.76) days vs (3.63±3.89) days, t=0.549, P=0.587]. There was no statistical difference in the cardiopulmonary bypass time between the two groups [(130.21±32.18) minutes vs (139.60±26.32) minutes, t=0.792, P=0.435]. The fast-track extubation group had a shorter postoperative ventilator support time compared to the conventional group [(11.98±6.05) hours vs (106.23±67.96) hours, t=4.376, P=0.002]. The fast-track extubation group had a shorter ICU stay compared to the conventional group [(197.47±63.18) hours vs (344.85±133.10) hours, t=3.311, P=0.007]. The fast-track extubation group had a shorter total hospital stay compared to the conventional group [(15.05±4.54) days vs (22.00±4.81) days, t=3.840, P=0.001]. The fast-track extubation group had lower total hospital costs compared to the conventional group [(109,300±18,000) RMB vs (179,200±33,800) RMB, t=4.181, P=0.001]. Fast-track extubation after arterial switch operation for neonates with transposition of the great arteries is safe and feasible. This approach reduces postoperative ventilator support time, ICU stay, total hospital stay, and hospital costs.

Keywords: Neonates, transposition of the great arteries, fast-track extubation, ventilator

4. Consideration of optimal timing for initiation of veno-venous extracorporeal membrane oxygenation in neonatal and pediatric respiratory failure

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Abstract:

VV-ECMO guidelines for pediatric respiratory distress syndrome (RDS) patients still seems unclear. We aimed to clarify optimal timing to initiate the VV-ECMO in pediatric RDS patients based on our clinical experience. Thirty-two RDS patients requiring VV-ECMO support (December 2016 and February 2024) were retrospectively reviewed. Patients were divided into two groups, mortality and survival cases. We primarily evaluated oxygen index (OI) value at the time VV-ECMO initiated and OI value before 8 hours from VV-ECMO initiation. we reviewed other various clinical parameters, including fraction of inspired oxygen (FiO2), mean airway pressure (MAP), partial pressure arterial oxygen (PaO2) level, PaO2/FiO2 (PF) ratio, serum lactate level, ventilator use with nitric oxide (NO), anticoagulation associated complications in peri-ECMO support period and analyzed outcomes. 32 patients were enrolled. The median age of the patients was 3.4 years (Interquartile range [IQR], 0.7-6.0 years), and body surface area was 0.63 m2 (IQR, 0.32-0.76) at the time of ECMO insertion. The median duration of VV-ECMO support was 9.5 days (IQR, 4.8-32 days). 13 patients (40.6%) survived. OI at the time of VV-ECMO support started (19.9 [IQR:10.8-43.9] in survivors vs. 39.0 [IQR:26.7-62.7] in deceased, p-value=0.03) and at 8 hours before initiation of ECMO was significantly lower in the survivor group (15.6 [IQR:12.9-24.0] in survivors vs. 31.5 [IQR:19.5-45.8] in deceased, p-value=0.008). PaO2 and mechanical ventilation duration showed no significant differences between groups. Including anticoagulation-related complications, there were no major complications during ECMO support. In pediatric RDS patients, regular monitoring of OI seemed essential to determine appropriate timing for initiating ECMO. With little risks in

maintaining VV-ECMO, we should consider earlier initiation of VV-ECMO support than we have done so far.

Keywords: Extracorporeal membrane oxygenation, respiratory distress syndrome, pediatric

(4) Poster Sessions

P-001. The association of NT-proBNP and hs-TnT with postoperative outcomes of pediatric congenital heart surgery

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Abstract:

The existing evidence on the predictive value of troponins and natriuretic peptides for early postoperative outcomes in pediatric patients is scarce, conflicting, and derived from small sample sizes. Our objective was to examine the correlation between N-terminal pro B-type natriuretic peptide (NT-proBNP) and high-sensitivity troponin T (hs-TnT) levels and the occurrence of adverse in-hospital outcomes following congenital cardiac surgeries. To explore the association of NT-proBNP and hs-TnT levels within 6 hours after surgery with in-hospital adverse events, a secondary analysis was performed using data from a prospective study involving pediatric patients with congenital heart disease (CHD). Utilizing a multivariate logistic regression analysis with a minimum p-value approach, we aimed to determine the optimal thresholds of NT-proBNP and hs-TnT for effective risk stratification. A total of 1015 pediatric CHD

patients were enrolled in this study. NT-proBNP demonstrated excellent predictive performance for adverse events in both patients younger than 1 year (AUC: 0.771, 0.693-0.850) and those older than 1 year (AUC: 0.839, 0.757-0.922). Conversely, hs-TnT showed satisfactory predictive value only in patients aged over 1 year (AUC: 0.784, 0.717-0.852). In patients younger than 1 year, NT-proBNP levels ranging from 2000 to 10000 ng/L (OR: 3.79, 1.47-9.76) and exceeding 10000 ng/L (OR: 12.21, 3.66-40.80) were associated with a higher risk of postoperative adverse events. For patients older than 1 year, NT-proBNP levels higher than 500 ng/L (OR: 15.09, 6.05-37.66) or hs-TnT levels exceeding 1200 ng/L (OR: 5.50, 1.47-20.59) were linked to a higher incidence of postoperative adverse events. In CHD patients older than 1 year, both NT-proBNP and hs-TnT measured within 6 hours after surgery showed significant predictive value for postoperative adverse events. However, among CHD patients younger than 1 year, only NT-proBNP demonstrated commendable predictive performance for postoperative adverse events.

