30. TRANSCATHETER INTERVENTION FOR PARAVALVULAR LEAK IN MITROFLOW BIOPROSTHETIC PULMONARY VALVE

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**History and Physical:** Paravalvular leak (PVL) is a complication due to suture dehiscence between the sewing ring and native tissue resulting in regurgitation around the replaced valve. The standard treatment for pulmonary PVL is surgical repair or valve replacement. However, surgery is associated with greater morbidity and mortality. Transcatheter intervention for aortic and mitral valve PVL is effective and known to have better long-term outcomes than surgery, which has a 12-year survival of 30-40% and high rate of recurrence. In the setting of pulmonary PVL, transcatheter approach may be a useful technique with optimal outcomes.

A 22-year-old male with tetralogy of Fallot and bilateral peripheral pulmonary artery (PA) stenosis presented with multiple episodes of syncope, dyspnea on exertion (NYHA class III) and worsening lower extremity edema. He had a transannular patch repair early in life. Due to severe pulmonary regurgitation (PR), his pulmonary valve was replaced with a 27 mm Mosaic tissue valve at 8 years of age. He was noted to have free PR, and depressed systolic function at 15 years of age. Subsequently, he underwent pulmonary valve replacement with a 25mm Mitroflow bioprosthetic valve and intraoperative stenting of the branch PAs. Postoperative period required extracorporeal membrane oxygenation support and prolonged tracheostomy leading to severe post-traumatic stress syndrome. On Holter monitoring, he was noted to have ventricular tachycardia.

**Imaging:** (See Figures 1 & 2).

**Indication for Intervention:** In view of worsening dyspnea, syncope, and edema, PVL closure was considered (Figure 1). Considering his complex history and associated risks with redo-sternotomy, a multi-disciplinary team recommended transcatheter PVL closure.

**Intervention:** Moderate stenosis was noted across the Mitroflow valve at the pulmonary position with gradient of

30. Figure 1. CT on True3D Viewer (Echopixel, Inc., Mountain View, CA) showing paravalvular tunnel measuring 8x6x9 mm in the posteromedial side of the pulmonary valve.

30. Figure 2. Panel A. PVL size confirmed using Armada balloon; Panel B. AVP II deployed in the PVL.
25-30 mmHg, and Qp:Qs of 1:1; PA angiography demonstrated moderate pulmonary insufficiency and PVL. The PVL was localized by balloon occlusion of the valve and simultaneous contrast injection into the PA. The defect was sized using an Armada balloon (8x4 mm; Figure 2A). After careful hemodynamic and angiographic evaluation, a 12 mm Amplatzer vascular plug II (AVP II) was deployed in the tunnel-like leak without any complications or residual leak (Figure 2B). The diastolic PA pressure improved from 6 to 20 mmHg after PVL closure. The patient recovered well and was discharged without arrhythmias on follow-up.

**Learning Points:** Although transcatheter closures of pulmonary PVL are reported using AVP II and ventricular septal defect occluders, successful closure is dependent on appropriate case selection and operator expertise. Transcatheter intervention is a feasible treatment option with lower complication rates than surgery and must be considered in the setting of pulmonary PVL.

### 31. DIFFERENT MANAGEMENT FOR THROMBOSIS COMPLICATIONS IN POST FONTAN SURGERY: REPORT OF TWO CASES

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**History and Physical:** We reported two cases of silent thrombus formation after fenestrated extra-cardiac conduit Fontan procedure which detected on routine trans-thoracic echocardiography (TTE) evaluation and its management. The first case is a 5-year-old girl with DORV, non-committed muscular VSD, severe PS, smallish LV and PDA. She underwent an uneventful fenestrated extra-cardiac Fontan procedure after bidirectional cavo-pulmonary shunt (BCPS) and atrial septectomy done a year earlier. The second case is an 11-year-old girl with dextrocardia, pulmonary atresia with the aorta arises from the RV, hypoplastic LV, large muscular VSD, PFO and MAPCAs. Fenestrated extra-cardiac Fontan procedure was also done after previous BT shunt and BCPS with atrial septectomy and MAPCAs embolization. They were both had no clinical symptoms or abnormal hemodynamic data.

**Imaging:** For the first patient, multiple large thrombi of 8x6mm and 5x4mm were seen inside the extra-cardiac conduit on TTE evaluation 6 months after the operation.

There was also a mild stenosis found at the anastomosis of IVC to extra-cardiac conduit and a good anastomosis of right SVC to RPA. TTE evaluation on second patient at 8 days post Fontan procedure revealed a large long thrombus of 10x14mm in the IVC. The anastomosis of IVC to extra-cardiac conduit and right SVC to RPA were good.

