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Deciphering Congenital CV Procedure & Surgery Coding

June 18, 2020

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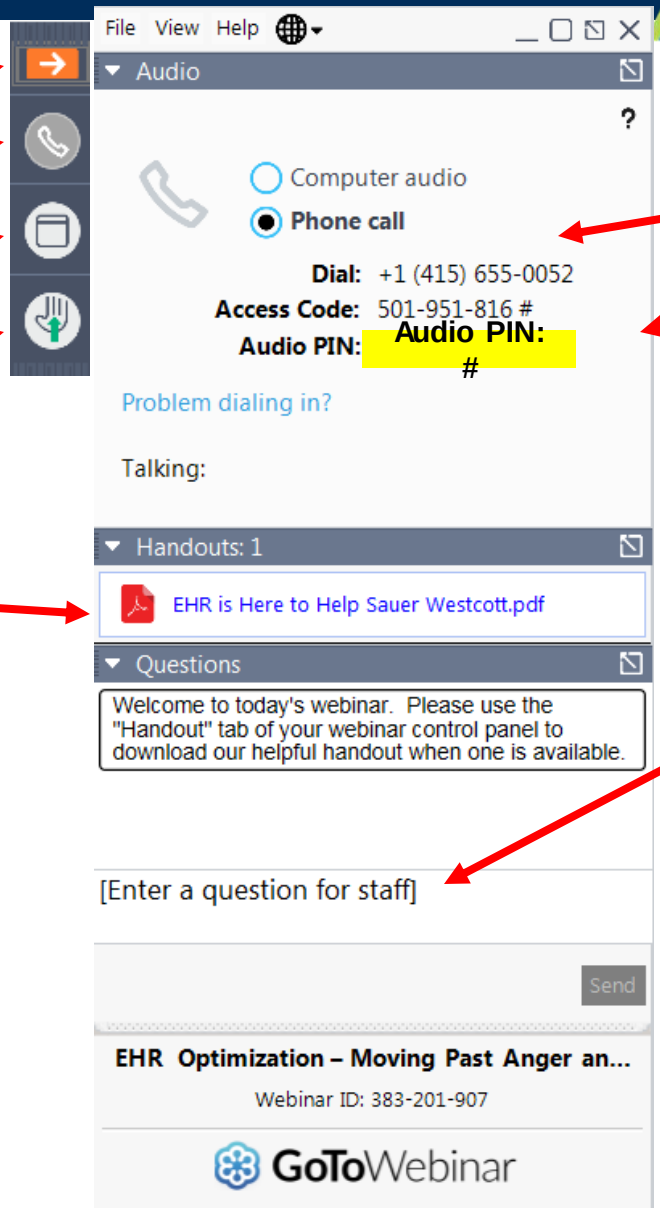

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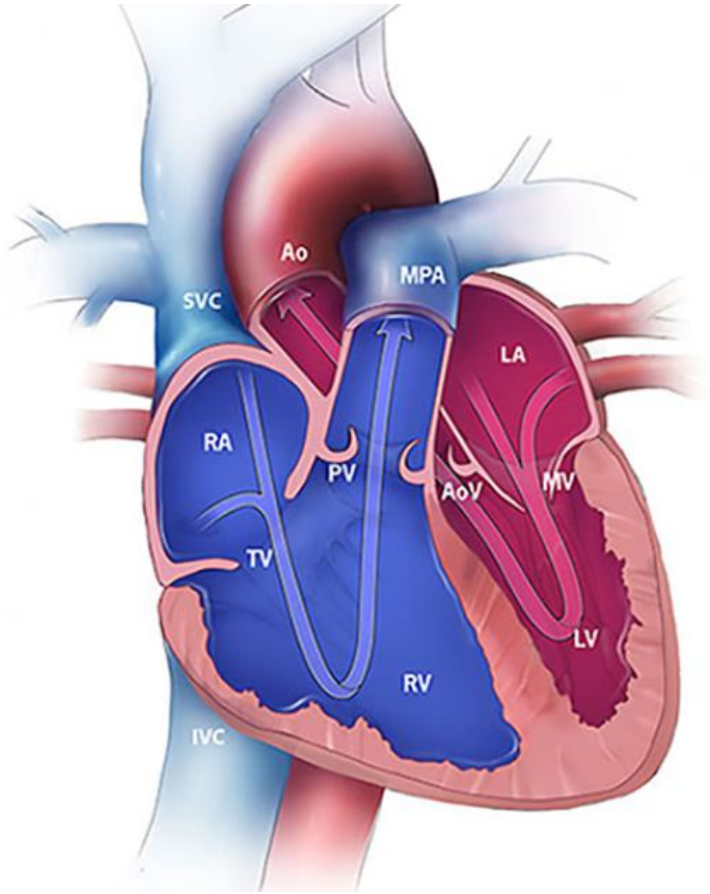
Anatomy of Congenital Heart Defects

What is Congenital Heart Disease?

- Congenital Heart Disease is the most common type of birth defects affecting nearly 40,000 births in the United States each year
- At conception, the heart starts forming and is complete by 8 weeks of gestation. It is during these critical 8 weeks that defects can occur
- CHDs can vary from mild (such as a small hole in the heart) to severe (such as missing or poorly formed parts of the heart)
- Treatment for CHDs depends on the type and severity of the defect present

Normal Cardiac Anatomy



The heart has four chambers:

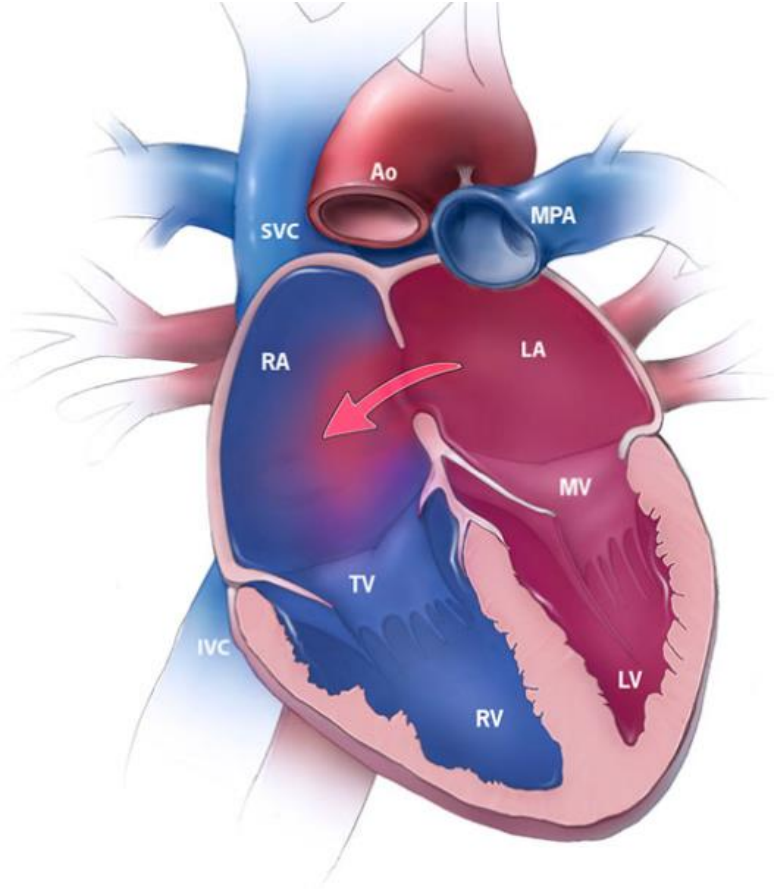
- The upper two chambers are the atria
- The lower two chambers are the ventricles

The heart has four valves:

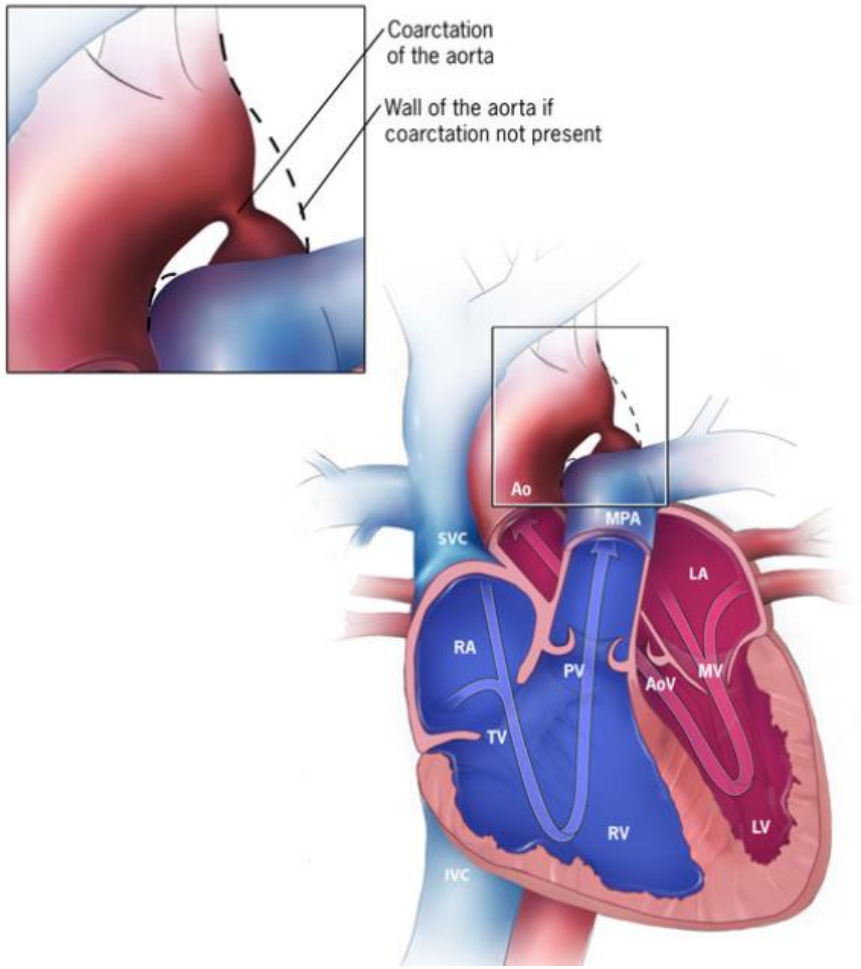
- Tricuspid valve (located between the right atrium and right ventricle)
- Pulmonary valve (located between the right ventricle and the pulmonary artery)
- Mitral valve (located between the left atrium and left ventricle)
- Aortic valve (located between the left ventricle and the aorta)

Atrial Septal Defect

- ASD is a hole in the heart, located between the left and right atriums
- The hole increases the amount of blood that flows through the lungs
- Overtime, this may cause damage to the blood vessels in the lungs



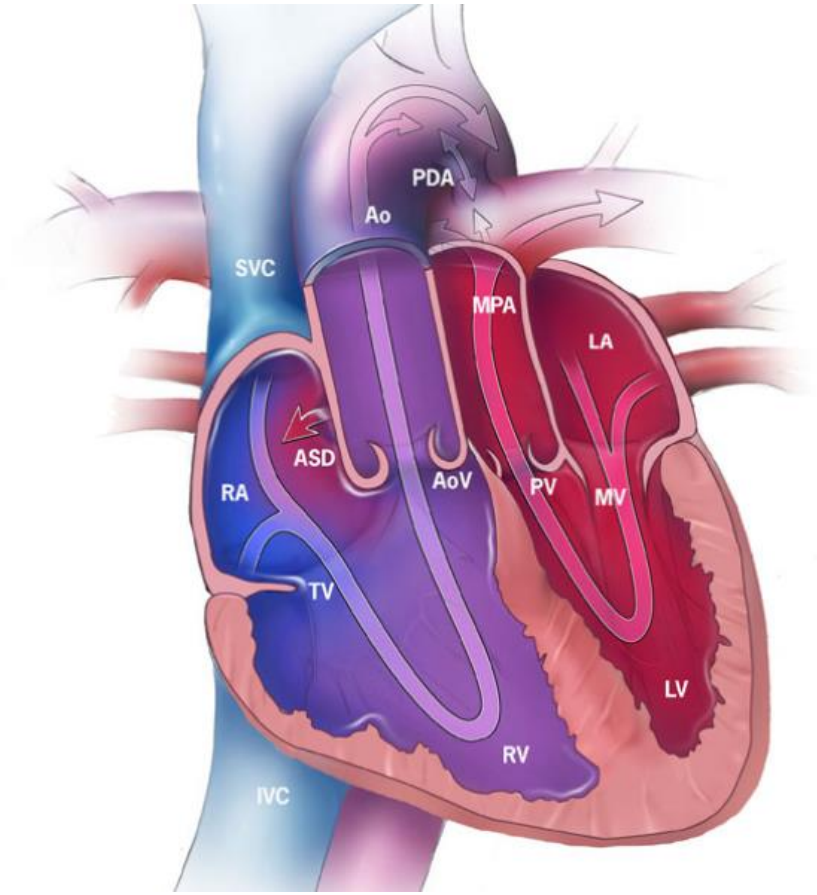
Coarctation of the Aorta



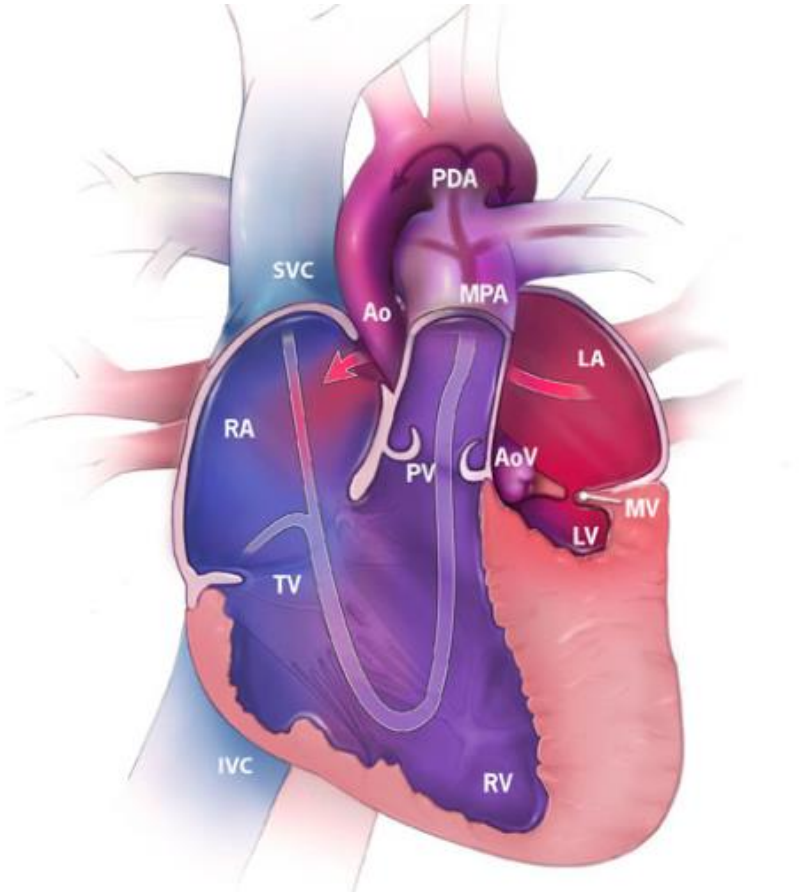
- A coarctation is an abnormal narrowing in the aorta.
- May develop congestive heart failure or high blood pressure
- The majority of theses cases also have a bicuspid aortic valve

d-Transposition of the Great Vessels

- In transposition, the two great vessels: The aorta and pulmonary artery, are backwards in position