Keywords: Congenital heart disease, cardiac biomarker, NT-proBNP, hs-TnT, postoperative outcomes

P-002. Early and mid-term outcomes of the modified Senning procedure in the double switch operation: application of the triangular double-door technique

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Abstract:

We developed a modified Senning procedure using the triangular double-door technique to preserve the right atrium function as much as possible and report our early and mid-term outcomes of the modified procedure in the double switch operation (DSO) for the patients with congenitally corrected transposition of the great arteries (ccTGA). A retrospective chart review was performed for patients who had undergone the DSO using our modified Senning procedure in the anatomical repair of ccTGA since July

2018. Five consecutive patients underwent the DSO for an anatomical repair of ccTGA using our modified Senning procedure. Median age and weight at the operation were 37 months (range, 28-40 months) and 13.1 kg (range, 12.2-14.6 kg). All five patients had pulmonary artery (PA) banding at mean age 2.6±1.3 months (range, 1-5 months), and period between PA banding and DSO was 32.3±5.4 months (range, 26-39 months). There was no operative mortality. All patients show no significant systemic and pulmonary venous pathway obstruction and normal sinus rhythm during median 16.6 months (range, 5-59 months) follow-up period. All patients also show good ventricular function at last follow-up echocardiography. Our modified Senning procedure using triangular double-door technique could be part of the safe and effective surgical option for the DSO of ccTGA in low-volume centers. However, long-term follow-up in more patients is mandatory.

Keywords: Congenitally corrected transposition of the great arteries, Senning procedure

P-003. Exploring precursors to recoarctation in patients with aortic coarctation

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Abstract:

Coarctation of the aorta (CoA) is a congenital heart defect characterized by a narrowing of the aorta, often necessitating surgical repair to restore normal blood flow. Despite successful initial interventions, a significant subset of patients experiences recoarctation, the reoccurrence of aortic narrowing, presenting a considerable clinical challenge. This study aims to investigate the triggers or contributing factors associated with the development of recoarctation (reCoA) following the initial repair of coarctation of the aorta (CoA), to identify potential strategies for its prevention and management. A retrospective cohort study includes information about 120 patients, who

underwent 4 different types of surgical repairs of coarctation of aorta through left thoracotomy between 2012-2022. Recoarctation was evaluated using the pressure gradient on the coarctation site measured by echocardiography (echoCG). A threshold of more than 20mmHg was employed to define recoarctation. All statistical analysis was performed using SPSS and Jamovi applications. The study revealed that 30 patients (25%) experienced early recoarctation, while 52 patients (43.7%) encountered late recoarctation. Patient-related variables such as age, height, weight, gender, and BMI were not correlated with early or late recoarctation. Among the 28 patients (23.3%) who had arch hypoplasia, 12 of them experienced early recoarctation, and 22 of them exhibited late recoarctation. Correlation tests demonstrated a strong negative correlation of the z-score of the arch size with both early recoarctation ($r=-0.229$, $p=0.013$) and late recoarctation ($r=-0.421$, $p<0.001$). Resection and end-to-end anastomosis (EEA) displayed the highest proportions of early (59%) and late (77%) recoarctation. Prosthetic patch aortoplasty (PPA) showed a relatively higher rate of recoarctation, with 27% of patients experiencing early recoarctation and 44% exhibiting late recoarctation. Resection and extended end-to-end anastomosis displayed a comparatively lower rate, with 0% experiencing early recoarctation and 23% exhibiting late recoarctation. Aortic arch hypoplasia emerges as a significant risk factor for both early and late recoarctation. Additionally, while all coarctation repair methods carry some risk of recoarctation, resection and end-to-end anastomosis and prosthetic patch aortoplasty may pose a higher risk compared to extended end-to-end anastomosis. Recognizing these factors is crucial for optimizing surgical outcomes and reducing recoarctation incidence in patients with coarctation of the aorta.

Keywords: Congenital heart defects, coarctation of aorta, hypoplastic aortic arch, recoarctation.

P-004. Outcomes of mitral valve reoperation in children: single center experience

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Abstract:

This study aimed to analyze the surgical outcomes of mitral valve (MV) reoperation in children. A single-center retrospective study was performed enrolling 24 patients who underwent MV reoperation after MV repair (n=259) between January 2013 and July 2023. Patients were divided into two groups according to the type of diseases: atrioventricular septal defect (AVSD) group (n=13) and primary MV disease group (n=11). Kaplan–Meier curves and Cox regressions were utilized to analyze freedom from death after MV reoperation, freedom from MV re-reoperation as well as risk factors. A total of 22 patients (91.7%) received MV repair, and 2 patients received MV replacement in the MV reoperation. There were 3 early deaths and 1 late death, and 5 patients experienced MV re-reoperations. 10 patients (76.9%) in AVSD group were discovered residual cleft in the anterior MV and received cleft closure plus annuloplasty during MV reoperation. Other surgical techniques adopted including leaflet augmentation (n=3), annuloplasty (n=2), papillary muscle splitting (n=2), supravalvular ring resection (n=2), artificial chordae reconstruction (n=1), double-orifice MV technique (n=1) and partial incision of valve leaflet (n=1). 7 patients (63.6%) in primary MV disease group were discovered mixed MV pathology during MV reoperation. Various surgical techniques such as annuloplasty (n=4), cleft closure (n=4), double-orifice MV technique (n=3), mechanical MV replacement (n=2), supravalvular ring resection (n=2), papillary muscle splitting (n=1), leaflet plication (n=1) and leaflet augmentation (n=1) were applied. There was only 1 early death in AVSD group, and 2 early deaths and 1 late death in primary MV disease group. The survival rate at 1, 3 and 5 years was 92.3±7.4%, 92.3±7.4% and 92.3±7.4% respectively in AVSD group, 79.5±13.1%, 79.5±13.1% and 39.8±28.9% respectively in primary MV disease group. 5 patients in primary MV disease group experienced MV re-reoperations including 2 MV repair and 3 mechanical MV replacement. Meanwhile no patients received re-reoperation in AVSD group. Patients who adopted the double-orifice MV technique in the MV reoperation had significantly higher probability in receiving mechanical MV replacement ($P<0.01$) than others. The use of double-orifice MV technique in MV reoperations was the independent risk factor for MV re-reoperation ($P=0.040$). MV

repair was still the first option for MV reoperation. Patients in AVSD group seems to have better survival rate and lower MV re-reoperation. Once the double-orifice MV technique was adopted in the patients, MV replacement in the short term after surgery seems inevitable.