**Indication for Intervention:** The first patient was on achieved therapeutic anticoagulant treatment, and the second one was still under heparin infusion, but thrombus was found on routine TTE evaluation after the operation.

**Intervention:** Percutaneous balloon angioplasty and stenting implantation were planned in the first case after 5 days of intravenous heparin was given. Unfortunately, due to the unavailability of the suitable stent and vena cava filter, we have to postpone the procedure. She was then on oral anticoagulation and no thrombus seen any more on TTE evaluation after 2 days and 1 months later. For the second case, a direct catheter thrombosuction and thrombolysis with TPA was performed. It was followed by intravenous TPA with 4 hourly fibrinogen level evaluation. The TPA was stopped after 10 hours since the fibrinogen level drop to 40 mg/dL. It was continued with intravenous heparin for 5 days and oral warfarin subsequently. Thrombus is not found any more on TTE evaluation after 4 hours, 5 days, and 2 months above the procedures.

**Learning Points of the Procedure:** Patients who have undergone the Fontan operation are at a high risk for thromboembolism.

Thromboembolism complication in Fontan surgery can occur despite of anticoagulation treatment with achieved APTT and PT level or therapeutic international normalized ratio (INR). Routine TTE evaluation can detect this complication clearly so treatment can be performed immediately. Aggressive anticoagulation infusion and catheter direct thrombosuction followed by thrombolysis reestablish the patency of Fontan circuit and save the risks of re-surgeries.

### 32. DUMBBELL-SHAPED CONTROLLED INFLATION OF STENT FOR FENESTRATION OF FONTAN TRACT

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**History and Physical:** A 20-year-old male patient with lateral tunnel Fontan procedure had suffered from intractable protein losing enteropathy (PLE) for 13 years that required 14 times of hospitalization.
**Indication For Intervention:** Because his pulmonary arteriess were already acceptably dilated with pulmonary artery stenting, we decided to create interatrial fenestration, using PALMazen P3008E™ stent (Cordis, Switzerland) this time.

**Intervention:** Procedure was guided under intracardiac echocardiography. Because of slipping of the tip of Brockenbrough needle, we directed the needle by snare guide wire for tip to enface the Fontan tract wall. Once we punctured the tract, we advanced 0.035 stiff guidewire. Over the guidewire, we advanced the distal half of pre-mounted 8mm-PALMAZ stent through the inter-atrial septum. Covering proximal half of the stent with long sheath, we dilated distal half of the stent without dilating proximal part of stent. Then, we further pull back the long sheath and exposed entire stent. After pulling back the balloon until the tip of the balloon at the middle of stent, we dilated proximal part of the stent tightly holding the middle part of stent with snare guidewire to make it dumbbell shape. Finally, we further dilated the middle part of stent with 5 and 6 mm balloon and the patient SpO2 decreased from 93% to 86% resulting in increase of cardiac index.

**Learning Points of the Procedure:** Staged uncovering of the stent by long sheath and tight holding of stent by snare wire can make ideal dumbbell shaped stent for fenestration of Fontan tract.

### 33. DUCTAL STENTING IN CONGENITAL HEART DISEASE WITH DUCT DEPENDENT PULMONARY BLOOD FLOW: A FOUR YEARS EXPERIENCE FROM NATL REFERRAL CENTRE IN INDONESIA

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**Introduction:** Cyanotic congenital heart disease with duct-dependent pulmonary blood flow is a life threatening condition and often require early intervention. Blalock Taussig (BT) shunt remains the treatment of choice, but it is associated with high morbidity and mortality. Ductal stenting is becoming an alternative to maintain pulmonary blood flow as it is less invasive. However, this challenging procedure is not widely available in Indonesia.

**Objective:** This study aims to present our early experience with the short-term outcomes and safety of ductal stenting procedure.

**Methods:** We studied 14 patients who underwent ductal stenting in National Cardiovascular Centre Harapan Kita, Jakarta, Indonesia between October 2013 until Mei 2017.

**Results:** Indications were pulmonal atresia (n=13) and pulmonal atresia- tricuspid atresia (n=1). Median age at the procedure was 21 days (7-227 days) and median weight at the procedure was 3350 gram (2800-7200 gram). Femoral artery access was used in all procedure. Five procedure used uneventfully antegrade technique. Types of PDA were type A(n=5), C(n=5), E(n=3), and D (n=1). Stent implantation was succesful in 57% of the cases. All procedure used Bare Metal Stent as a device with vary diameter and length 2.5-4 mm x 8-15mm. A significant improvement in mean arterial oxygen saturations after stent placement was observed from previously 43.12% to 84.25% (p<0.05). There was no cardiac death during the procedure. Complications after the procedure were thrombosis (n=2), bleeding (n=3), and stent dislodged (n=2). Three deaths after the procedure were due to bleeding and stent dislodged. Due to thrombosis, only one patient underwent balloon dilatation, and done successfully. Due to stent dislodge, one patient died and other was succesfull for re-stenting. During follow up, one patient underwent radiofrequency ablation and balloon pulmonary valvuloplasty and one patient had Blalock-Taussig shunt operation. There was non significant reduction in pulse oxygen saturation six months after the procedure (7-22%;p>0.05)

**Conclusion:** Stent implantation of ductus arteriosus can be a good alternative for initial palliation in cyanotic congenital heart disease with duct dependent pulmonary blood flow.