Hypoplastic Left Heart Syndrome

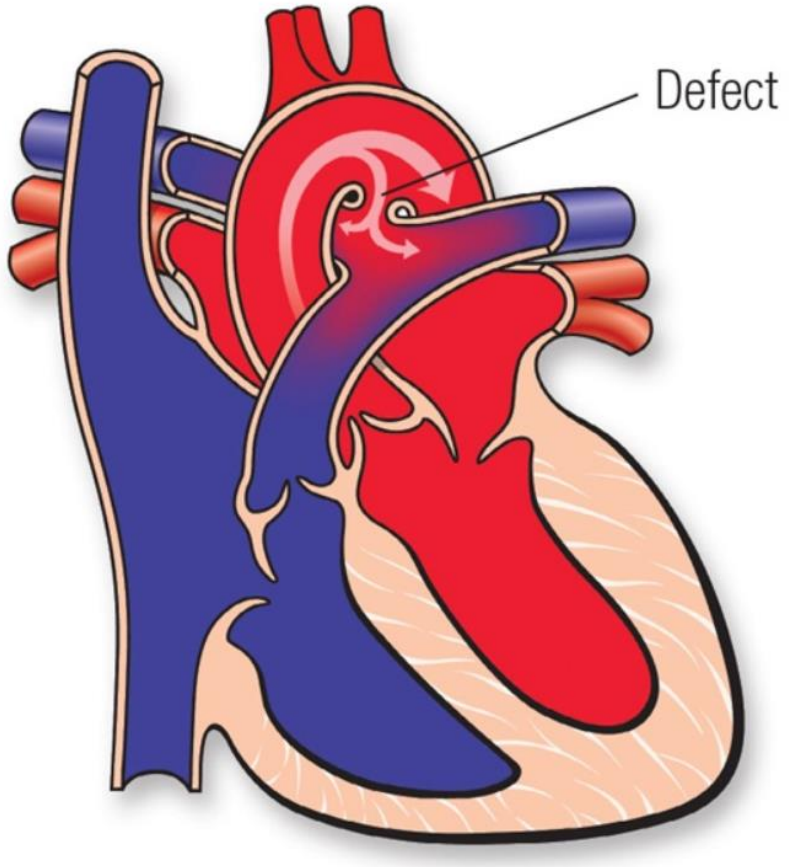


- In HLHS, the heart's left side – including the aorta, aortic valve, left ventricle and mitral valve – is underdeveloped
- Affects normal blood flow through the heart

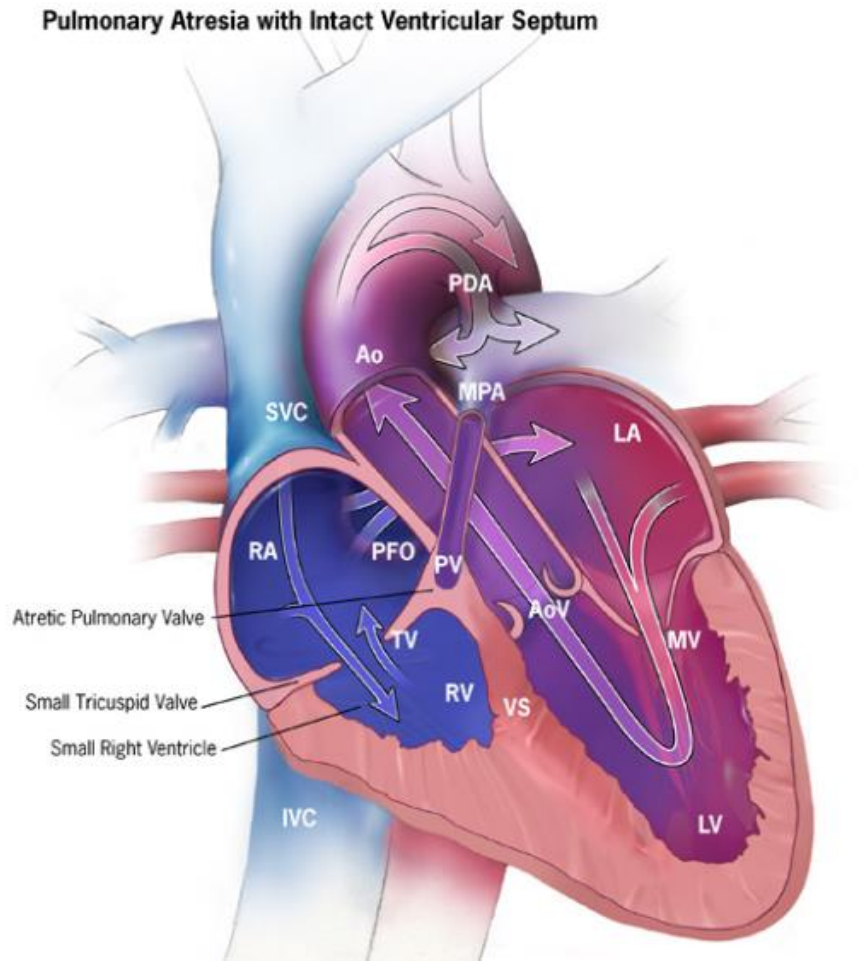
PDA

Patent Ductus Arteriosus

- PDA is an abnormal opening between the aorta and the pulmonary artery, if this remains after birth and if it is the primary heart defect, the blood flow will reverse and cause oxygenated blood from the aorta to recirculate to the lungs.



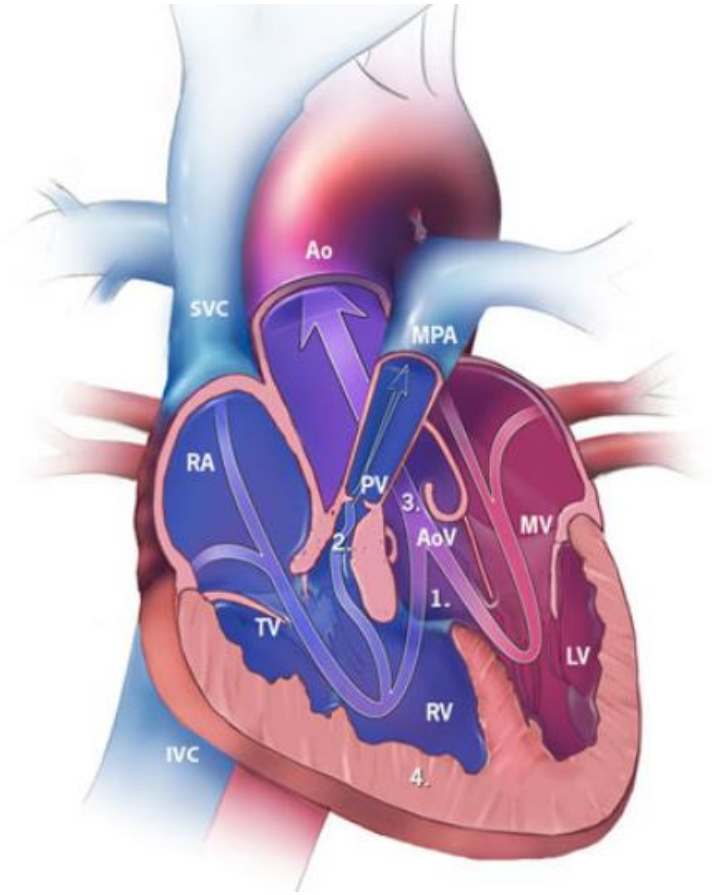
Pulmonary Atresia



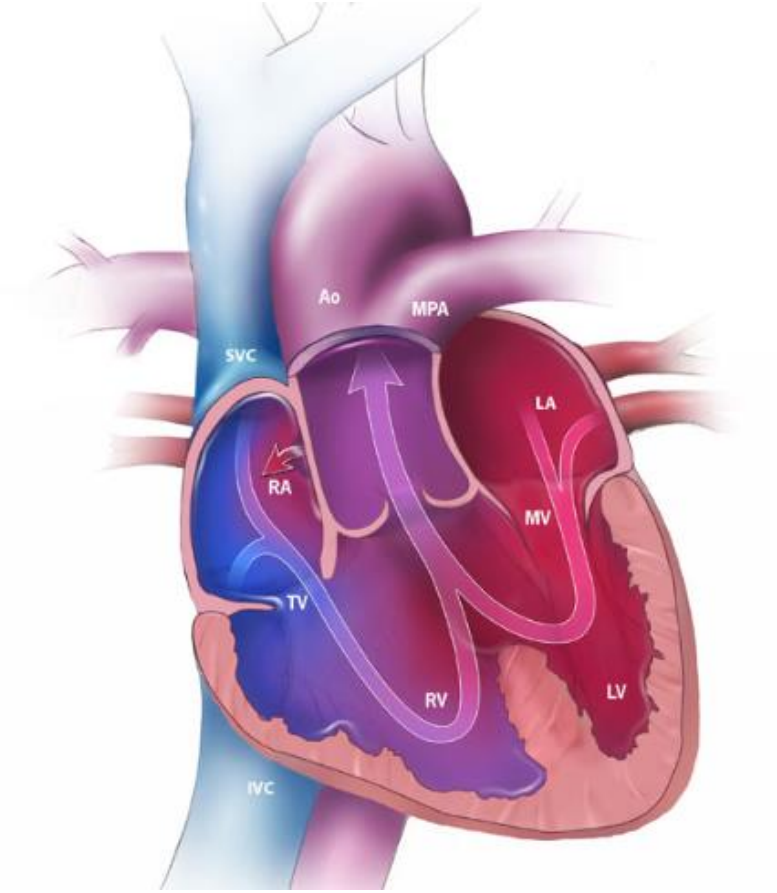
- Pulmonary Atresia is when the pulmonary valve did not form
- No blood can go from the right ventricle of the heart out to the lungs
- Two Types:
  1. Pulmonary Atresia with an intact ventricular septum
  2. Pulmonary Atresia with a ventricular septal defect

Tetralogy of Fallot

- Tetralogy of Fallot is a combination of four congenital abnormalities:
  1. Ventricular Septal Defect (VSD)
  2. Pulmonary Valve Stenosis
  3. Misplaced Aorta
  4. Right Ventricular Hypertrophy



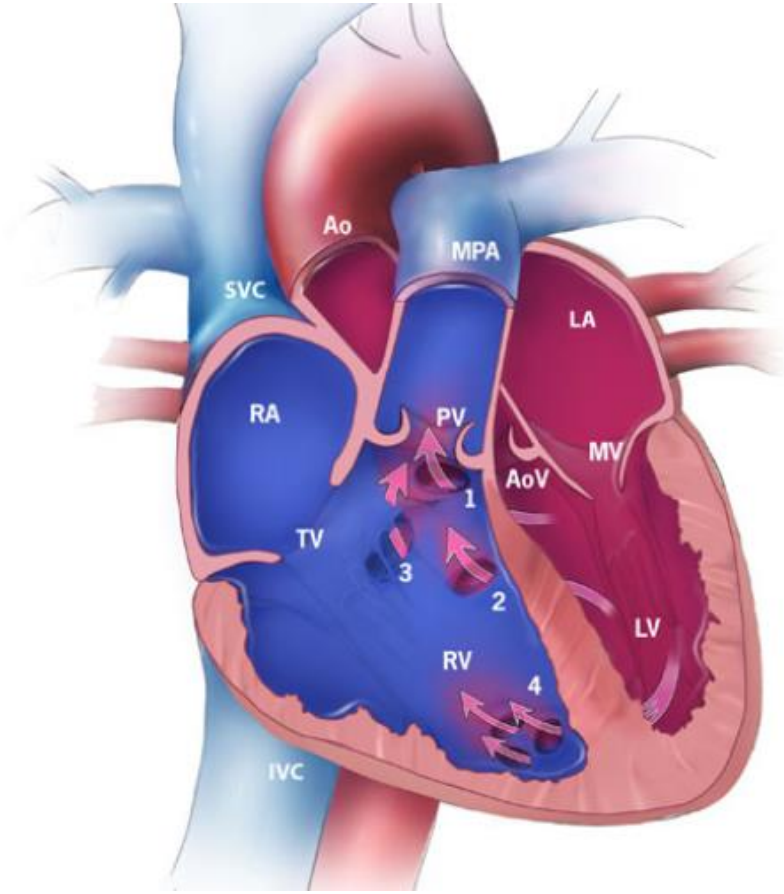
Truncus Arteriosus



- Rare defect of the heart in which a single common blood vessel comes out of the heart, instead of the usual two vessels (the main pulmonary artery and aorta)
- Several different types of truncus, depending on how the arteries remain connected

Ventricular Septal Defect

- VSD is a hole in the heart between the left and right ventricles.
- Types of VSDs:
  1. Conoventricular Ventricular Septal Defect
  2. Perimembranous Ventricular Septal Defect
  3. Inleft Ventricular Septal Defect
  4. Muscular Ventricular Septal Defect



Diagnostic Congenital Cardiac Catheterizations

Congenital Heart Cath

"As long as there is a congenital cardiac anomaly, it is appropriate to report these codes"

Age is NOT a factor

Congenital Heart Cath

Once diagnosed as a congenital cardiac patient, all cath procedures are considered congenital for coding purposes unless ALL aspects of congenital heart disease have been removed via a heart transplant.

