Supplemental Table S1: Surgical History and Anatomy for N=41 Patients.

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| --- | --- | --- | --- | --- | --- |
| **Level of Corrected Aortic Pathology** | **Diagnoses** | **Type of Prior Surgeries** | **# Sternotomies** | **Age at Index (y)**  | **Type of Index Surgery\*** |
| Post- Subvalvular | Shone syndrome (CoA, subAS) | 1. SubAS resection x22. Modified Konno procedure | 2 | 8 | SubAS and AS resection; AVr |
| Transitional AV canal VSDAI and MR s/p modified Konno | 1. AVSD repair2. LVOT membrane resection3. Modified Konno procedure | 3 | 13 | Konno-Rastan procedure; TVr; and MVr. |
| SubAS VSD | 1. Modified Konno procedure2. SubAS resection  | 2 | 16 | SubAS resection |
| Shone’s syndrome (MS, SubAS, AS) | 1. LVOT resection | 1 | 21 | MVR; LVOT resection; AVr |
| Congenital coronary artery anomalySubASAI | 1. SubAS resection, unroofing of RCA from L aortic sinus | 1 | 22 | Konno-Rastan procedure; RVOT patch |
| SubASVSDAI | 1. VSD closure and SubAS resection2. Permanent pacemaker insertion | 2 | 24 | Konno-Rastan procedure; explant of unused pacemaker |
| AV canal defect SubAS Mitral dysfunction | 1. Repair of AV canal 2. MVr, SubAS resection | 2 | 30 | SubAS resection; TVr; and MVr. |
| SubASAS AI | 1. SubAS resection x3 | 3 | 34 | Konno-Rastan procedure  |
| Dilated AA AS (BAV)SubASMyocardial bridge w/ apical ischemiaAccessory MV papillary muscle | 1. SubAS resection | 1 | 36 | Aortoplasty; SubAS resection; detachment of secondary chordae to MV; unroofing of LAD.  |
| Post- Valvular | Shone's syndrome (AS, parachute mitral valve, MR, hypoplastic aortic arch) | 1. AVr, PDA ligation, ASD closure | 1 | 0.25 | Ross-Konno procedure; MVr; endocardial fibroelastosis resection |
| AS (BAV)Severe AI | 1. Ross procedure2. Replacement of pulmonary homograft  | 2 | 22 | Bentall procedure  |
| Shone's syndrome (hypoplastic aortic annulus, LVOTO, MS, MR) | 1. Balloon aortic valvuloplasty x22. AVr | 1 | 31 | Konno-Rastan procedure, MVr; LVOT resection, subAS resection and CryoMaze. |
| Shone’s syndrome (BAV, Cleft MV, LVOTO due to septal hypertrophy) | 1. AVr2. ASD repair3. MVR4. MVr | 4 | 34 | SubAS resection, resection of anterior MV leaflet, AVR |
| AS (BAV)Dilated AAAI | 1. AVR2. Ross procedure | 2 | 45 | Bentall procedure  |
| ToF | 1. AVR2. ToF repair | 2 | 48 | Redo AVR; Plication of non-coronary sinus; subAS resection  |
| Post- Supravalvular | TGASupravalvar ASASDVSD | 1. ASO, ASD closure, VSD closure | 3 | 0.4 | Supravalvar AS repair; AA and transverse aortic arch patch augmentation |
| TAAI | 1. TA repair, RV-PA conduit, VSD closure | 1 | 0.75 | Ozaki procedure; truncal valve repair; RV-PA conduit replacement |
| Shone's syndrome (supramitral ring, parachute MV, MS, LVOTO, BAV, supravalvar AS, hypoplastic aortic annulus, CoA) | 1. CoA repair with patch augmentation of the hypoplastic arch2. Balloon angioplasty of supravalvar AS3. Patch augmentation of supravalvar AS | 2 | 1 | Supramitral membrane resection; MVr; AVr; subAS resection  |
| DORV (Taussig Bing type) SubASRPA stenosis | 1. ASO and VSD closure 2. RPA balloon dilation3. Diaphragm plication | 2 | 3 | SubAS resection; RPA augmentation |
| TA with interrupted aortic arch RPA stenosisDilated AA | 1. TA with interrupted aortic arch repair2. RPA stenting | 2 | 12 | PA plasty; RV-PA conduit; Replacement of AA and noncoronary sinus. |
| TGAPV stenosisDilated AASevere AI | 1. ASO and ASD closure;2. PA plasty and closure of PFO | 4 | 16 | Bentall procedure  |