### 34. A CASE OF MULTIPLE SECUNDUM ATRIAL SEPTAL DEFECT TREATED WITH TWO FIGULLA FLEX

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A case was a 75-years-old female. She was diagnosed with paroxysmal atrial fibrillation (PAF) and sinus arrest by Holter electrocardiography. Transthoracic echocardiography revealed atrial septal defect (ASD) and right heart overload (Qp/Qs 2.9). She was scheduled to ASD closure after 6 months treated catheter ablation for PAF. In transesophageal echocardiography, two ASDs were confirmed.
34. Figure 1.

34. Figure 2.
Sizes of ASDs were 3.4×8.5 mm and 5.0×12.7 mm, and the length between both ASDs was 7.6 mm. A part of aortic rim was less than 5 mm, but the range was less than 30°, so we chose by transcatheter ASD closure. Balloon sizing was measured to be 10.5 mm for smaller ASD closer to the aortic rim (ASD1) and 12.3 mm for larger ASD in the center (ASD2). Considering short aortic rim, we chose and placed a 12 mm Figulla Flex II ASD occluder (FFO) for ASD1, then a 13.5 mm FFO placed for ASD2. After placed, a 12 mm FFO contacted with aortic vessel walls, but did not press the aortic vessel wall excessively at the contact point with FFO. Detachment was successful, and no complications have observed during follow-up period.

Erosion is a rare but serious complication of transcatheter ASD closure. In this case, FFO on the side of the aortic rim partly touched the aorta by overlapping both FFOs. FFO results in a soft contact with aortic vessel walls when placed adjacent to it. It is difficult to predict the device position after detachment in case of overlapping devices. We report a case of transcatheter ASD closure for multiple ASDs using FFOs.

35. SIMULTANEOUS TRANSCATHETER DEVICE CLOSURE OF ASD, VSD AND PDA IN AN INFANT WITH DOWN’S SYNDROME
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History and Physical Findings: An 11 month old infant with Down’s syndrome weighing 7 kg was referred to our hospital with frequent respiratory tract infections and soft systolic murmur for evaluation. External features of Down’s syndrome were present. Precordium was hyper dynamic with soft systolic murmur at Parasternal area with loud pulmonary component (P2).

Imaging: Chest radiograph revealed cardiomegaly with prominent vascular markings. Transthoracic echocardiogram (TTE) revealed moderate sized ostium secundum ASD (10 mm), perimembranous VSD (5 mm) and PDA (3.5 mm). There was biventricular enlargement, with severe PAH (estimated PA pressures 55 mmHg).

Indication for Intervention: After careful imaging it was found that all the defects were suitable for transcatheter closure, hence it was decided to perform simultaneous device closure of VSD, PDA and ASD.

Intervention: Hemodynamic assessment during the transcatheter procedure showed high pulmonary artery (PA) pressures (60/25 mm Hg) against systemic arterial pressures of 75/35 mmHg. First VSD device closure was performed from arterial route using 6/4 Amplatzer duct occluder II (ADO II) device by 5 French guiding catheter. Then PDA was closed using standard technique by 6/4 Amplatzer duct occluder device. Finally ASD device closure was performed using 12 mm Amplatzer Septal occluder device with 7 French delivery system. Post procedure PA pressures reduced to 45/15 mmHg against systemic pressures of 80/45 mmHg. Electrocardiogram (ECG) showed sinus rhythm with Heart rate of 110/min. Patient was discharged from hospital after 72 hours of observation.

Learning Points: Simultaneous transcatheter device closure of multiple defects is a safe alternative to surgery if suitable.

36. DEVICE SELECTION DURING TRANSCATHETER CLOSURE OF PATENT DUCTUS ARTERIOSUS IN PREMATURE INFANTS WEIGHING LESS THAN 2.5 KILOGRAMS
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Background: Transcatheter closure of patent ductus arteriosus (PDA) in preterm babies remains a highly challenging procedure. There is no ideal device to fit in these clinical scenarios.