If a patient has a heart transplant and there are residual congenital anomalies present, then the congenital cath codes should be used.

If the patient has a heart transplant and there are no residual congenital anomalies, then regular cath codes should be used.

Congenital Heart Cath

- Anomalous coronary arteries
- Patent foramen ovale
- Mitral valve prolapse
- Bicuspid aortic valve

....are to be reported with 93451-93464, 93566-93568

Categories of Cardiac Cath Codes

By Chamber	By Disease Type	By Approach
• Right • Left • Combo	• Acquired • Congenital	• Retrograde • Prograde • Transseptal • Transapical

Included in a Diagnostic Cath

- Introduction, positioning and repositioning of catheters
- Recording of intracardiac and intravascular pressures
- Acquisition of blood samples to measure blood gases and/or dye or other dilation curves
- Venous infusions during coronary intervention are bundled (the drug may be billed separately)
- Closure device angiography and placement is bundled with all cardiac cath procedures
- Injection of drugs directly into the coronary arteries is bundled

Billable Diagnostic Catheterization

1. No prior catheter-based coronary angio study is available, and a full diagnostic study is performed, and a decision to intervene is based on the diagnostic angiography
2. A prior study is available, but as documented in the medical record:
   a) The pt's condition with respect to the indication has since changed
   b) Inadequate visualization of anatomy and/or pathology
   c) There is a clinical change during the procedure that requires new evaluation outside the target area of intervention

Critical Documentation Pieces

- Access point(s) – arterial vs. venous
- Catheter movements
- Catheter placement at time of injections
- Imaging interpretations
- Intention of cath – diagnostic vs. road mapping based on prior diagnostic study
- Patient's congenital history – surgeries, interventions, variant anatomy

Non-Congenital Diagnostic Cath

Diagnostic Caths – Coronary and LHC

Coronary Angiography

- 93454 – Coronary artery(s)
- 93455 – Coronary artery(s) plus graft(s)

Left Heart Catheterization

- 93458 – LHC with coronary artery(s) w/wo LV
- 93459 – LHC with coronary artery(s) plus graft(s) w/wo LV

Left Heart Cath Hints

You know that the aortic valve was crossed if:

1. The report states that the aortic valve was crossed
2. There is an LV gram (ventriculogram)
3. The Ejection Fraction (EF) is noted
4. There is a LV Pressure (LVEDP)

Diagnostic Cath – Heart Cath w/o Angio

- 93451 – Right Heart Cath
- 93452 – Left Heart Cath (+/- LV Gram)
- 93453 – Combo RHC/LHC

Diagnostic Caths – Combo's

- 93460 – RHC & LHC w/wo LV
- 93461 – RHC & LHC plus graft(s) w/wo LV
- 93456 – RHC & Coronary artery(s)
- 93457 – RHC & Coronary artery(s) plus graft(s)

Congenital Diagnostic Cath

Congenital Diagnostic Caths

93530	93531	93532	93533
Right heart cath, for congenital cardiac anomalies	Combined right heart cath and retrograde left heart cath, for congenital cardiac anomalies	Combined right heart cath and transseptal left heart cath ***through an intact septum*** with or without retrograde left heart cath, for congenital anomalies	Combined right heart cath and transseptal left heart cath ***through existing septal opening***, with or without retrograde left heart cath, for congenital cardiac anomalies

LHC Only in Congenital Cases

- 93452 – Left Heart Cath Only
  - No congenital specific code. Per AMA, use this code
  - Rare for LHC only

Includes:

- Left Heart Hemodynamics
- Cath placement in the LT chambers (ventricle or atrium)
- LVEDP diastolic pressure

Add-On Injection Codes for Congenital Catheterization

+93563	+93564	+93565
Injection procedure during cardiac cath including imaging supervision, interpretation, and report; for **selective coronary angiography** during congenital heart cath	Injection procedure during cardiac cath including imaging supervision, interpretation, and report; for **selective opacification of aortocoronary venous or arterial bypass grafts**, during congenital heart cath	Injection procedure during cardiac cath including imaging supervision, interpretation, and report; for **selective left ventricular or left atrial angiography** **(Use 93563-93565 in conjunction with 93530-93533)**

Add-On Codes for Catheterization

+93463	+93464
Pharmacologic agent administration (e.g. inhaled nitric oxide, intravenous infusion of nitroprusside, dobutamine, milrinone or other agent including assessing hemodynamic before, during and after and repeat pharmacologic agent administration, when performed	Physiologic exercise study (e.g. bicycle or arm ergometry) including assessing hemodynamic measurements before and after

Injection Add-On Codes for Catheterization

+93566	+93567	+93568
…for selective right ventricular or right atrial angiography	…for supravalvular aortography	…for pulmonary angiography

Aortography

75600	75605	75625	75630
Aortography, thoracic, without serialography • Considered a "single shot" injection	Aortography, thoracic, by serialography • Utilized to describe findings related to the aorta distal to the left subclavian artery down to the diaphragm	Aortography, abdominal • Results must include more than just distal aorta findings	Aortography, abdominal plus bilateral iliofemoral lower extremity • Results must include: ✓ Abdominal aorta – more than just distal aorta ✓ Legs – more than just common iliacs, looking for femoral results too

Extremity Imaging

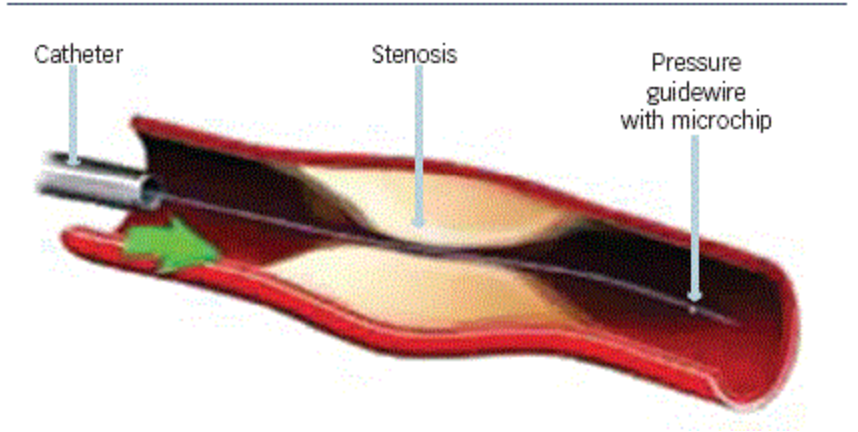
75710	75716
Angiography, extremity, unilateral	Angiography, extremity, bilateral

Venography

75820	75822	75825	75827
Venography, extremity, unilateral	Venography, extremity, bilateral	Venography, caval, inferior (IVC)	Venography, caval, superior (SVC)

FFR / CFR / IFR

- +93571 – Intravascular Doppler velocity and/or pressure derived coronary flow reserve measurement; initial vessel
- +93572 - …each add'l vessel



- FFR – Fractional Flow Reserve
- CFR – Coronary Flow Reserve
- iFR – Instant wave-Free Ratio
  - (iFR should be reported with modifier -52 since no infusion of a medication is administered)

93505

- Endomyocardial Biopsy
  - Add code for echo guidance 76932, if used
  - DO NOT BILL with 75970 – Transcatheter biopsy, radiologic supervision and interpretation

Medicare NCCI Edit with Endomyocardial Biopsy

NATIONAL CORRECT CODING INITIATIVE POLICY MANUAL FOR MEDICARE SERVICES

CHAP11-CPTcodes90000-99999_final103119.docx Revision Date: 1/1/2020

21. Endomyocardial biopsy requires intravascular placement of catheters into the right ventricle under fluoroscopic guidance. Physicians shall not separately report a right heart catheterization or selective vascular catheterization CPT code for placement of these catheters. A right heart catheterization CPT code may be separately reportable if it is a medically reasonable, necessary, and distinct service performed at the same or different patient encounter. The right heart catheterization CPT code may be reported only if a complete right heart catheterization procedure is performed. If an abbreviated right heart catheterization is medically reasonable and necessary, it may be reported with CPT code 93799 (Unlisted cardiovascular service or procedure). Fluoroscopy codes (e.g., CPT code 76000) are not separately reportable for an endomyocardial biopsy. (CPT code 76001 was deleted January 1, 2019.)

+76937 Ultrasound Guidance for Vascular Access

Ultrasound guidance for vascular access requiring ultrasound evaluation of potential access sites. Must have the following documented:

- ✓ Documentation of the selected vessel patency
- ✓ Concurrent real time ultrasound visualization of vascular needle entry
- ✓ Permanent recording and reporting

Medicare NCCI Edit with Ultrasound Guidance

NATIONAL CORRECT CODING INITIATIVE POLICY MANUAL FOR MEDICARE SERVICES

CHAP11-CPTcodes90000-99999_final103119.docx Revision Date: 1/1/2020

15. Cardiac catheterization, percutaneous coronary artery interventional procedures (angioplasty, atherectomy, or stenting), and internal cardioversion include insertion of a needle and/or catheter, infusion, fluoroscopy and ECG rhythm strips (e.g., CPT codes 36000, 36140, 36160, 36200-36248, 36410, 96360-96376, 76000, 93040-93042). All these services are components of a cardiac catheterization, percutaneous coronary artery interventional procedure, or internal cardioversion and are not separately reportable.. Additionally, ultrasound guidance is not separately reportable with these procedures. Physicians shall not report CPT codes 76937, 76942, 76998, 93318, or other ultrasound procedural codes if the ultrasound procedure is performed for guidance during one of these procedures. (CPT code 76001 was deleted January 1, 2019.)

Diagnostic Case Examples

Case Example #1

Indications: 3 year old male with tricuspid Atresia, VSD and severely narrowed RVOT who is s/p 4mm modified Blalock-Taussig shunt 3 years ago. Patient noted for oxygen saturations declining over the past several months. Patient presents for cardiac catheterization with hemodynamic evaluation.

Procedure Performed: Right and Left Heart Cath

Access Site(s): Right internal jugular (RIJ) and Right femoral vein (RFV)

Catheter Course: A prograde venous catheter was advanced from the right internal jugular vein into the SVC and into the branch pulmonary arteries into the wedge positions. A prograde left heart cath was performed from the right femoral vein into the IVC, right atrium and through an existing atrial septal defect into the left atrium, the pulmonary veins themselves, and into the left ventricle and aorta. Pulmonary veins were entered from the right femoral vein to the IVC, to the LA through an ASD from the right atrium.

Cineangiography/Injections:

1. Left upper pulmonary vein: Hand injection into the left upper pulmonary vein with a wedge catheter advanced from the IVC demonstrates a normally patent left pulmonary vein which drains to the left atrium.
2. Right middle pulmonary vein: Selective injection into the right middle pulmonary vein with a prograde wedge catheter demonstrates normal return from the right middle vein into the left atrium.

Case Example #1 Continue

3. Left pulmonary artery: Power injection into the proximal LPA with a prograde Berman catheter advanced from the right IJ sheath demonstrates a stenotic proximal LPA and a hypoplastic distal vascular tree compared to the right. The MPA peak has no regurgitation and no RV cavity is evident on this injection. Levo phase to the left atrium is normal and the transit time is normal.
4. Innominate vein: Power addition into the innominate vein with a Berman catheter advanced from the right IJ sheath demonstrates a normal left-sided innominate vein which drained to the SVC normally. The left internal jugular vein is widely patent. There is a tiny accessory hemiazygos vein draining from the base of the innominate which descends below the diaphragm, communicated with the IVC in the usual fashion. No other venous collaterals are noted.
5. SVC: Power injection into the right-sided SVC demonstrates an unobstructed cavopulmonary connection. There is proximal LPA stenosis (native RPA). There is no decompression through the Glenn circuit.
6. Left ventricle: Power injection into the LV with a prograde Berman catheter demonstrates a slightly dilated left ventricle which has excellent systolic function. The outflow tract is unobstructed and there are no significant AP collateral seen on the injection. Aortic arch is unobstructed. There is no visible mitral valve regurgitation.

Summary: Patient with tricuspid atresia. Overall, hemodynamics look good today. LPA is somewhat hypoplastic and there is proximal stenosis which we will schedule a planned angioplasty at a later date.

Case Example #1 Continue

Calculations:

Rest –

	Sats	O2 Content	Pressure
SV	71	16	12
PA	71	16	12
LA	99	22	10
AO	88	20	63
PBF	2.83		
SBF	4.66		
EBF	2.83		
L to R	0.00		
R to L	1.83		
Qp:Qs	0.61		
PVR	0.71		
SVR	10.94		
CO	3.03		

Condition	Site	S/A	D/V	M/ED
Rest	Right Atrium	10	12	9
Rest	Superior Vena Cava	13	13	13
Rest	Right Pulmonary Artery	12	12	12
Rest	Pulmonary Vein Right Lower	10	11	9
Rest	Pulmonary Vein Right Upper	10	12	10
Rest	Left Ventricle	79		9
Rest	Aorta Ascending	78	50	63
Rest	Pulmonary Vein Left Upper	18	18	10
Rest	Left Pulmonary Artery	12	13	12

02 Sats:

Time	Condition	Site	02 Sat
8:45:35 AM	Rest	Superior Vena Cava	71.0
9:17:37 AM	Rest	Right Atrium	71.0
9:17:14 AM	Rest	Left Ventricle	86.0
8:54:29 AM	Rest	Pulmonary Vein Left Upper	99.0
8:53:20 AM	Rest	Pulmonary Vein Right Upper	99.0
8:52:12 AM	Rest	Pulmonary Vein Right Lower	96.0
8:50:19 AM	Rest	Right Pulmonary Artery	71.0
8:55:49 AM	Rest	Left Pulmonary Artery	77.0
9:01:32 AM	Rest	Artery Femoral	88.0

Case Example #1 Answer

CPT Code(s) Supported:

- ✓ 93533 – Combined right heart catheterization and transseptal left heart catheterization through existing septal opening, with or without retrograde left heart catheterization, for congenital cardiac anomalies
- ✓ 93565 – Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective left ventricular or left atrial angiography
- ✓ 93568 – Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for pulmonary angiography
- ✓ 75820 – Venography, extremity, unilateral, radiological supervision and interpretation
- ✓ 36011 – Selective catheter placement, venous system; first order branch
- ✓ 75827 – Venography, caval, superior, with serialography, radiological supervision and interpretation

Case Example #2

Indications: 14 year old female with history of dilated cardiomyopathy who is status post orthotopic heart transplant. Patient presents today for annual s/p OHT cardiac catheterization and endomyocardial biopsy. Patient has been more short of breath the past few months therefore right and left heart cath is indicated to assess for interval development of graft coronary vasculopathy in the transplanted heart. Endomyocardial biopsy is indicated for graft surveillance for cell and/or antibody mediated rejection.