| PV stenosisAortic arch anomalyDORV with subaortic VSDAI | 1. BT shunt 2. Full repair with LV to aortic tunnel and RV-PA conduit3. Melody insertion in RV-PA conduit | 2 | 19 | AVR, RV-PA conduit replacement; Modified Konno procedure |
| TGA with VSDAS (BAV)AIMR | 1. ASO | 1 | 23 | AVR, MVr, and LeCompte reconstruction |
| TGAPA stenosisSupravalvar AS | 1. ASO2. PA plasty3. Diaphragm plication | 2 | 29 | Pulmonary valve replacement, PA plasty and aortoplasty  |
| TGADilated AAAI | 1. ASO | 1 | 29 | AVR and aortoplasty |
| Supravalvar ASSubAS | 1. ST junction augmentation, AA replacement | 1 | 30 | AA graft replacement; subAS resection |
| Aorto-left ventricular tunnelDilated AAAIAccessory mitral chordae | 1. Repair of LV to aortic tunnel x2 | 2 | 32 | AA replacement and hemi arch; MVr |
| TADilated AA and aortic root Bicommissural truncal valve  | 1. TA repair 2. Replacement of RV-PA conduit x2 | 4 | 33 | Plication of aortic root, replacement of truncal valve; RV-PA conduit replacement |
| Post- Multilevel | TGACoAASBranch PA stenosisPV incompetenceVSD | 1. CoA repair 2. ASO and VSD closure3. RVOT patch4. Arch repair, AVr, and RV-PA conduit5. Bentall procedure, RPA reconstruction, transventricular subpulmonic resection6. Redo root replacement  | 6 | 9 | Konno Rastan procedure; pulmonary valve replacement; RVOT augmentation |
| Shone's syndrome (MS, AS) | 1. MVR; Konno-Rastan procedure; Pacemaker placement  | 1 | 16 | Konno-Rastan reconstruction repair; redo AVR; redo MVR; BiV pacemaker insertion |
| CoA VSD BiV failure with multi-valve dysfunction (AI, MR, TR) | 1. CoA repair and PA banding2. VSD closure and PA plasty3. Redo PA plasty and AVr | 3 | 19 | Konno-Rastan procedure; MVr; TVr; Cryomaze procedure |
| CoAAS (BAV)Severe AIPAPVRGerbode defect | 1. CoA repair and anomalous L pulmonary venous confluence repair 2. AVR | 2 | 21 | Konno-Rastan procedure; TVr; Gerbode defect repair |
| Interrupted aortic arch, type ASubASASSevere AIDiGeorge syndrome | 1. Interrupted aortic arch repair2. SubAS resection x23. Modified Konno procedure4. AVR | 5 | 21 | Hemi-arch replacement; Bentall procedure; Konno-Rastan procedure; RPA and MPA plasty |
| TASevere AIRVOTO | 1. RV-PA conduit2. Truncal valve replacement 3. Aortic homograft replacement 4. AVR, RV-PA conduit replacement  | 5 | 22 | Bentall procedure, RV-PA conduit replacement  |
| CoAASAIMR | 1. Balloon aortic valvuloplasty2. Aortic arch repair3. AVr4. Ross procedure5. Pulmonary autograft replacement | 4 | 24 | Konno-Rastan procedure; MVr |
| Shone’s syndrome (Cleft leaflet of MV, MS, SubAS, AS, CoA)AIMR | 1. Konno-Rastan procedure | 1 | 25 | Redo AVR, RVOTO resection, MVr, and subAS resection |
| TAMSMR | 1. Primary TA repair2. Truncal valve replacement 3. RV-PA conduit replacement and AA repair4. RV-PA conduit replacement and debridement of AV 5. AVR 6. TAVR  | 5 | 25 | MVR; AVR and root replacement; RV-PA conduit replacement  |
| CoA AS (BAV)Dilated AA and innominate arterySevere AI | 1. AVR2. CoA repair 3. Balloon aortic valvuloplasty | 1 | 26 | Bentall procedure |
| SubASTR | 1. SubAS resection x22. SubAS resection, AVR, enlargement of aortic root, resection of septal hypertrophy | 3 | 32 | Konno-Rastan procedure; BiV pacemaker insertion; TVr |
| Shone’s syndrome (CoA, AS, mitral dysfunction)TR | 1. CoA repair2. AVR x2 | 3 | 34 | AVR and aortic root replacement; TVr |
| SubASDilated AAASAI | 1. SubAS resection, AVr | 1 | 35 | SubAS resection; MVr, AVr; AA replacement |