Keywords: Mitral valve regurgitation, atrioventricular septal defect, reoperation

P-005. Biventricular repair of double-outlet right ventricle with noncommitted ventricular septal defect using intraventricular conduit

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Abstract:

In cases of double-outlet right ventricle (DORV) with a non-committed ventricular septal defect (ncVSD), biventricular repair stands as the preferred approach. Nonetheless, current surgical methodologies are intricate and associated with significant risks of mortality and morbidity. In response, we've introduced a tailored approach utilizing an intraventricular conduit to link the VSD with the aorta, specifically designed for patients aged two years and older. Between May 2006 and December 2023, thirty-five patients (aged 2-23 years; median, 5.1) diagnosed with DORV and ncVSD underwent biventricular repair with intraventricular conduit. A 16-mm or 19-mm polytetrafluoroethylene (Gore-Tex; WL Gore & Associates, Flagstaff, Ariz) conduit was utilized to reroute the VSD to the aorta. Additionally, VSD enlargement and resection of hypertrophic muscular bands in the bilateral conus were performed when indicated. Follow-up evaluations were conducted for all patients, with a median duration of 120 months (range, 8-200 months) During the follow-up period, three patients expired. One patient died during hospitalization, another patient at 8 months post-operation, and a third at 10 years post-operation due to infective endocarditis, resulting in a mortality rate of 7.8%. Across all patients, except one (3.3%),

the peak pressure gradient across the left ventricular outflow tract remained below 30 mm Hg. Notably, in the latter case, this gradient increased from 16 mm Hg shortly after the operation to 50 mm Hg at the 7-year follow-up. The peak pressure gradient across the right ventricular outflow tract varied from 6 to 30 mm Hg among all patients. Additionally, one patient exhibited moderate mitral regurgitation classified as New York Heart Association class II, while another patient presented with preoperative severe pulmonary arterial hypertension and received bosentan treatment. our analysis suggests that biventricular repair with an intraventricular conduit represents a feasible and secure intervention for patients aged over 2 years afflicted with DORV and ncVSD.

Keywords: Biventricular repair, double-outlet right ventricle, intraventricular conduit, noncommitted ventricular septal defect.

P-006. Prognostic nomogram for patients with supravalvular aortic stenosis

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Abstract:

An effective prognostic nomogram to predict the prognosis for supravalvular aortic stenosis (SVAS) patients is lacking. A multi-center retrospective study of consecutive SVAS patients with surgery between 2002 and 2020 was conducted. Patients underwent McGoon repairs (Single-patch repairs), Doty repairs (two-patch repairs), and other repairs (Brom repairs and Sliding-aortoplasty). The primary outcome was the re-operation or restenosis at follow-up. The nomogram based on Cox regression and Kaplan–Meier method was used to show the risk factors of the primary outcome. The predictive accuracy was determined by the concordance index (C-index) and calibration curve. The results were validated using the bootstrap resampling method. Of the 291 SVAS patients, 143 (49.1%) used McGoon repairs, 118 (40.5%) used Doty repairs and 30 (10.3%) used other repairs. The median age at operation was 4.9 years (IQR 2.3-9.9). The re-operation or restenosis rates were 19.2% (11.3%, 26.5%) at 5-year follow-

ups. Age, gender, SVAS type, pulmonary artery stenosis, aortic valve stenosis, sinotubular junction z-score and gradient were considered independent risk factors by Lasso regression and were included in the nomogram. The C-index of the nomogram was 0.71 (95% CI, 0.61 to 0.81). The calibration curve for the probability of re-operation or restenosis showed good agreement between prediction by nomogram and actual observation. Surgical repair of congenital SVAS is an effective treatment with low surgical risk, but late adverse events require focused attention. In this study, there were no significant differences in surgical outcomes between McGoon repairs and Doty repairs. We established a nomogram with good predictive abilities for the occurrence of re-operation and restenosis in SVAS patients, and the nomogram could be used as a practical method for individualized risk evaluation for patients with SVAS after surgery. Future prospective, multi-center, long follow-up studies are needed to externally validate the nomogram.

Keywords: Supravalvular aortic stenosis, surgical repairs, nomogram, risk factors

P-007. Minimally closure of doubly committed subarterial ventricular septal defect via the left third intercostal space through a small incision in the middle part of the chest: a single-center experience

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Abstract:

To share the experience closing doubly committed subarterial ventricular septal defect (dcVSD) with eccentric occluder via the left third intercostal space through a small incision in the middle part of the chest in our hospital. According to the consensus of Chinese experts on transthoracic minimally invasive closure of ventricular septal defect in 2017,we improved the inclusion criteria and exclusion criteria. The data of 105 children with a single dcVSD from January 2019 to December 2023 in our hospital were analysed retrospectively. All patients were treated with the left third intercostal