Procedure Performed: Right and Left Heart Cath, Biopsy, Coronary Study

Access Site(s): Right Femoral Artery (RFA), Right Femoral Vein (RFV)

Procedure Details: After obtaining vascular access from the RF vein, a right heart catheterization was performed following which 4 endomyocardial biopsies were obtained from the right ventricle. A retrograde left heart cath was then performed via the RFA.

Cineangiography/Injections: Selective RCA and LCE injections demonstrated normal coronaries without stenosis and unchanged from previous. The catheter was then manipulated to the left ventricle and left ventriculogram was obtained. There was no pullback across the aortic valve. CAV=0. The RCA is dominant.

Summary: Patient continues to have normal and stable hemodynamics and coronaries. Biopsy results are pending.

Case Example #2 Continue

Calculations:

	Sats	O2 Content	Pressure
SV	72	9	7
PA	72	9	14
LA	99	12	8
AO	99	12	61
PBF	4.14		
SBF	4.14		
EBF	4.14		
L to R	0.00		
R to L	0.00		
Qp:Qs	1.00		
PVR	1.45		
SVR	13.03		
CO	3.81		

Hemodynamic Pressures:

Condition	Site	S/A	D/V	M/ED
Rest	Superior Vena Cava	9	8	7
Rest	Inferior Vena Cava	7	9	7
Rest	Right Atrium	8	9	7
Rest	Right Ventricle	26		7
Rest	Right Pulmonary Artery	19	11	14
Rest	Pulmonary Capillary Wedge Right	11	10	8
Rest	Left Ventricle	80		10
Rest	Aorta Ascending	82	47	61

Case Example #2 Answer

CPT Code(s) Supported:

- ✓ 93460 – Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation; with right and left heart catheterization including intraprocedural injection(s) for left ventriculography, when performed
- ✓ 93505 – Endomyocardial biopsy

Case Example #3

Indications: 8 day old with HLHS who had surgery yesterday (Norwood/BT shunt) and patient failed to wean from bypass. Was felt to be overcirculated and despite partial occlusion of the shunt still failed to come off bypass. Now presents on ECMO for evaluation.

Procedure Performed: Cardiac Catheterization

Access Site(s): Right femoral artery (RFA)

Catheter Course: Using US guidance, the RFA was entered and a 4 Fr sheath inserted. A catheter was then passed to the systemic RV. After multiple angiograms failing to show any significant flow into the native aorta and coronaries, the DSK was finally entered.

Cineangiography/Injections:

1. RV injection demonstrates severe RV systolic function and almost no forward flow to the neoaorta.
2. Aortic injections on and off ECMO demonstrated a well repaired aortic arch without significant narrowing. The RBT shunt is widely patient and there is good flow to bilateral pulmonary arteries. The shunt and bilateral pulmonary arteries are all about 3mm. There is trivial filling of the native aorta and the coronaries hardly fill despite positioning the catheter close to the DKS and turning the ECMO circuit off.
3. Coronary injection into the native aorta demonstrated the native aorta was 1-1.3mm. The RCA filled well and there was limited LCA vasculature.

Summary: Patient has evidence of ventricular dysfunction and ischemia and wide complex tachycardia in the setting of poor angiographic coronary perfusion and a diminutive ascending aorta.

Case Example #3 Answer

CPT Code(s) Supported:

- ✓ 93454 – Catheter placement in coronary artery(s) for coronary angiography, including intraprocedural injection(s) for coronary angiography, imaging supervision and interpretation
- ✓ 93567 – Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for supravalvular aortography
- ✓ 93566 – Injection procedure during cardiac catheterization including imaging supervision, interpretation, and report; for selective right ventricular or right atrial angiography

Repair of Heart Defects

Transesophageal Echo Guidance

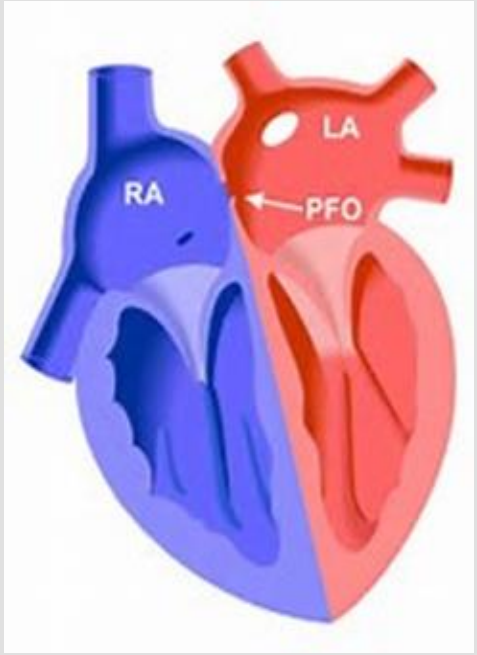
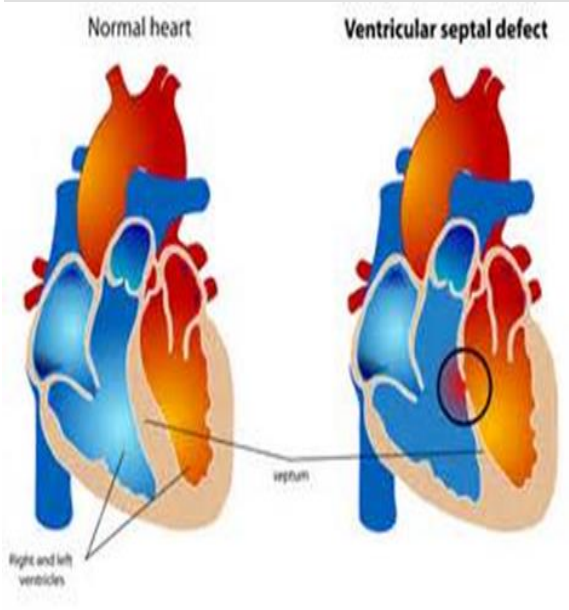
93355 TEE for guidance for transcatheter advanced structural interventions

- A range of intracardiac therapies may utilize TEE guidance. Included but not limited to are: TAVR, Melody Valve, TMVR, Paravalvular leak therapy LAA occlusion and VSD/ASD Closure

- Includes diagnostic TEE, 3D reconstructions, Doppler/Color Flow and use of ultrasound contrast agent

-Provider performing the TEE cannot be the same as the provider performing the intervention

Percutaneous Repairs

93580		93581	
Percutaneous transcatheter closure of congenital interatrial communication (PFO, Fontan Fenestration, Atrial Septal Defect with implant)		Percutaneous transcatheter closure of a congenital ventricular septal defect with implant	

Septal Defect Repair Includes

- Right and Left Heart Caths
- Right and Left Atrial/Ventricular Imaging
- Supervision and Interpretation for Imaging
- Access across the PFO in the Left Atrium/Ventricle

Do not bill codes 93580/93581 with 93451-93453, 93455-93461, 93530-93533 or 93564-93566

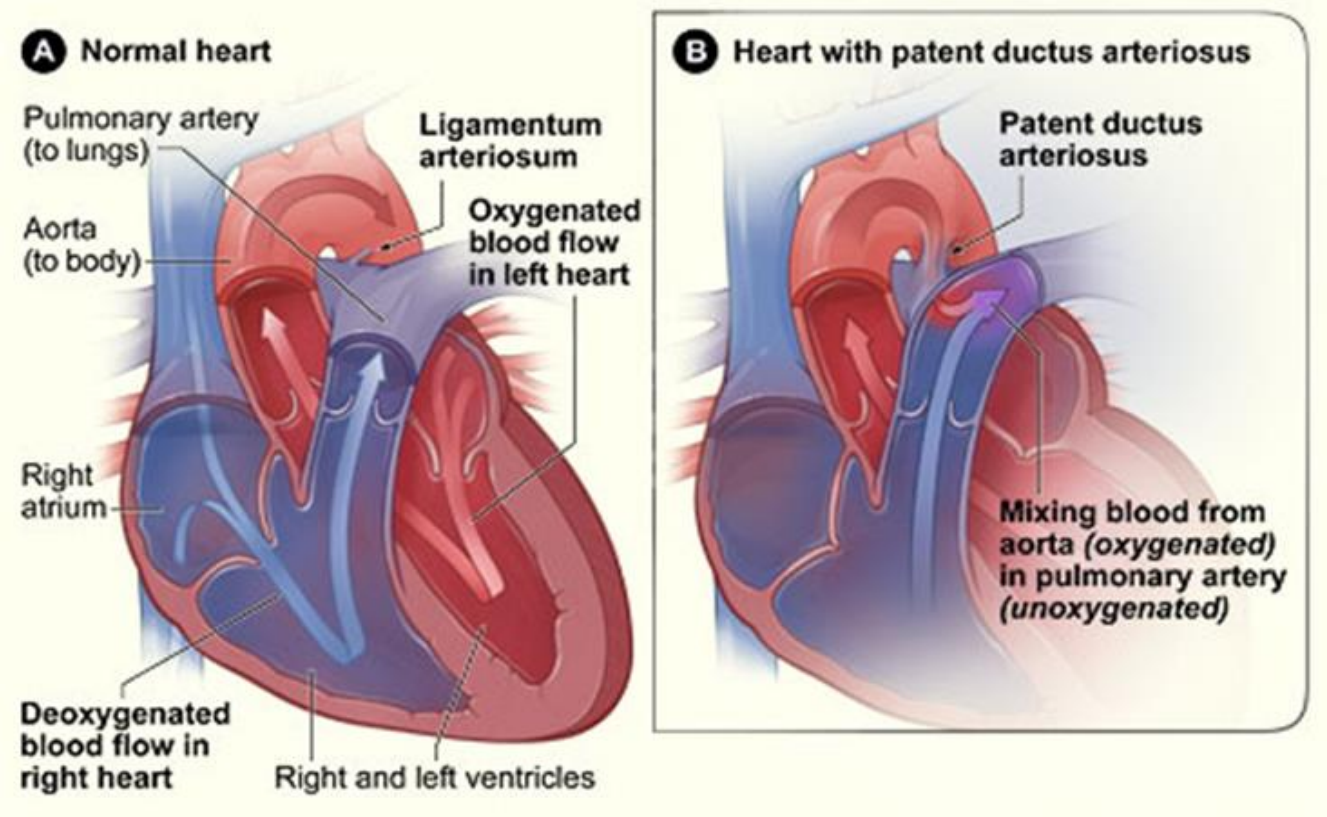
Separately Billable with Septal Repair

Echo

- Transthoracic
- TEE
- Intracardiac - ICE

Coronary, aortic or pulmonary angiography

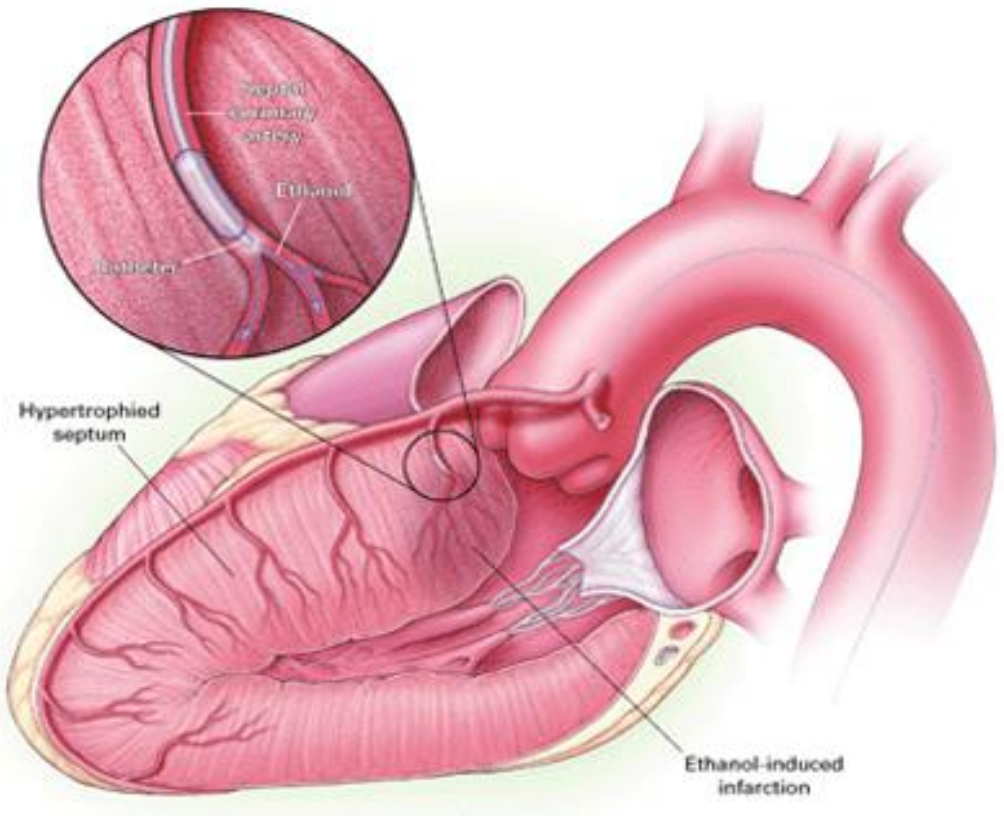
Percutaneous Repairs Cont.