AA = ascending aorta, AI = aortic incompetence, AS = aortic stenosis, ASD = atrial septal defect, ASO = arterial switch operation, AV = aortic valve, AVI = aortic valve intervention, AVr = aortic valve repair, AVR = aortic valve replacement, AVSD = atrioventricular septal defect, BiV = biventricular, BT = Blalock-Taussig, CoA = coarctation, DORV = double outlet right ventricle, L = left, LV = left ventricle, LVOT = left ventricular outflow tract, LVOTO = left ventricular outflow tract obstruction, MPA = main pulmonary artery, MS = mitral stenosis, MR = mitral regurgitation, MV = mitral valve, MVr = mitral valve repair, MVR = mitral valve replacement, PA = pulmonary artery, PAPVR = partial anomalous pulmonary venous return, PDA = patent ductus arteriosus, PFO = patent foramen ovale, PA = pulmonary artery, PV = pulmonary vein, R = right, RCA = right coronary artery, RPA = right pulmonary artery, RVOT = right ventricular outflow tract, RVOTO = right ventricular outflow tract, RV-PA = right ventricle to pulmonary artery, TA = truncus arteriosus, TAVR = transcatheter aortic valve replacement, TGA = transposition of great arteries, ToF = Tetralogy of Fallot, TR = tricuspid regurgitation, TVr = tricuspid valve repair, VSD = ventricular septal defect

Each patient in the cohort is described, including presenting anatomy/diagnoses, operations prior to index surgery, number of pre-index sternotomies, age at index surgery, and index surgery type. Each row describes an individual patient. Categorization was dependent on the anatomic level(s) of aortic pathology that was surgically corrected in interventions prior to index surgery.

Supplemental Table S2: AI Grades and LVOT Gradients

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| --- | --- | --- | --- | --- |
| **Group** | **Pre-Index Grade of AI** | **Discharge Grade of AI** | **Pre-Index LVOT gradient (mean)**  | **Discharge LVOT gradient (mean)** |
| Primarily AI(N = 12) | Moderate/Severe (12) | None (2)Trace/Trivial (10)Mild (1) |  |
| Without AI(N = 29) |  | 34.9±17.5 | 12.6±6.0 |
| P<0.001 |

AI = aortic insufficiency, LVOT = left ventricular outflow tract

Grade of aortic insufficiency (AI) and mean left ventricular outflow tract (LVOT) gradients are noted for the ‘primarily AI’ and ‘without primarily AI’ groups, respectively. The number of patients with a particular AI grade is shown in parentheses pre-index and post-index surgery (discharge). LVOT gradients pre-index and post-index surgery (discharge) are recorded as mean ± standard deviation.