Objective: The aim of this study was to describe our experiences in device selection during transcatheter device closure of PDA in premature infants weighing less than 2.5 kilograms.

Methods: Hospital records and catheterization reports of all premature babies who underwent transcatheter PDA closure since October 2014 in our hospital were reviewed. Basic demographics clinical information, echocardiographic, angiographic data, and devices were recorded.

Results: Seventeen premature infants (seven boys and ten girls) born at gestational ages ranging between 22 and 35 weeks (median, 28 weeks) were identified. All patients had
significant PDA and received pharmacological therapy as protocols. Median age and weight for procedure was 22 days (2-133 days) and 1,500 g (478-2,350 g), respectively. Six patients were associated massive pulmonary haemorrhage. The mean minimal ductal diameter was 3.5 ± 1.1 mm. The mean ductal length was 7.8 ± 3.6 mm. The most common PDA type was type C (n=7). There were 3 times of device migration before detachment which required to retrieve and deploy a new one. Devices used in this study were AMPLATZER™ duct occluder II additional size (ADO II AS) (n=13), AMPLATZER™ vascular plug I (VP 1) (n=1), and vascular plug II (VP 2)(n=3). Complete closure were achieved in all patients except one patient had progressive coarctation which required surgical removal 4 months later.

Conclusions: It is now currently feasible to undertake transcatheater PDA closure in premature infants body weight greater than 478 grams according to our experiences. We added at least 1.5 mm in minimal ductal diameter by echocardiogram to select the device waist. We concluded that ADO II AS could be best used in ductal diameter less than 3.5 mm, and VP 2 could be used in larger and long ductus, while VP 1 used in large and short (less than 10 mm) one.

37. TRANSCATHETER CLOSURE OF DOUBLE VENTRICULAR RUPTURE IN A PATIENT WITH NON-ST ELEVATION MYOCARDIAL INFARCTION
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History and Physical: A 68-year-old lady has history of hypertension, type 2 diabetes mellitus and uremia with regular hemodialysis, presented with sudden acute of chest pain on Jun. 1st 2015. Non-ST-elevation myocardial infarction was diagnosed, and percutaneous coronary intervention (PCI) with drug-eluting stent was performed over the proximal portion of left anterior descending (LAD) artery. Three days after PCI, apical ventricular septal rupture (VSR) was diagnosed because of grade 3 holosystolic murmur at the apical area. Three weeks after PCI, surgical repair for VSR was performed smoothly and she was discharged asymptomatically. Three months after surgical repair, she experience exertional dyspnea and effort-related chest pain. The CT angiography showed a left ventricular pseudoaneurysm over the middle portion of anteroseptum with connections to RV. The coronary angiography showed diffuse atherosclerosis over distal portion of left anterior descending artery with dynamic compression of LAD by the pseudoaneurysm. After thorough evaluation of the heart team, percutaneous coronary intervention, transcatheter closure of VSR and pseudoaneurysm were proceeded.

Imaging: See Figures 1 and 2.

Computed tomography angiography: apical ventricular septal defect with communicated pseudoaneurysm formation

Transthoracic echocardiogram: apical ventricular septal defect with shunt noted

Indication for Intervention:
1. Left ventricular pseudoaneurysm with ragged edge, narrow neck, and high risk of rupture
2. The pseudoaneurysm with LV and RV connections
3. Dynamic compression of left anterior descending artery by the pseudoaneurysm

Intervention:
a. A 5 Fr. cutted-head pig-tail catheter and a 0.032in*260cm Terumo guidewire crossed the ventricular septal rupture through the LV pseudoaneurysm.
b. The 0.032in*260cm guidewire was externalized by a 25mm Amplatz Goose Neck Snaire kit.
c. A 8F 80cm (45 degree) Amplatzer Torvue delivery system was crossed the VSR through the 0.032in*260cm guidewire.
d. A 16mm Amplatzer muscular VSD occluder was deployed over one of necks of LV pseudoaneurysm

e. Second transcatheter closure of pseudoaneurysm will be performed soon.

37. Figure 1.
Learning Points of the Procedure:
1. The postinfraction ventricular septal rupture (post-MI VSR) of apical septum was difficult to diagnose on transthoracic echocardiography, and new-onset holosystolic murmur is an important clue.
2. Although there is no consensus on timing of surgical intervention of the post-MI VR, surgical intervention may be deferred as long as possible if hemodynamic stable.
3. Complete image examinations, including ECG-gated computed tomography angiography and echocardiography (transthoracic and transesophageal), are crucial in patients complicated ventricular septal rupture, especially in whom accompanied with pseudoaneurysm formation.
4. Transcatheter closure is feasible in patients with residual VSR or pseudoaneurysm after surgical repair of post-MI VSR.

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