93582 – Percutaneous Transcatheter Closure of Patent Ductus Arteriosus (PDA)

- May be via venous through the RA, RV, PA to aorta or arterial via femoral to thoracic
- Includes RT/LT Heart Caths, aortography, roadmapping guiding shots and deployment
- ICE, TEE cardiac chamber/coronary vessel imaging is separately reported

Percutaneous Repairs Cont.

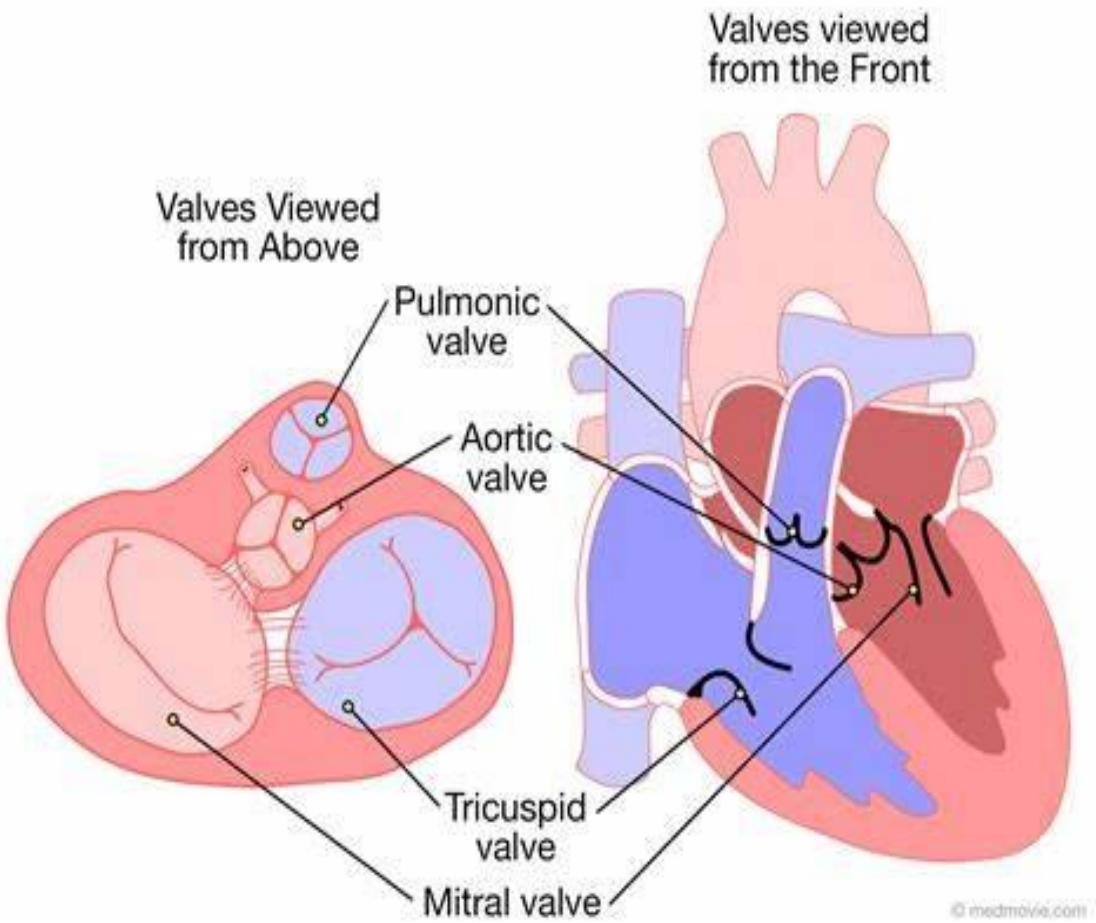


93583 – Percutaneous Transcatheter Septal Reduction Therapy (e.g. alcohol septal ablation) including temporary pacemaker

-Includes roadmapping, guidance of intervention vessel and completion angiography.

- Diagnostic cath codes may be billed
- ICE is separately billable
- Other echocardiographic services must be done by a separate physician

Percutaneous Valve Procedures



Valvuloplasty

- 92986 – Percutaneous Balloon Valvuloplasty; Aortic
- 92987 – Percutaneous Balloon valvuloplasty; Mitral
- 92990 – Percutaneous Balloon Valvuloplasty; Pulmonary
- 93799 – Percutaneous Balloon Valvuloplasty; Tricuspid

Transcatheter Pulmonary Valve Implantation (TPVI)

- 33477 Implantation of catheter delivered prosthetic pulmonary valve, endovascular approach (Melody Valve)
  - Includes all congenital cardiac caths, intraprocedural contrast injection(s), fluoroscopic radiological supervision and interpretation, and imaging guidance performed to complete the pulmonary valve procedure (including 93662)
  - Do not report w/93451, 93453--93461, 93530--93533, 93563,93566--93568
  - Includes percutaneous balloon angioplasty/stent placement of the pulmonary valve/ conduit within the prosthetic valve delivery site
  - Do not report with valvuloplasty code 92990
  - Report coronary or pulmonary artery stent placement (e.g., 92928, 92929, 37236, 37237) when performed at a site **separate** from the prosthetic valve delivery site
  - Report pulmonary artery angioplasty 92997, 92998 **separately** when performed at a site separate from the prosthetic valve delivery site
  - Report percutaneous VAD, Balloon Pump, ECMO, ECLS or CP--Bypass separately

Billable Add-Ons with TPVI

+33367	+33368	+33369
Cardiopulmonary bypass support with percutaneous peripheral arterial and venous cannulation	Cardiopulmonary bypass support with open peripheral arterial and venous cannulation	Cardiopulmonary bypass support with central arterial and venous cannulation

Included with TPVI

- Cardiac Caths including intraprocedural injections
- Fluoroscopic radiological supervision and interpretation
- Imaging Guidance
- Balloon angioplasty of the conduit/treatment zone
- Valvuloplasty of the pulmonary valve conduit
- Stent deployment within the pulmonary conduit or an existing bio prosthetic pulmonary valve

Separately Billable with TPVI

Diagnostic Left Heart Cath and Diagnostic Right Heart Cath are separately billable for the following conditions

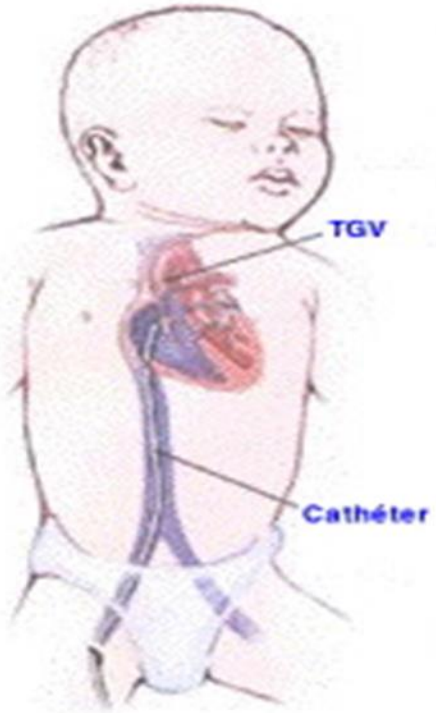
- The Caths are not part of the TPVI procedure
- No prior study is available and a full diagnostic study is performed
- If study is available but has inadequate visualization or patient's condition has changed
- There is a clinical change during the procedure

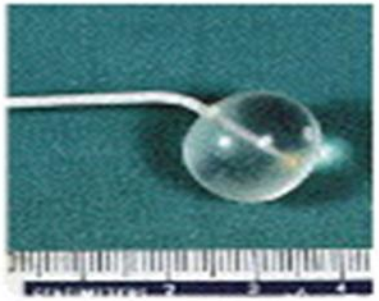
Separately Billable with TPVI

- Percutaneous coronary interventions
- Percutaneous pulmonary artery branch interventions when separately performed
- Ventricular Assist Device (33990-33993)
- Extracorporeal Membrane Oxygenation (ECMO) (33946-33989)
- Balloon Pump Insertion (33967, 33970, 33973)

Other Therapeutic Procedures

Atrial Septectomy or Septostomy

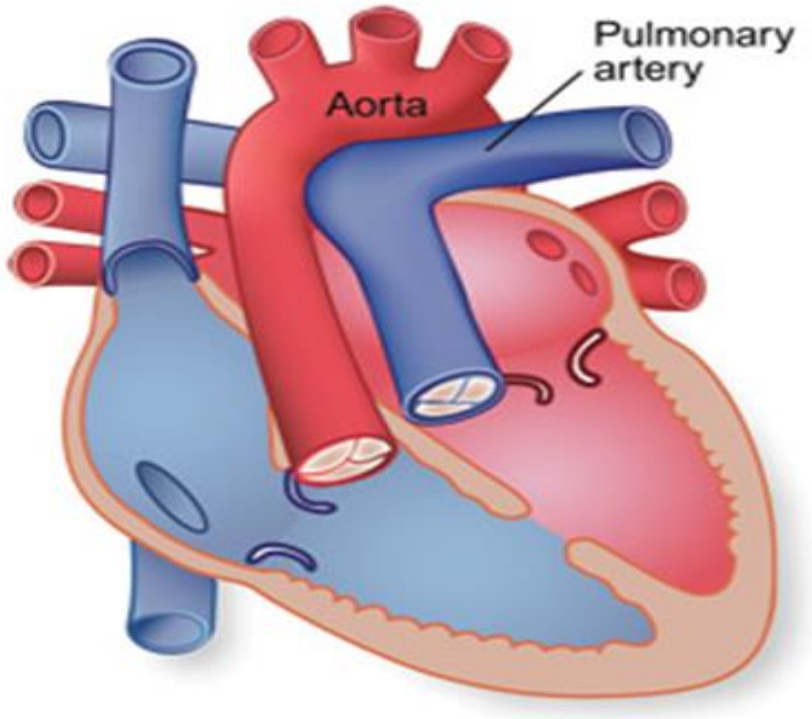




- 92992 Atrial septectomy transverse method balloon (Rashkind) type includes cardiac cath
- 92993 Blade method (Park septostomy) includes cardiac cath

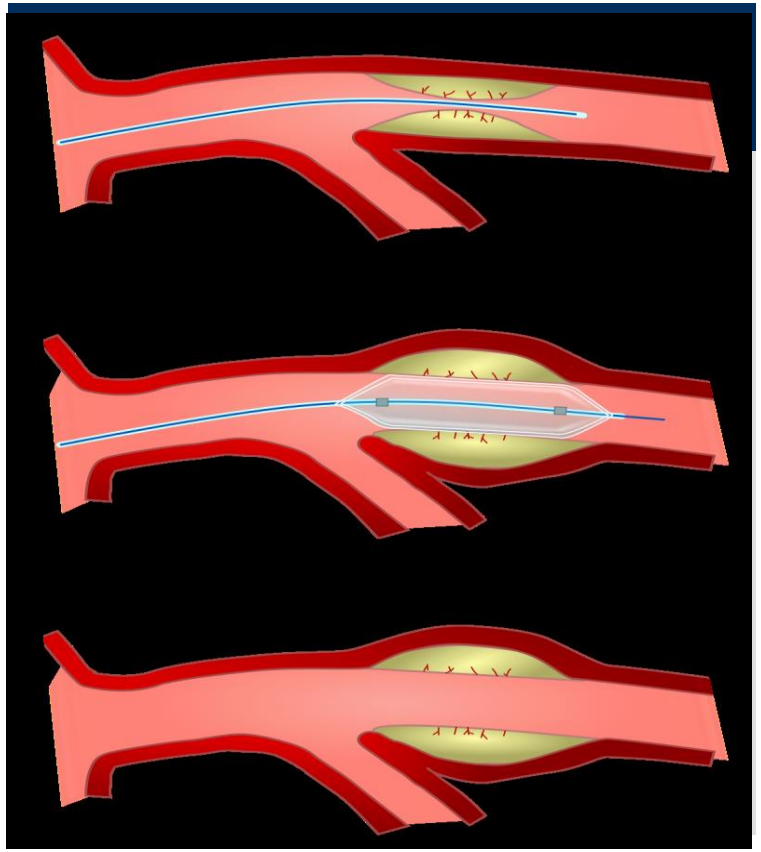
Percutaneous Transluminal Pulmonary Artery

- 92997 Percutaneous transluminal pulmonary artery balloon angioplasty; single vessel
- +92998 each additional vessel

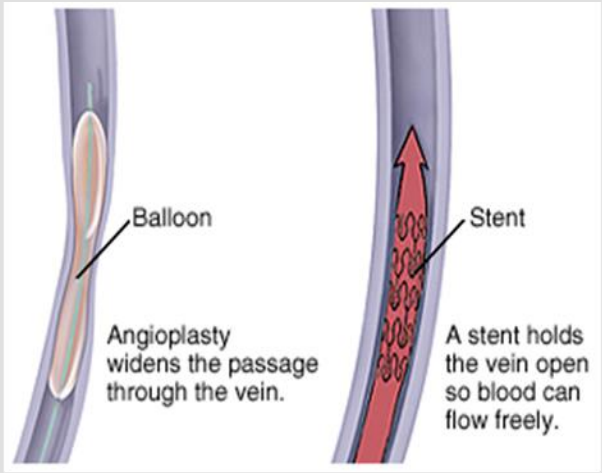


If performed with a cath use add on code 93568 once for all separate pulmonary artery injections. If not done with a cath use codes 75741, 75743, 75746, and/or 75774 as appropriate along with cath placement codes 36013, 36014, and 36015 as appropriate

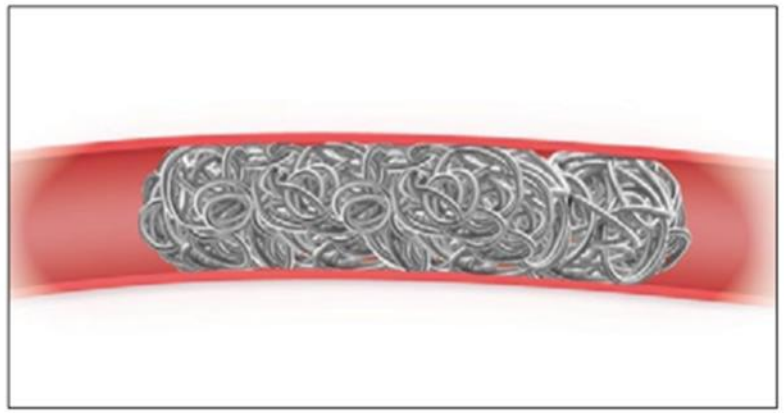
Venoplasty with Congenital Heart Disease