space through a small incision in the middle part of the chest. After positioning by transesophageal echocardiography (TEE), purse suturing was performed at the right ventricular wall under the pulmonary valve ring, the delivery track was established, and the eccentric occluder was released under the monitoring of TEE. Transthoracic echocardiography (TTE) and electrocardiography were performed 1 day before discharge, 1 month, 3 months, 6 months, 1 year and 2 years after the operation. The eccentric occluder was successfully implanted in 90 patients. Filamentous residual shunts less than 1 mm were found in 7 cases, which disappeared after 1 month to 3 months. However, a 3-year-old child was found was found to have displaced occluder and aggravated aortic regurgitation (AR) by TTE 3 days after operation, and the occluder was removed by emergency cardiopulmonary bypass, the patient was improved after repairing the VSD; Another 1-year-old patient had high fever more than 20 days after discharge, the occluder was found to be displaced and AR was severely regurgitated by TTE. The occluder and vegetation on the aortic valve were removed surgically under cardiopulmonary bypass, and the VSD was repaired with Go-tex patch, after 4 weeks of anti-infection treatment, the patient finally improved. The rest had no complications during and after operation. According to the single dcVSD patients selected by the inclusion criteria, invasive closure of dcVSD via the left third intercostal space through a small incision in the middle part of the chest is feasible, minimally invasive, safe and effective.

Keywords: Doubly committed subarterial ventricular septal defect, closure, minimally invasive, eccentric occluder

P-008. Left ventricular dysfunction in infants with coarctation of aorta

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Abstract:

Coarctation of the aorta (CoA) often leads to significant hemodynamic alterations and subsequent cardiac complications. Among these complications, left ventricular (LV) dysfunction emerges as a critical concern, particularly in infants under one year of age. This abstract aims to elucidate the trigger factors associated with LV dysfunction in infants diagnosed with CoA. All relevant information and CT scan measurements about 46 patients under the age of 1, who underwent surgical repair of coarctation of aorta between 2012-2022 was acquired retrospectively to perform statistical analysis (using Jamovi application). 46 patients (31 males, 67.4%), with mean age of 4.11±3.23 months. Patients were divided into 2 groups: Group 1-with normal LV function (34 patients) and, Group 2 - with impaired LV function (12 patients). The statistical analyses showed that, patients with low LV function (Group 2) showed significantly higher pressure gradient on coarctation site, less number of patients with LV hypertrophy, more number of patients with LV dilation, lower ejection fraction of LV (EFLV) and higher end-diastolic volume of LV (EDVLV) by echoCG, and smaller aortic arch and isthmus size, lower z-score for aortic arch and isthmus sizes by CT, compared to Group 1 (patients with normal LV function). The correlation analysis indicates that the EFLV exhibits a positive correlation with the size of the aortic arch ($r=0.462$, $p=0.006$) and the z-score of the aortic arch size ($r=0.500$, $p=0.003$). This implies that patients with a smaller aortic arch tend to have a lower EFLV. Conversely, EFLV showed a negative correlation with the pressure gradient on the coarctation site ($r=-0.393$, $p=0.008$), mitral regurgitation ($r=-0.817$, $p<0.001$), and EDV LV ($r=-0.492$, $p=0.006$). Hence, patients with a higher-pressure gradient at the coarctation site, or those with more severe aortic coarctation, are likely to have a lower EFLV and a higher EDVLV. These findings suggest that LV dysfunction is primarily a consequence of LV pressure overload, with the severity of aortic coarctation directly influencing the manifestation of LV dysfunction. Aortic arch hypoplasia and mitral regurgitation further exacerbate the impairment of left ventricular function.

Keywords: Congenital heart defects, coarctation of aorta, left ventricular dysfunction, low ejection fraction

P-009. Research about biological vascular prostheses (graft)'s durability & uniformity of prostheses (graft) thickness & pore sizes

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Abstract:

There are depthful research about the vascular graft. In previous research, various types of materials are used. Vascular grafts which are used in surgery today are composed primarily following materials: 1. Expanded Teflon (ePTFE), 2. Dacron fabric. The conventional materials have the advantages and merits such as biodurability. These materials overcome the issue related to loss of tensile strength. For improvement of biological vascular graft, mixed material like heparin bonded PTFE. Following up on these studies, our research initiated. Our basic method is electrospinning. We developed different types of electrospinning compared to previous electrospinning method. Using one nozzle in one electrospinning device was the simplified and basic principle when we make the vascular graft with the small diameter. But using the multi nozzles in one electrospinning device can be much effective way to make the vascular graft. It can reduce the manufacturing time and it can alleviate the worker's burden. Functional tests related to leak are performed to prove the biological vascular graft's quality & mechanical properties. Porosity, water permeability and leak test are the main tests that we have to check. Water permeability test measures the ability of the graft's fibrous structure or membrane to allow passage through fine pores. Porosity test measures the porosity of graft to determine the extent to which blood or cells can pass through it. Leak test evaluates the graft's ability to prevent leakage during blood passage. All three tests passed the test criteria. Important factors that we have to consider during vascular prostheses (grafts)'s research are followed. Leakage issue and maintaining the cylindrical shape can be the key point of the vascular graft research. Regarding the maintaining shape is related to the durability and thickness uniformity. Further preclinical & clinical studies and researches about vascular graft using biodurable materials are needed. There are various types of materials that we can apply to

biological vascular graft. Non degradable polymer, bioresorbable and biodegradable polymers can be vascular's future materials.