37248		+37249
Transluminal balloon angioplasty open or percutaneous including Venoplasty		Each additional vein

Stenting with Congenital Heart Disease

37236		+37237
Transcatheter placement of intravascular stent; initial artery		-each additional artery

Vascular Embolization

37241		37242
Vascular embolization or occlusion venous other than hemorrhage or tumor (e.g. congenital or acquired venous malformations)	 Figure 3. Tight coil packing.	Vascular embolization or occlusion arterial other than hemorrhage or tumor (e.g. congenital or acquired malformations)

Open Congenital Procedures

Open Congenital Procedures – Most Common

- Patent Ductus Arteriosus Closure
- Coarctation of Aorta
- Ventricular Septal Defect
- Atrial Septal Defect
- Tetralogy of Fallot

76

Patent Ductus Arteriosus (PDA)

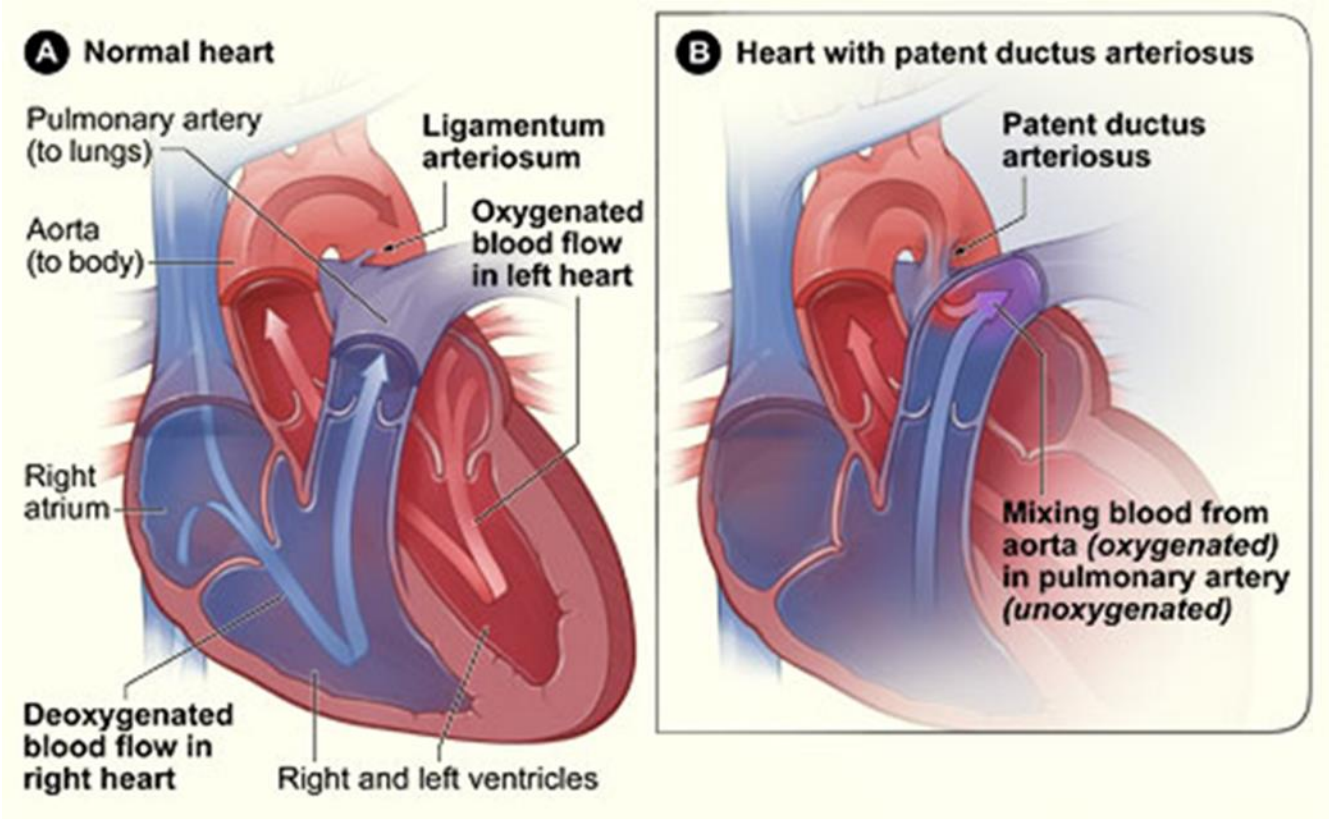
33820 Repair by ligation

33822 Repair by division

(Younger than 18)

33824 Repair by division

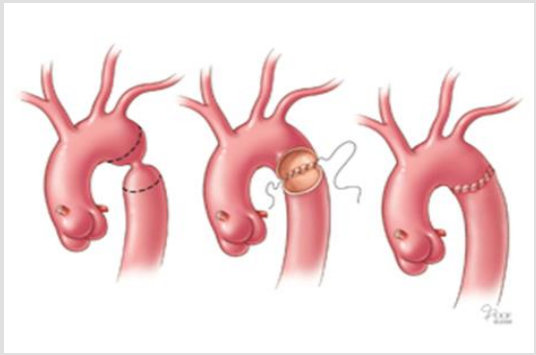
(18 years and older)



Coarctation of Aorta

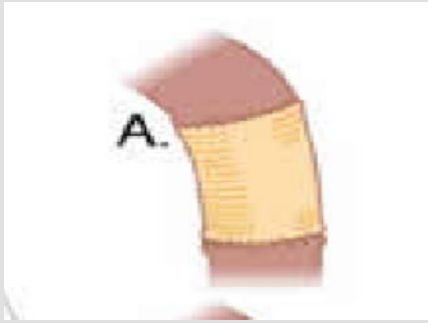
33840

Excision of Coarctation of aorta with or without PDA; with direct anastomosis

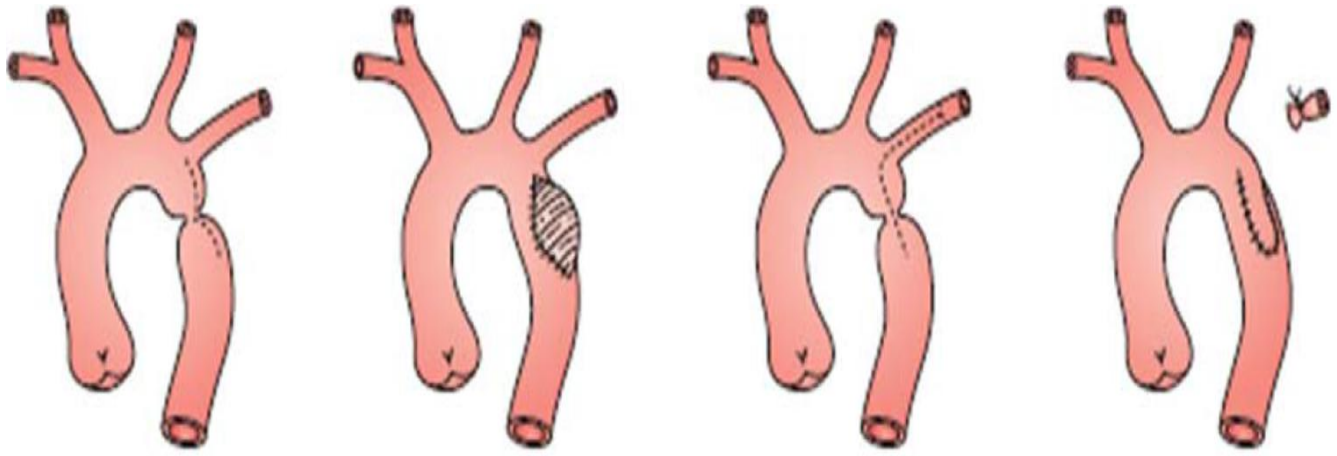


33845

Excision of Coarctation of aorta with or without PDA; with graft



Coarctation of Aorta

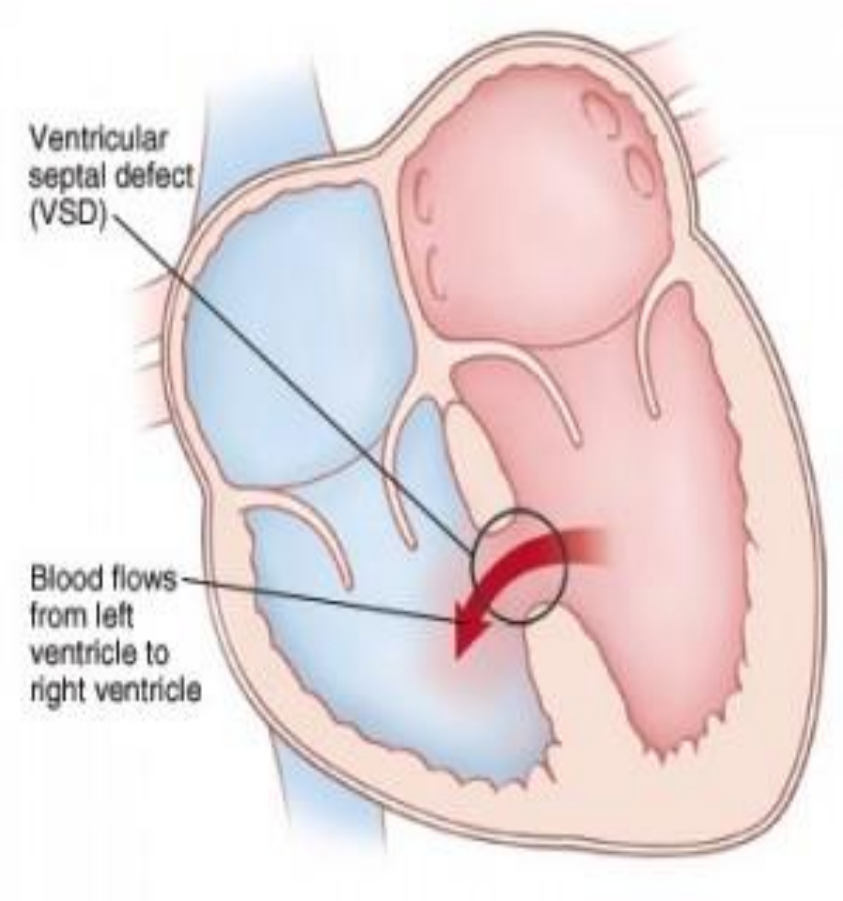


B Patch angioplasty D Subclavian flap

33851 Excision of Coarctation of aorta with or without PDA; repair using either prosthetic material or the left subclavian artery as a gusset for enlargement

Repair of Single Ventricle Septal Defect (VSD)

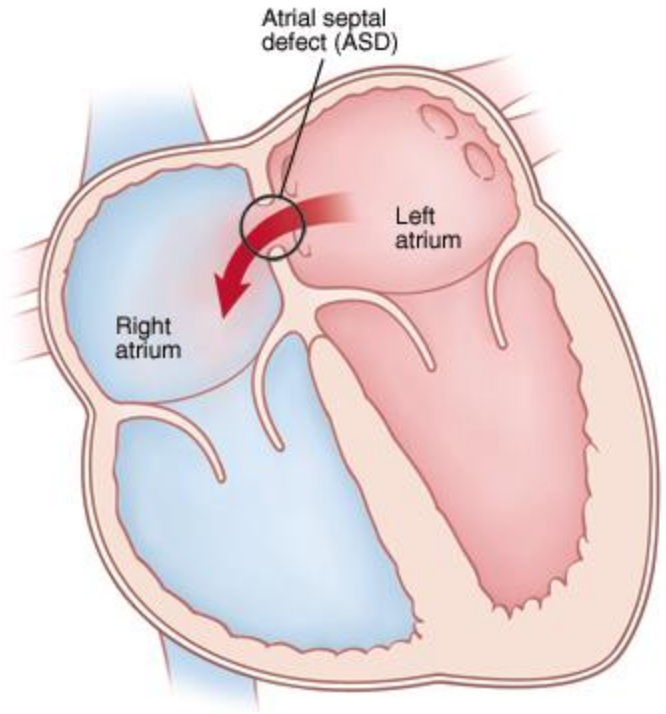
- 33681 Closure of single ventricular septal defect w/ or w/out patch
- 33684 Closure of VSD with pulmonary valvotomy or infundibular resection – with possible use of +33924
- 33688 Closure of VSD with removal of pulmonary artery band w/ or w/out gusset –with possible use of +33924



Repair of Multiple Ventricular Septal Defects

33675	33676	33677
Closure of multiple ventricular septal defects	Closure of multiple ventricular septal defects with pulmonary valvotomy or infundibular resection (acyanotic)	Closure of multiple septal defects with removal of pulmonary artery band with or without gusset

Atrial Septal Defect



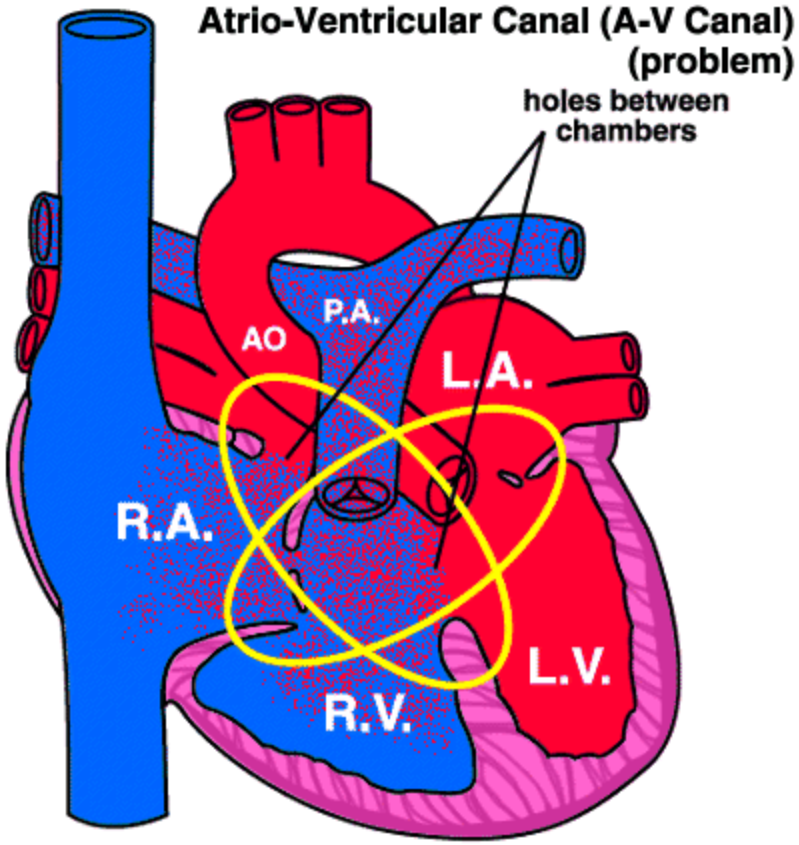
- 33641 Repair of atrial septal defect secundum with cardiopulmonary bypass with or without patch
- 33645 Direct or patch closure of a sinus venosus with or without anomalous pulmonary venous drainage