Keywords: Vascular graft, vascular, electrospinning

P-010. Application of aortic valve reconstruction and repair techniques in treatment congenital aortic valve disease in children

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Abstract:

Aortic valve disease continues to be a challenging problem in pediatric patients. We continuously search for new innovations, as our best options are imperfect. Aortic valve repair is the first choice for treating simple aortic valve lesions in children, while for more severe or difficult to repair conditions, the options are available including prosthetic aortic valve replacement, the Ross procedure, or aortic valvuloplasty. The treatment of aortic valve disease in children and adolescents requires an individualized approach to provide a long-term solution with optimal hemodynamic profile. Clinical data were retrospectively reviewed for children underwent aortic valve reconstruction technique using tricuspidalization procedure or aortic valve repair in Children's Hospital of Zhejiang University School of Medicine from August 2015 to December 2023. Short-term operative outcome was evaluated. A total of 21 children were included in this study. Seven patients underwent leaflet neo-tricuspidalization, five patients undergoing single leaflet reconstruction, both using glutaraldehyde fixed autologous pericardium. Nine patients underwent aortic valve repair. The median age was 13 years (interquartile range, 9.5-17 years). Six patients had isolated aortic regurgitation. The peak velocity across the aortic valve remained stable (2.1± 0.9 m/s) during the follow-up period. There were 5 late reoperations due to aortic valve stenosis, aortic regurgitation and endocarditis. Children with aortic valve disease continue to

present a challenging pathology to manage. They require an individualized treatment approach based on the aortic valve anatomy, associated cardiac lesions, previous valve interventions, patient size and age at the time of intervention, as well as surgeon experience. Aortic leaflet reconstruction provides acceptable short-term hemodynamic outcomes and proves the utility of this technique as an adjunctive strategy for surgical treatment of aortic valve disease in children. The management strategy pursued must consider the durability provided to minimize the need for repetitive procedures, as well as the morbidity associated with lifelong anticoagulation therapy.

Keywords: Aortic valve, aortic valve reconstruction, aortic valve repair, children

P-011. Assessing the risk of reoperation for mild pulmonary vein obstruction post-TAPVC repair

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Abstract:

This study investigates the impact of mild pulmonary vein obstruction, detected via echocardiography before hospital discharge, on the likelihood of reoperation in patients who have undergone repair for Total Anomalous Pulmonary Venous Connection (TAPVC). Utilizing a single-center, retrospective cohort approach, we analyzed 38 cases from October 2017 to December 2023, excluding patients with functionally univentricular circulations or atrial isomerism. Our primary outcome was the necessity for reoperation within one year due to anatomical issues related to the initial TAPVC repair. Mild obstruction was defined as a pulmonary vein flow velocity ≥1.2 m/s. Our findings revealed that 31.6% of patients exhibited pre-discharge mild obstruction. During the median follow-up of 10 months, reoperations were notably higher in the mild obstruction group compared to the normal group, with a significant association between pre-discharge mild obstruction and increased risk of reoperation. Specifically, in the fully adjusted model, mild obstruction was linked to a 13.9-fold increased risk of

reoperation. Our results suggest that a pre-discharge echocardiography Doppler velocity threshold of 1.2 m/s could serve as a critical predictor for reoperation, emphasizing the need for targeted follow-up strategies for at-risk patients.

Keywords: Total anomalous pulmonary venous connection, reoperation, mild pulmonary vein obstruction, risk factor

P-012. Pulmonary atresia with intact ventricular septum and critical pulmonary stenosis in neonates: initial management and definitive repair

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Abstract:

To summarize the experience and results of personalized staged hybrid therapy for pulmonary atresia with intact ventricular septum (PA/IVS) and critical pulmonary stenosis (CPS) patients in our hospital. 43 children with PA/IVS or CPS who were hospitalized in our hospital from 2016-2022 were reviewed. In the neonatal period, 2 cases underwent B-T shunt, 3 cases underwent pulmonary valvotomy under cardiopulmonary bypass, 7 cases underwent patent ductus arteriosus (PDA) stenting, 30 cases underwent percutaneous ballon pulmonary valvuloplasty (PBPV), and 1 case underwent PBPV+PDA stenting. 9 patients underwent reoperation during the perioperative period, and 1 patient died, with an early mortality rate of 2.3%. 42 cases were discharged successfully, 3 cases were lost to follow-up, and 5 cases died during follow-up. 16 children underwent surgical re-intervention between 6 months and 1 year of age, including 6 cases of biventricular correction, 8 cases of 1½ ventricular correction and single ventricular correction were performed in 2 cases. Excluding 1 early death, 3 lost to follow-up and 5 deaths during follow-up, among the remaining 34 children, 2 were treated with single ventricle correction, 8 were 1½ Ventricular correction (1 case died of intracranial hemorrhage during the perioperative period), and

24 cases were biventricular correction. There were 6 late deaths, and the late mortality rate was 13.9%. Freedom from reoperation at 5 years was 34.4% (95%CI, 15.3%-53.4%). The 5-year survival rate after one-stage operation was 81.4% (95%CI, 68.8%-93.9%). Individualized staged hybrid therapy is an effective treatment strategy for PA/IVS and CPS in neonates. Dysplasia of the right ventricle and tricuspid valve are high-risk factors for perioperative re-intervention. The pulmonary valve dysplasia before the first operation and the small ratio of tricuspid valve diameter to mitral valve diameter before the second intervention are significantly correlated with the single ventricle correction.

Keywords: Pulmonary atresia with intact ventricular septum, critical pulmonary stenosis, neonate, individualized staged hybrid therapy

P-013. Cardiac arrest and myocardial calcification in a child

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Abstract:

Anomalous aortic origin of a coronary artery from the inappropriate sinus of Valsalva (AAOCA) is a rare congenital heart lesion. We report a child with cardiac arrest and massive myocardial calcification due to anomalous aortic origin of the left coronary artery from the non-coronary sinus. This case demonstrates a rare but critical condition in a child that requires surgical repair. A 13-year-old boy was transferred to our institution because of syncope one hour prior. His syncope occurred suddenly after physical activity at school. Ventricular fibrillation occurred shortly after admission. He was sent to the intensive care unit following cardiopulmonary resuscitation and defibrillation. The echocardiogram indicated anomalous aortic origin of the left coronary artery from the non-coronary sinus of Valsalva (Figure A). The coronary CTA showed AAOCA with an intramural segment (Figure B). Massive myocardial calcification of the left atrium and ventricle was also found. Coronary artery unroofing

was performed. During the operation, we found that the left coronary artery arised from the non-coronary sinus of Valsalva with an intramural segment (Figure C). The top of inter-coronary commissure was below the intramural segment. Since the length of the interarterial course was limited, we did not perform pulmonary artery translocation. Myocardial calcification of the left heart was significant, and biopsy of the left ventricle was performed. The pathology indicated calcification and necrosis of cardiomyocytes (Figure D). The postoperative recovery was uneventful. He was discharged twelve days after surgery. He was asymptomatic at the one-month follow-up. The echocardiogram at the follow-up showed no signs of narrowing of coronary arteries. The left ventricular ejection fraction was 64%. AAOCA can be related to coronary ischemia and cardiac sudden death, especially in adolescents. By timely diagnosis and treatment, this patient is successfully rescued.

Keywords: Anomalous coronary artery; children; cardiac arrest

P-014. Discussion of safety and effectiveness of percutaneous pulmonary valve implantation in children: a case report

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Abstract:

Tetralogy of Fallot (TOF) is a common cyanotic congenital heart disease (CHD), accounting for approximately 3.5-10% of CHD cases. With advances in surgical techniques, the survival rate of children with TOF has significantly improved. However, long-term complications like pulmonary regurgitation (PR) cannot be overlooked. Percutaneous pulmonary valve replacement (PPVR) is emerging as a minimally invasive treatment for PR in TOF patients, offering advantages such as reduced trauma, lower risk, shorter hospital stays, and faster recovery. We report a case of percutaneous pulmonary valve implantation in a child with TOF after surgical repair. A 16-year-old

patient who was diagnosed with TOF underwent surgery 15 years ago, admitted with severe PR. Preoperative evaluations included cardiac magnetic resonance imaging, cardiac CT angiography, and echocardiography to assess pulmonary vascular conditions and spatial relationships with the coronary arteries. Angiography revealed absent pulmonary valve, severe regurgitation, pulmonary artery diameter of 26 mm, length from pulmonary artery bifurcation to right ventricular outflow tract of 65 mm, pulmonary valve annulus diameter of 28 mm measured by balloon sizing, and no coronary compression. Using a 22F delivery sheath, the self-expanding valve was successfully implanted with angiographic confirmation of good positioning and no significant regurgitation. The patient was extubated and began oral intake on the day of surgery and was discharged three days later. After surgery, the patient received antiplatelet therapy with 150 mg aspirin daily. Currently, the patient has good quality of life, no activity limitations, NYHA functional class I, and favorable echocardiographic findings at 1, 3, 30 and 90 days postoperatively. Compared to conventional surgery with cardiopulmonary bypass, PPVI offers advantages such as less trauma, faster recovery, lower surgical risk, and shorter hospital stay. It may become an effective treatment for PR in long-term follow-up after repair of TOF.

Keywords: Congenital heart disease, tetralogy of Fallot, percutaneous pulmonary valve implantation

P-015. Application of transthoracic pulmonary valve implantation in complex right ventricular outflow tract morphology

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Abstract:

Percutaneous pulmonary valve implantation has yielded encouraging clinical results in patients with pulmonary valve regurgitation after native right ventricular outflow tract

(RVOT) reconstruction. However, it is still limited in patients with complex RVOT anatomy, which the world is facing problems such as low acceptance rate of patient screening and often large valve selection models. At present, the application of transcatheter pulmonary valve implantation with complex RVOT morphology has not been reported. In this study, patients with moderate to severe pulmonary valve regurgitation after native right ventricular outflow tract reconstruction and complicated right ventricular outflow tract were selected as the study objects. The primary endpoint event was successful valve implantation with 3 complex events: no valve displacement embolization within 24 hours after implantation; The mean peak pressure difference between right ventricle and pulmonary artery ≤30mmHg; Submoderate total pulmonary regurgitation. Secondary endpoint events: Response rate at 6 months after valve implantation: mean peak pressure difference between right ventricle and pulmonary artery ≤30mmHg; Less than moderate common pulmonary regurgitation; Avoid further intervention or valve replacement. In this study, demographic, preoperative, intraoperative and follow-up data were reviewed. Between June 2021 and August 2023, nine patients with moderate-to-severe pulmonary valve regurgitation after native right ventricular outflow tract reconstruction with complex right ventricular outflow tract morphology underwent physical examination, transthoracic echocardiography, and cardiac MRI evaluation. Pulmonary valve implantation through thoracic intervention was attempted in 9 patients, with an average age of 19.37±6.18 years, all of whom were treated with trans-annular valve patch correction for tetralogy of Fallot, including 5 patients with pulmonary artery branch stenosis, 4 patients with type I right ventricular outflow tract morphology, 3 patients with severe right ventricular outflow tract dilatation, 1 patient with double aortic arch, and 1 patient with patent ductus arteriae. transcatheter pulmonary valve implantation was successfully completed in 8 patients, and intraoperative valve displacement was in 1 patient and . The surgical approach was intercostal in 4 cases and transthoracic in 5 cases. In the same period, pulmonary artery branch balloon dilatation was performed in 5 cases, pulmonary artery stenting external fixation in 7 cases, pulmonary artery ring contraction in 3 cases, aortic double arch correction in 1 case, and patent ductus arteriosus ligation in 1 case. All patients were

followed up 6 months after surgery, and no valvular dysfunction or re-intervention event occurred. All patients had minimal or mild total pulmonary valve regurgitant, and the peak pressure difference between right ventricle and pulmonary artery was <30 mmHg. No external valvular stent rupture was found in chest radiography. This study demonstrates the feasibility, safety, and efficacy of transthoracic transcatheter pulmonary valve implantation in patients with moderate to severe pulmonary valve regurgitation and complex right ventricular outflow tract morphology after native right ventricular outflow tract reconstruction. The short term curative effect is clear, the medium and long term curative effect still needs follow-up observation.