Repair of Atrial and Ventricular Septal Defect

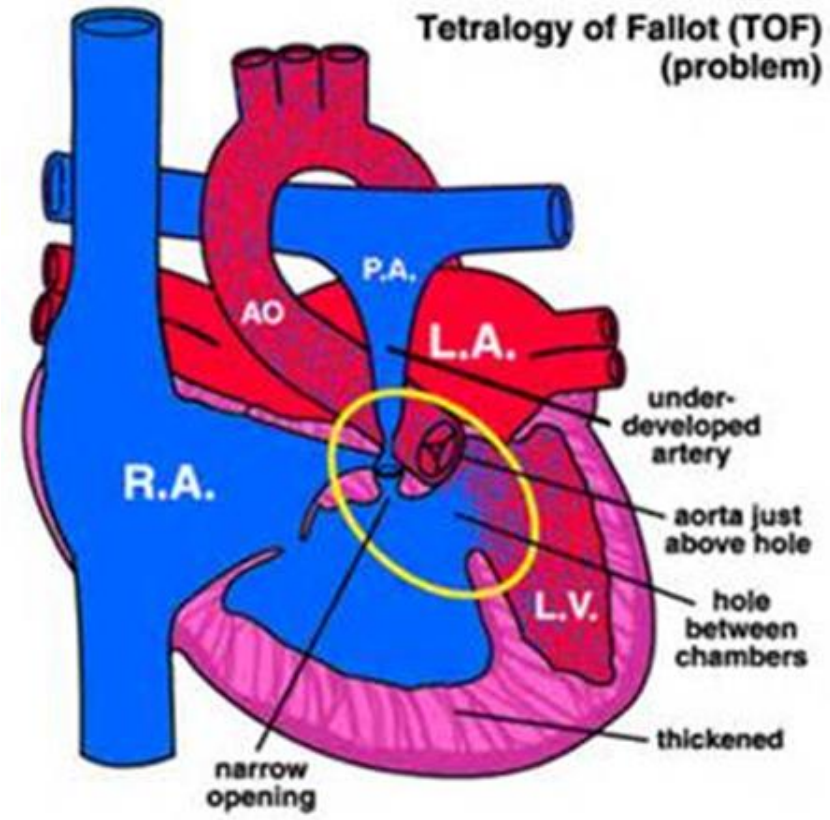
- 33647 Repair of atrial septal defect and ventricular septal defect with direct or patch closure

Repair of Atrioventricular Canal

- 33660 Repair of incomplete or partial atrioventricular canal ostium primum ASD with or without atrioventricular valve repair
- 33665 Repair of intermediate or transitional atrioventricular canal with or without atrioventricular valve repair
- 33670 Repair of complete atrioventricular canal with or without prosthetic valve



Tetralogy of Fallot Repair



- 33692 Complete repair tetralogy of Fallot without pulmonary atresia;
- 33694 with transannular patch
- 33697 Complete repair tetralogy Fallot w/pulmonary atresia including construction of conduit from right ventricle to pulmonary artery and closure of VSD

Case Studies

Case #4

Indications: 3 m.o. male with congenital hear disease comprising hypoplastic left heart syndrome (HLHS) MS/AS sub type s/p Stage 1 Norwood with a 6mm Sano conduit. He has done well and is referred for pre-Glenn catherization with interventions as indicated.

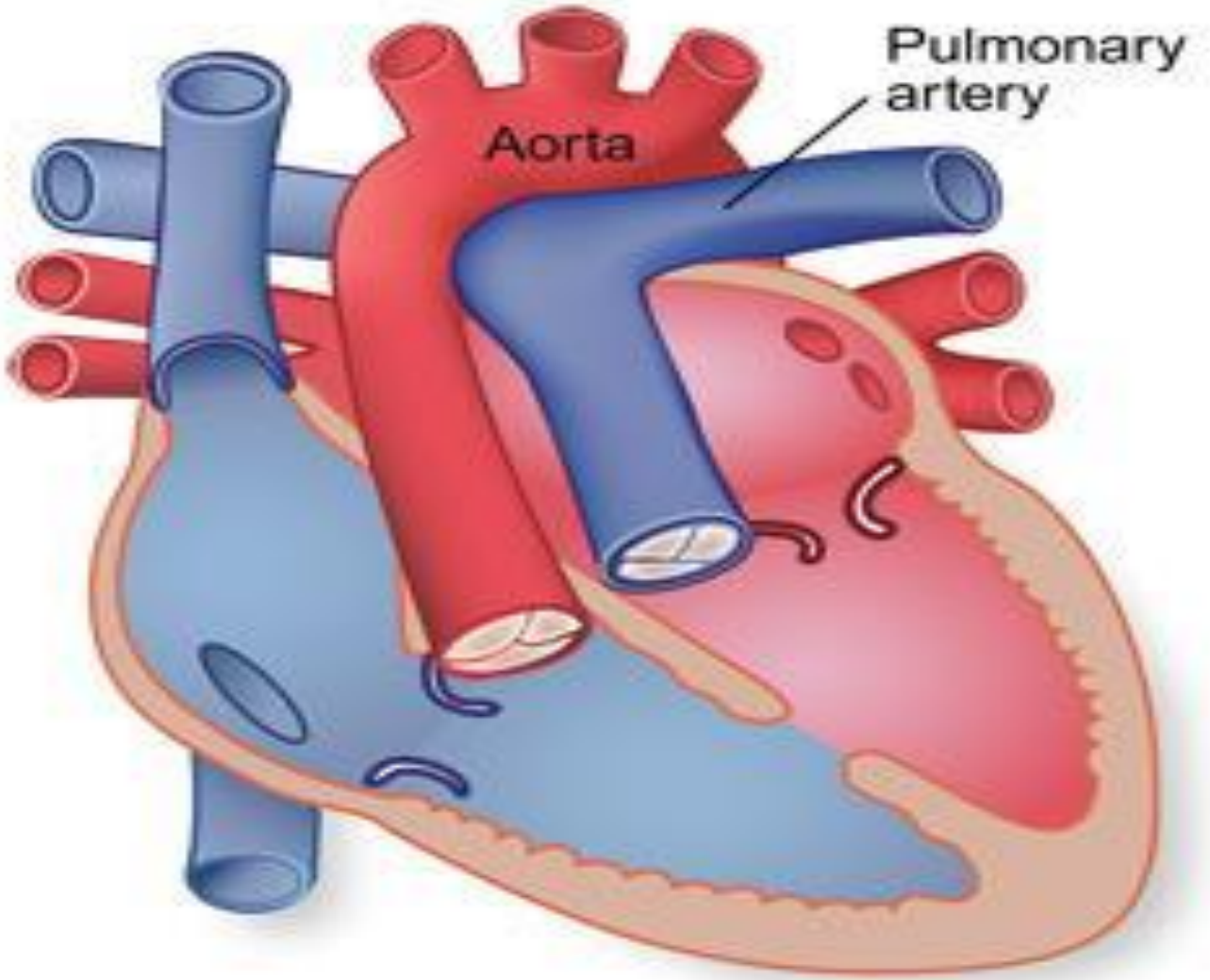
Description of Procedure: The procedure included a right and left (via septal opening) heart catheterization with oximetry and hemodynamics. Interventional components included microparticle occlusion of the right IMA.

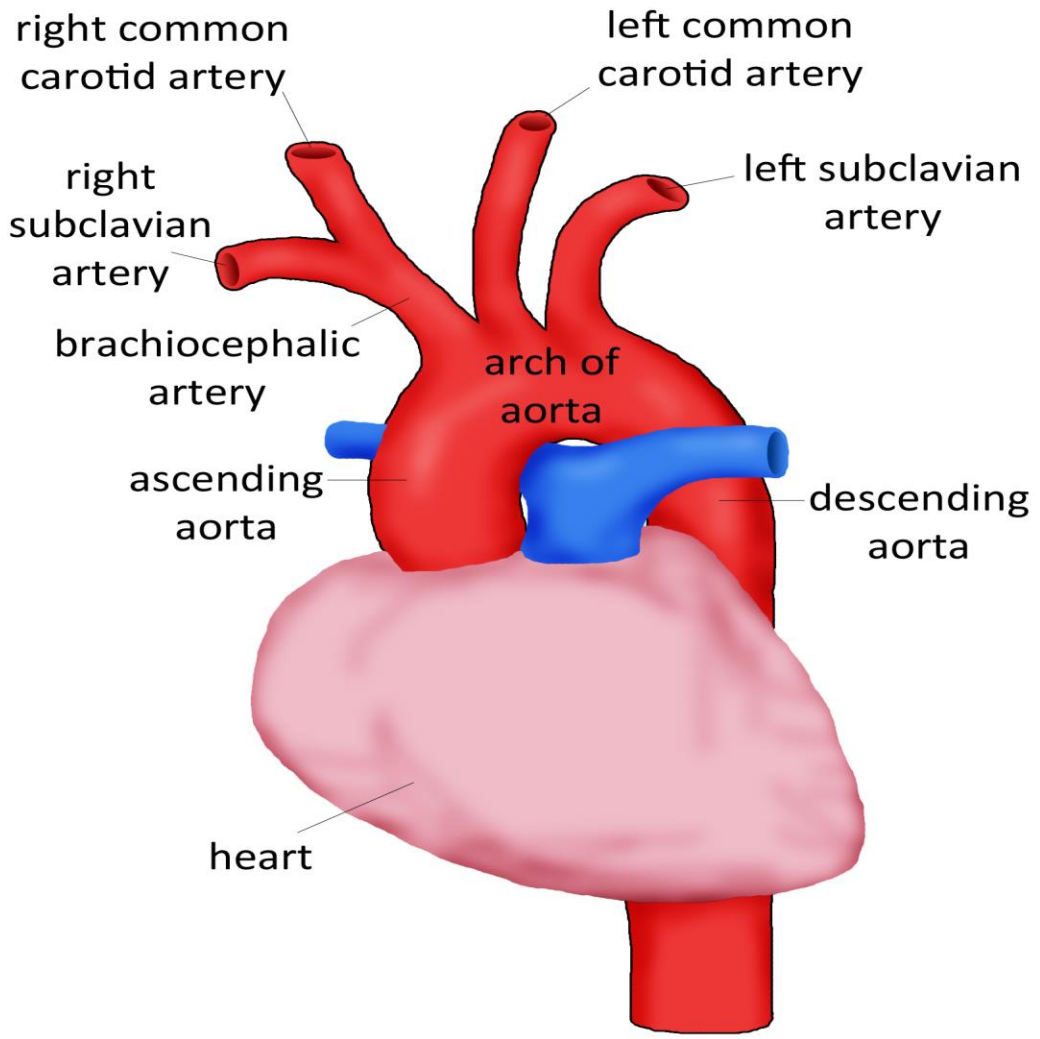
Patient was brought to the cardiac cath lab. After all consents were checked and the hold points completed, he was placed in the usual position and placed under general anesthesia by the anesthesia team. The access site was prepared in the usual sterile manner. **Vascular ultrasound imaging was utilized to define selected vessel patency and given the need minimize vascular complications. Real time imaging was used during vascular access attempts including visualization of needle passage into the vessel lumen. Access was obtained using the Seldinger technique in the right femoral vein with a 5 French sheath and the right femoral artery with a 4 French sheath. Both vessels were patent. Ultrasound imaging was captured and placed in the medical record. (76937)**

After access was obtained, we obtained a blood gas and heparin was administered. **We then performed a right and antegrade left heart cath (via existing septal opening given the single ventricle physiology/anatomy (93533) Oximetric and hemodynamic data were obtained from the SVC, IVC, RA, LA, both right sided and left sided pulmonary veins, the systemic ventricle AscAo and DescAo. Pulmonary vein wedge pressures were measured to approximate PA pressures. Hand injection angiograms were obtained within the pulmonary veins/LA pressure pullbacks were obtained from pulm. Vein to LA/RA The groin catheter was placed in the atrium and pigtail retracted to the ascending aorta. Concomitant ventricle ascending and then descending aorta pressures were then measured. We completes the hemodynamic assessment by performing angiograms in the LA, (93565) SVC/Innominate vein (1st order vein) by selectively advancing a catheter into the innominate vein (36011, 75827, 75820), the aortic root (93567) and then selectively into the PA/Sano conduit by selectively advanding the wedge catheter into the PAs. (93568)**

I then occluded the SPC's. From the femoral artery I advanced a 4 Fr cath selectively into the right subclavian artery ~~(36216)~~ I performed selective right subclavian artery angiogram which showed a significant amount of collaterals to the right lung small arising from the RIMA. (75710)

Case #4 Cont.





Case #4 Cont.