Keywords: Pulmonary regurgitation, transthoracic transcatheter pulmonary valve implantation, complex right ventricular outflow tract morphology, native right ventricular outflow tract reconstruction

P-016. Combined approaches tailored to individual patients can achieve an acceptable complete repair ratio in patients with pulmonary atresia with ventricular septal defect and major aortopulmonary collateral arteries

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Abstract:

Pulmonary atresia with ventricular septal defect and major aortopulmonary collateral arteries (PA/VSD/MAPCAs) is a complex and diverse disease that has led to a variety of treatment strategies. Though early one-stage complete unifocalization is considered a relatively preferred strategy with satisfying complete repair ratios, the characteristic of poorer pulmonary vascular beds associated with delayed interventions in China makes it more difficult to select approaches. We reported single-center surgical approaches and outcomes of these patients. This was a retrospective review of 199 consecutively treated patients in our center from 2010 to 2024. The dominant pathway

utilized in 136 (68.3%) patients is midline unifocalization, which includes one-stage unifocalization and unifocalization after rehabilitation. Less frequently employed strategies include 40 (20.1%) systemic-to-pulmonary shunts and 63 (31.6%) right ventricle to pulmonary artery (RV-PA) conduits. For patients who underwent systemic-to-pulmonary shunt, a central shunt was usually preferred over the modified Blalock-Taussig shunt. 106 (53%) patients achieved complete repair, including 55 (27.6%) one-stage complete repair and 51 (25.6%) staged complete repair; other 13 (6.5%) cases had "almost complete" repair with small ventricular fenestrations preserved. For 21 patients with absent intrapericardial pulmonary arteries (Type C), 15 (71.4%) achieved complete repair, while 6 (28.6%) patients had small ventricular fenestrations preserved. For 178 patients with Type B PA/VSD/MAPCAs, 91 (51.1%) achieved complete repair. 8 (4.0%) perioperative deaths occurred, while 4 (2.0%) mid-to-late death cases were reported. For patients who underwent unifocalization, 68 (50%) reinterventions were performed, among which 42 (61.8%) were ventricular septal defect complete or partial closure. Despite the relatively older age and poorer pulmonary vascular bed, complete repair was achieved in most cases by employing combined approaches tailored to individual patients. Unifocalization was still the dominant strategy, and the unifocalized pulmonary vascular had the ability to further grow, ultimately leading to complete repair.

Keywords: PA/VSD, MAPCAs, unifocalization

P-017. Mid-term outcomes of atrioventricular valve repair in functional single ventricle patients

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Abstract:

Surgical treatment of functional single ventricle combined with atrioventricular valve regurgitation remains a clinical challenge. The outcomes of atrioventricular valve repair in patients with single ventricle are limited. A retrospective study was conducted of all 28 patients with functional single ventricle treated with single-ventricle palliation who

underwent atrioventricular valve operation at the First Hospital of Tsinghua University between April 2007 and October 2022. In our cohort, the female/male ratio was 7:21, with an average age of 8.7±6.0 (0.75-26) years. Half of patients (50%) were right-ventricle type for single-ventricle morphology. 18 patients(64.3%) were with a common atrioventricular valve. Twenty-three patients (82.1%) were combined with heterotaxy syndrome. Pre-operatively, twenty-four patients (85.7%) were diagnosed with severe atrioventricular valve regurgitation. AVV was repaired at the Glenn(n=16, 57.1%), Glenn-Fontan (n=2, 7.1%) and Fontan (n=10, 35.7%) stage, respectively. Valve plastic techniques included valve annulus/commissure constriction (n=24), clefts repair(9 cases), edge-to-edge suturing (13 cases) and common atrioventricular valve separation (4cases). The early mortality was 3.6% (1/28). All survival patients were observed with improved regurgitation situations. Twenty-two patients (78.5%) were observed with no more than mild regurgitation postoperatively. The mean follow-up time was 5.4±2.9 years (range,3.08-11.83 years), with late mortality of 11.1% (3/27). All these three cases were observed with a severe regurgitation by echocardiogram in the last follow-up. Besides, reoperation rate of this cohort was 3.6% (1/28). AVV repair could significantly improve AVV function in SV patients combined with severe AVVR, with satisfactory mid-term results. Part of the cohort showed poor prognosis due to repeated AVVR. Regular follow-up by echocardiogram is critically important for these patients.

Keywords: Single ventricle, atrioventricular valve regurgitation, valve repair

P-018. Anatomical correction of tetralogy of Fallot in neonates: from fetal pulmonary vascular development to postnatal changes: outcomes in a series of 33 consecutive cases

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Abstract:

Tetralogy of Fallot (ToF) is a complex congenital heart defect characterized by four

anatomical abnormalities that significantly affect the cardiopulmonary system. Early surgical intervention is crucial to optimize outcomes and reduce long-term morbidity. This study evaluates a series of 33 consecutive neonates with ToF who underwent a one-stage, non-transannular repair, aiming to assess the impact of early anatomical correction on pulmonary vascular development and postoperative outcomes. We retrospectively analyzed 33 neonates diagnosed with ToF who underwent primary surgical repair without the use of a transannular patch. Prenatal and postnatal echocardiographic measurements of the pulmonary valve, main pulmonary artery, and branch pulmonary arteries were compared. Specifically, we examined the z-scores of these measurements from the fetal period to the day of birth and tracked the progression of hemodynamic parameters such as pulmonary valve antegrade flow pressure gradients in the immediate postnatal period. Postoperative outcomes, including the development of pulmonary vasculature, early surgical complications, and the need for reintervention, were systematically recorded and analyzed. The z-scores for the pulmonary valve, main pulmonary artery, and branch pulmonary arteries measured at birth were greater than those measured during the fetal period in this cohort ($P<0.01$). Initially, the pressure gradient across the pulmonary valve was minimal but increased significantly in the days following birth ($P<0.01$). Postoperatively, significant growth was observed in the left and right pulmonary arteries, the main pulmonary artery, and the pulmonary valve annulus ($P<0.01$). None of the 33 patients experienced early postoperative complications such as arrhythmias, effusion syndrome, or low cardiac output syndrome. To date, there have been no mortalities or cases requiring reintervention in this patient series. As neonatal pulmonary vascular resistance gradually decreases, early intervention to shorten the natural ischemic course in the pulmonary vascular bed of ToF patients can more effectively promote pulmonary vascular development. One-stage primary repair of ToF in the neonatal period is both safe and feasible, providing timely support for the growth and development of the pulmonary vasculature and improving clinical outcomes.

Keywords: Pulmonary vascular development, neonatal tetralogy of Fallot, one-stage primary repair

P-019. Critical tricuspid regurgitation in the newborn with chordal rupture and flail leaflet: surgical management and mid-term follow-up

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Abstract:

Tricuspid chordal rupture with flail leaflet in the newborn leading to critical tricuspid regurgitation (TR) is an extremely rare pathology and often leads to severe neonatal distress. We present our surgical experience with two such neonates, along with a two-year follow-up. In both patients, no abnormalities or concerns were detected during the routine prenatal assessments. Patient 1 had a history of peripartum fetal distress and was delivered via cesarean section at 40 weeks'gestation. One hour after birth, he developed cyanosis and had oxygen saturation of 80%. An echocardiogram demonstrated a flail tricuspid anterior leaflet, severe TR, a patent foramen ovale (PFO) with right-to-left shunting. He was taken up for surgery on day 16 of life. The ruptured chordae tendineae were found to be contracted and fibrotic. The surgical repair involved the implantation of artificial chordae using a 6/0 polytetrafluoroethylene (PTFE) suture. Patient 2 had a history of peripartum fetal distress and was delivered via cesarean section at 38+5 weeks' gestation. Shortly after birth, she developed respiratory distress and cyanosis, requiring intubation. Semi-urgent surgery was performed at 5 days after birth. Successful repair was achieved with direct suturing of the ruptured chordae to the papillary muscle using a 6/0 polypropylene suture with pledges. A Sebening stitch was added bringing the anterior papillary muscle to the ventricular septum. Patient 1 had a successful tricuspid valve repair, and the early postoperative echocardiogram showed only mild TR. The patient was discharged home on postoperative day 11. The regular follow-up over a period of 2 years showed he is active and well-developed with only trivial TR. In patient 2, early postoperative echocardiogram showed no TR. Her cardiac condition improved significantly after surgery. Unfortunately, she experienced a complication of severe cerebral haemorrhage

and succumbed two days after surgery. Early diagnosis and timely surgical intervention for chordal rupture and flail tricuspid valve are vital for the neonate's survival. The direct suturing technique is possible and preferable. The use of PTFE artificial chordae implantation has shown satisfactory mid-term results in neonatal tricuspid valve repair.

Keywords: Congenital heart disease, neonate, tricuspid regurgitation, tricuspid valve surgery, chordal rupture

P-020. Mid-term outcomes of atrioventricular valve repair in functional single ventricle patients

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Abstract:

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time was 5.4±2.9 years (range, 3.08-11.83 years), with late mortality of 11.1% (3/27). All these three cases were observed with a severe regurgitation by echocardiogram in the last follow-up. Besides, reoperation rate of this cohort was 3.6% (1/28). AVV repair could significantly improve AVV function in SV patients combined with severe AVVR, with satisfactory mid-term results. Part of the cohort showed poor prognosis due to repeated AVVR. Regular follow-up by echocardiogram is critically important for these patients.

Keywords: Single ventricle, atrioventricular valve regurgitation, valve repair

P-021. Management in a 5-year-old diagnosed with severe coarctation of the aorta, aortic arch hypoplasia, doubly-committed subarterial ventricular septal defect, large patent ductus arteriosus, and severe pulmonary hypertension

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Abstract:

Coarctation of the aorta is a congenital heart disease often associated with other cardiac abnormalities, including aortic arch hypoplasia and ventricular septal defect. These multiple anomalies also contribute to pulmonary hypertension, which can significantly increase mortality and morbidity. Management strategies for aortic coarctation combined with other heart defects vary based on individual cases. We present the case of a 5-year-old diagnosed with coarctation of the aorta, aortic arch hypoplasia, doubly-commited subarterial ventricular septal defect, large patent ductus arteriosus, and severe pulmonary hypertension, who underwent staged surgery beginning in 2023. The initial surgery successfully addressed aortic coarctation and aortic arch hypoplasia, along with pulmonary artery banding. A second surgery, intended for ventricular septal defect closure and pulmonary artery de-banding, is scheduled with a one-year interval following the initial procedure. Throughout this period, close monitoring of the patient's condition, particularly pulmonary pressure, will be maintained. The patient is under

anti-hypertensive medication since before the first surgery. The primary goal of intervention is to manage severe pulmonary hypertension and improve circulatory function. Follow-up evaluations in the patient have revealed favorable outcomes, evidenced by the patient's improved hemodynamic status and echocardiography results. Staged surgery combined with anti-hypertensive management has a favourable outcome in treating our patients diagnosed with coarctation of the aorta and multiple cardiac abnormalities including pulmonary hypertension.

Keywords: Coarctation of the aorta, long aortic arch hypoplasia, pulmonary hypertension, staged surgery

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