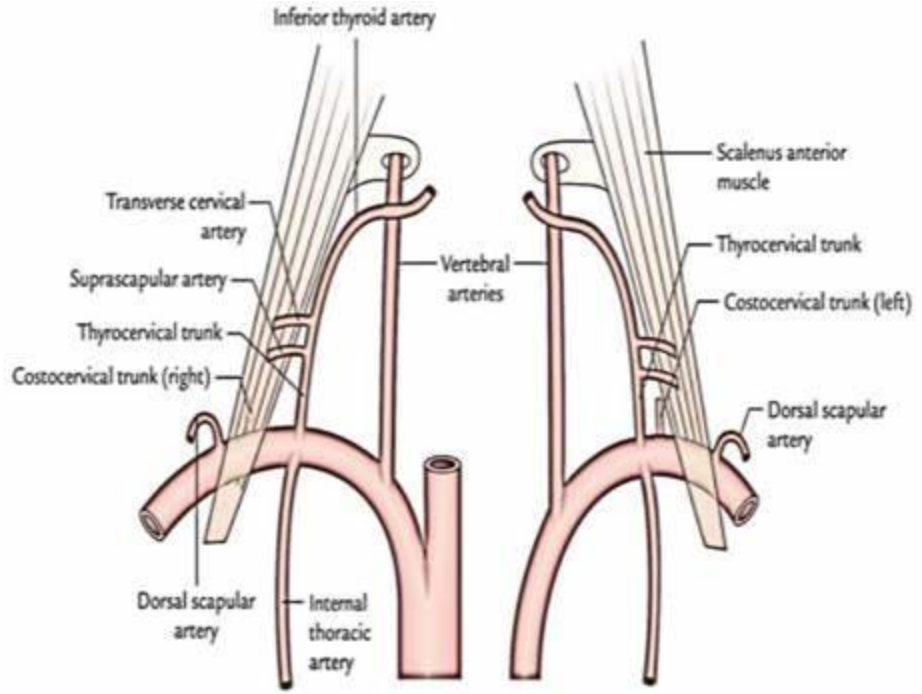
A microcatheter was then advanced into the RIMA (36217) a y adapter was placed on the back of the microcatheter to prevent bleeding and towels placed under the catheters to collect prevent contamination of the table with particles. **I then obtained a vial of 710-1000 micron PVA particles made a slurry with contrast and flush and injected them into the microcatheter to occlude the RIMA and right lung collaterals as described (37242)** Great care was taken to prevent backflow of the particles into the RSCA or onto the cath table. After occluding these collaterals the microcatheter was carefully removed into the underlying towels, wrapped and immediately discarded from the cath table.

After completion of the procedure, local anesthesia was given at the access site. The sheaths were removed hemostasis was obtained.

Catheterization Findings: (please see the PedCath report for further details)
1. **Oximetry**:
On FiO2 21%, ABG was pH 7.4, pCO2 40, pO2 38.
HgB: 12.7gm/dL
Representative saturations were as follows:

Location	O2 Sat (%)
SVC	50%
IVC	53%
RUPV	99%
LUPV	97%
dAO (PA)	71%

VO2: 148 ml/min/m2 (measured)
Calculated cardiac index was:
- Qp: 3.29 L/min/m2
- Qs: 4 L/min/m2
- Qp:Qs: 0.8:1



Case #4. Cont.

2. **Hemodynamics**:

Baseline	Systolic pressure / a wave (mmHg)	Diastolic pressure / v wave (mmHg)	Mean pressure (mmHg)
SVC			8
RA	10	9	8
RPVW	16	11	14
RPA	16	10	13-14
LPVW	18	10	14
RUPV	9	11	9
LUPV	9	11	9
LA	9	11	9
RV	79	10	
aAO	78	37	54
dAO	78	38	54

Calculated pulmonary vascular resistance (Rp): 1.52 units x m2
Calculated systemic vascular resistance (Rs): 11.27 units x m2
Rp:Rs: 0.13

Angiography
Runs 1-2: R-SVC and innominate vein, Straight AP and lateral projections. Hand injections via a wedge catheter with balloon inflation and then deflation in the SVC. No SVC stenosis. The innominate vein partially backfills, and there is suggestion of a potentially decompressing collateral, though it is not visualized adequately for diagnostic purpose.

Run 3: Innominate vein, Straight AP and lateral projections - Hand injections via a wedge catheter now selectively advanced into the innominate vein. The innominate vein is widely patent with stenosis. The small vessel is a normal vein which flows into the vertebral plexus, with no connections to venous chambers of the heart.

Runs 4-5: RUPV/LLPV & LA angiograms. Straight AP and lateral projections. Hand injections into the pulmonary veins / LA. The pulmonary veins drain normally to the LA and are unobstructed. The LA is small given the HLHS and contrast flows across the ASD and into the RA then RV.

Runs 5-7: MPA/conduit angiograms. Straight AP with caudal 20-24 and straight lateral. Hand injection through the wedge in the Sano. The Sano is widely patent with obstruction. The branch PAs arise normally and there are no significant discrete stenoses, though there is some wash-in to the right lung. Contrast returns to the LA via unobstructed pulmonary veins.

Run 8: Aortic angiogram. RAO 30 and straight lateral. Power injection. Injection in the neo-aortic root / proximal DescAo. The DKS anastomosis is widely patent and there is no significant recurrent coarctation. There is no significant neo-AR. The coronary arteries appear normal. There are significant systemic-to-pulmoary collaterals arteries arising from the right internal mammary.

Run 9-10: Right SPC occlusion via RIMA – A JR catheter is advanced into the RSCA and then into the RIMA. A hand injection is performed and a relatively large meshwork of collaterals to the right lung is identified. A microcatheter is then advanced and a slurry of contrast, flush, and PVA particles is slowly injected to occlude these collaterals. Great care is taken to ensure that no particles reflux back into the RSCA. There is no residual flow through these collaterals after injection of the particles.

Case #4 Answers

- 93533/26 RHC/LHC through existing septal opening
- +93565 LA or LV angiography
- +93567 Supravalvular aortography
- +93568 Pulmonary angiography
- 37242 Vascular embolization or occlusion arterial
- 36017 3rd Order arterial cath placement
- 36011 1st Order venous cath placement
- 75710/26 Extremity angiography
- 75827/26 SVC venography
- 75820/26 Extremity venography
- 76937/26 Ultrasound guidance

Case # 5

PREOPERATIVE DIAGNOSIS: Coarctation of aorta.

POSTOPERATIVE DIAGNOSIS: Coarctation of aorta.

PROCEDURES:
1. Left thoracotomy.
2. Resection of coarctation and extended end-to-end anastomosis repair.
3. Insertion of femoral venous triple-lumen line.

BRIEF CLINICAL NOTE: This is a 6-day-old child who was postnatally diagnosed with coarctation of aorta. She was started on prostaglandins; however, the ductus did not open up, and although femoral artery pulses were difficult to palpate, she continued to have good urine output with no lactate elevation. She is now brought to the operating room for repair.

DESCRIPTION OF PROCEDURE: Patient was identified and brought to the operating room. General endotracheal tube anesthesia was administered. She had a preexisting UVC and UAC line. Right femoral triple-lumen central venous line was placed using sterile precautions. Then, the patient was appropriately positioned in right lateral decubitus, and left chest wall was prepped and draped in standard fashion.

Case # 5 Cont.

- **A limited posterolateral thoracotomy incision was made inferior to the scapula and carried through to the subcutaneous tissues. The fourth interspace was identified and intercostal muscles divided to gain entry into the pleural cavity. Rib retractors were placed. Lung was retracted medially and caudally to expose the proximal descending aorta. The mediastinal pleura was divided. The Vagus nerve and the recurrent laryngeal nerve were both visualized. The ductus was carefully isolated and ligated with 2-0 Ethibond tie and further suture ligated with 5-0 Prolene suture. The distal arch was mobilized up to takeoff of the left common carotid artery. Marking sutures were then placed and then the proximal and distal aorta was clamped. The Coarctation segment was resected, taking care to remove all ductal tissue. There was a very tight juxtaductal Coarctation segment noted. Then the incision was extended up to the takeoff of the left common carotid artery. The two ends of the aorta were anastomosed with a continuous 7-0 Prolene suture. 33840.**

- The distal clamp was briefly flashed followed by removal of the proximal clamp for a total clamp time of 21 minutes. The mediastinal pleural was reapproximated with a continuous 6-0 Prolene suture.

Case #5 Answer

- 33840 Excision of Coarctation of the aorta with or without associated patent ductus arteriosus; with direct anastomosis.

Case #6

PREOPERATIVE DIAGNOSES:
1. Secundum atrial septal defect.
2. Patent ductus arteriosus.

POSTOPERATIVE DIAGNOSES:
1. Secundum atrial septal defect.
2. Patent ductus arteriosus.

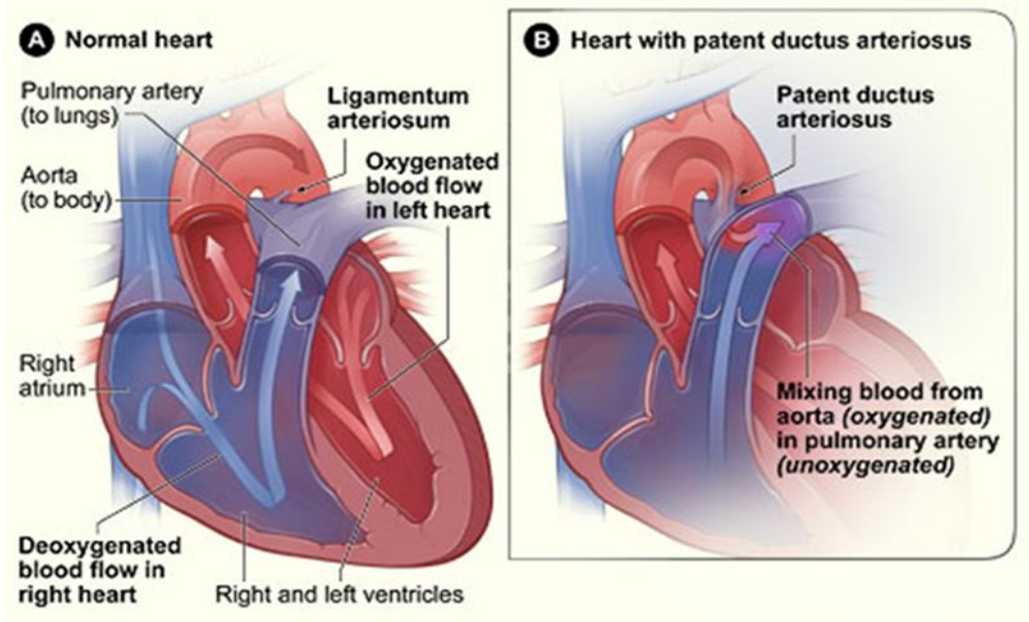
PROCEDURES:
1. Median sternotomy, ligation of patent ductus arteriosus, hypothermic cardiopulmonary bypass, patch closure of secundum atrial septal defect with autologous pericardium.
2. Insertion of right femoral arterial line and right femoral triple-lumen central venous line.

BRIEF CLINICAL NOTE: This is a 4-month-old child with Down syndrome, who was diagnosed to have a large fenestrated secundum type atrial septal defect and patent ductus arteriosus. Echocardiogram showed enlargement of both the right and the left ventricles. Recently, he was noted to have failure to thrive with failure to gain weight and intermittent chest wall retractions. He is now brought to the operating room for repair.

Case # 6 Cont.

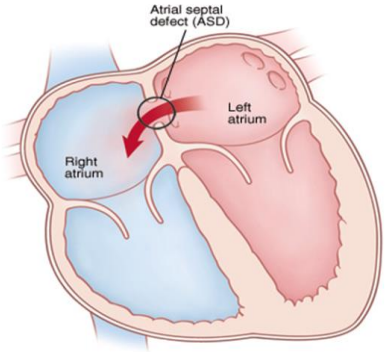
- Description of Procedure: Patient was identified, and general endotracheal tube anesthesia was administered. Using sterile precautions right femoral arterial line and right femoral triple lumen central venous lines were placed. The chest was prepped and draped in standard fashion. Midline skin incision was made and carried through to the subcutaneous tissues. **Sternum was opened with sternal saw and retractors were placed. The thymus gland was reflected off the pericardium and resected completely. Pericardium was opened in the midline and stay sutures were placed. Initially dissection was carried out to delineate the patent ductus arteriosus which was quite large. Five-0 Prolene suture was used to suture ligate the ductus arteriosus. 33820.**

Intravenous heparin was administered. Ascending aorta was cannulated with a 10-French aortic cannula and connected to the arterial end of the bypass circuit taking care to avoid air entry. SVC and IVC were cannulated with 12 and 14-French right angle DLP cannulas and connected to the venous end of the bypass circuit. When the ACT was appropriately elevated, cardiopulmonary bypass was commenced and patient was cooled to 34 degrees Centigrade. The aorta was crossclamped and cold blood cardioplegia was administered through a needle inserted in the aortic root. Caval snares were snugged down and right atrium was opened. A large secundum type atrial septal defect was noted with fenestrations along the inferior margin of septal tissue.



Case #6

- Inspection through the ASD to evaluate the mitral valve and rule out a supra-mitral ring was also carried out since the preoperative echocardiogram had shown some suggestion of thickening in the area proximal to the mitral valve. All four pulmonary veins were identified and no supra-mitral ring was noted. **A piece of autologous pericardium was harvested appropriately trimmed to size. This was then sutured to the edges of the atrial septal defect with a continuous 5-0 Prolene suture.** **33641**



- Prior to completion of the suture line the patient was placed in Trendelenburg position. Warm blood was trickled through the cardioplegia line and de-airing maneuvers were instituted as a Valsalva breath was given followed by tying down the suture line. The atriotomy was closed in two layers of 6-0 Prolene. Caval snares were released. The patient was then ventilated after suctioning of the ET Tube. Then vacuum and plegia were turned off and strong root suction applies as de-airing maneuvers were performed prior to removal of the aortic cross-clamp. The heart regained normal contractility in sinus rhythm. The IVC Cannula was clamped and removed. The patient was subsequently weaned off of cardiopulmonary bypass without difficulty. Modified ultrafiltration was done after which IV Protamine was administered.

Case # 6 Answers

- 33820 Repair of Patent Ductus arteriosus by ligation

- 33641 Repair of atrial septal defect

Q&A

Jammie Quimby, CPC, CCC, CEMC, CCS-P, CPMA, CRC, CDEO
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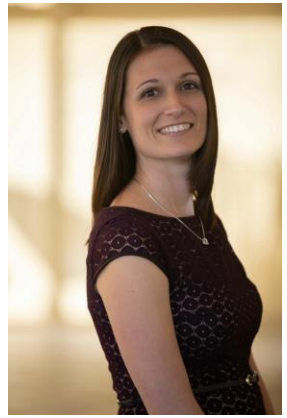

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