PRECATHETERIZATION DIAGNOSIS (ES):, Hypoplastic left heart, status post Norwood procedure and Glenn shunt.,POSTCATHETERIZATION DIAGNOSIS (ES):,1. Hypoplastic left heart.,A. Status post Norwood.,B. Status post Glenn.,2. Left pulmonary artery hypoplasia.,3. Diminished right ventricular systolic function.,4. Trivial neo-aortic stenosis.,5. Trivial coarctation.,6. Flow to right upper lobe more than left upper lobe from collaterals arising from branches of the aortic arch.,PROCEDURE (S):, Right heart and left heart catheterization by way of right femoral artery, right femoral vein, and right internal jugular vein.,I. PROCEDURES:, XXXXXX was brought to the catheterization lab and was anesthetized by anesthesia. He was intubated. His supplemental oxygen was weaned to 24%, on which all of his hemodynamics were obtained. The patient was prepped and draped in the routine sterile fashion, including both groins and the right neck. Xylocaine was administered in the right femoral area. A 6-French sheath was introduced into the right femoral vein percutaneously without complication. A 4-French sheath was introduced into the right femoral artery percutaneously without complication. A 4-French pigtail catheter was introduced and passed to the abdominal aorta.,Dr. Hayes, using the SiteRite device, introduced a 5-French sheath into the right internal jugular vein without complication.,A 5-French wedge catheter was introduced through the sheath in the right internal jugular vein and was passed to the left pulmonary artery and further to the left pulmonary capillary wedge position. This catheter would not

pass to the right pulmonary artery. The wedge catheter was removed. A 5-French IMA catheter was then introduced and passed to the right pulmonary artery. After right pulmonary artery pressure was measured, this catheter was removed.,The 5 wedge catheter was advanced through the right femoral sheath and was passed to the following chambers or vessels: Inferior vena cava, right atrium, left atrium, and right ventricle.,The previously introduced 4 pigtail catheter was advanced to the ascending aorta. Simultaneous right ventricular and ascending aortic pressures were measured. A pullback from ascending aorta to descending aorta was then performed. Simultaneous measurements of right ventricular and descending aortic pressures were measured.,The wedge catheter was removed. A 5-French Berman catheter was advanced down the Glenn shunt to the right pulmonary artery, where a pullback from right pulmonary artery to Glenn shunt was performed. An injection was then performed using Omnipaque 16 mL at 8 mL per second with the Berman catheter positioned in the Glenn shunt. The 5-French Berman was removed.,A 6-French Berman was introduced through the right femoral vein sheath and was advanced to the right ventricle. A right ventriculogram was performed using Omnipaque 18 mL at 12 mL per second. The Berman catheter was pulled back to the inferior vena cava, where an inferior vena cavagram was performed using Omnipaque 10 mL at 8 mL per second.,The 4-French pigtail catheter was advanced to the ascending aorta and an ascending aortogram was performed using Omnipaque 16 mL

at 12 mL per second.,Following the ascending angiograms, two kidneys and a bladder were noted. The catheters and sheaths were removed, and hemostasis was obtained by direct pressure. The estimated blood loss was less than 30 mL, and none was replaced. Heparin was administered following placement of all of the sheaths. Pulse oximetry saturation, pulse in the right foot, and EKG were monitored continuously.,II. PRESSURES:,A. Left pulmonary artery, mean of 11; left capillary wedge, mean of 9; main pulmonary artery, mean of 12; right pulmonary artery, mean of 10; descending aorta, 75/45, mean of 57; right atrium, A6 to 9, V6 to 8, mean 7; left atrium, mean 8; inferior vena cava, mean 7.,B. Ascending aorta, 65/35, with a simultaneous right ventricular pressure of 70/10; descending aorta, 60/35, with a right ventricular pressure of 72/10.,C. Pullbacks, left pulmonary artery to main pulmonary artery, mean of 11 to mean of 12; main pulmonary artery to Glenn, mean of 12 to mean of 13; right pulmonary artery to Glenn, mean of 12 to mean of 13; ascending aorta 68/35 to descending aorta 62/35.,INTERPRETATION:, Right and left pulmonary artery pressures are appropriate for this situation. There is a gradient of, at most, 2 mmHg on pullback from both the right and left pulmonary arteries to the Glenn shunt. The left atrial mean pressure is normal. Right ventricular end-diastolic pressure is, at most, slightly elevated. There is a trivial gradient between the right ventricle and ascending aorta consistent with trivial neo-aortic valve stenosis. There is a roughly 10-mm gradient between the right ventricle and

descending aorta, consistent with additional coarctation of the aorta. On pullback from ascending to descending aorta, there is a 6-mmHg gradient between the two. Systemic blood pressure is normal.,III. OXIMETRY:, Superior vena cava 65, right pulmonary artery 67, left pulmonary artery 65, left atrium 96, right atrium 87, inferior vena cava 69, aorta 86, right ventricle 83.,INTERPRETATION:, Systemic arteriovenous oxygenation difference is normal, consistent with a normal cardiac output. Left atrial saturation is fairly normal, consistent with normal oxygenation in the lungs. The saturation falls passing from the left atrium to the right atrium and further to the right ventricle, consistent with mixing of pulmonary venous return and inferior vena cava return, as would be expected in this patient.,IV. SPECIAL PROCEDURE (S):, None done.,V. CALCULATIONS:,Please see the calculation sheet. Calculations were based upon an assumed oxygen consumption. The _____ saturation used was 67%, with a pulmonary artery saturation of 65%, a left atrial saturation of 96%, and an aortic saturation of 86%. Using the above information, the pulmonary to systemic flow ratio was 0.6. Systemic blood flow was 5.1 liters per minute per meter squared. Pulmonary blood flow was 3.2 liters per minute per meter squared. Systemic resistance was 9.8 Wood's units times meter squared, which is mildly diminished. Pulmonary resistance was 2.5 Wood's units times meter squared, which is in the normal range.,VI. ANGIOGRAPHY:, The injection to the Glenn shunt demonstrates a wide-open Glenn connection. The right pulmonary artery is widely patent, without stenosis.

The proximal portion of the left pulmonary artery is significantly narrowed, but does open up near its branch point. The right pulmonary artery measures 6.5, the left pulmonary artery measures 3.0 mm. The aorta at the diaphragm on a later injection was 5.5 mm. There is a small collateral off the innominate vein passing to the left upper lobe. Flow to both upper lobes is diminished versus lower lung fields. There is normal return of the pulmonary veins from the right, with simultaneous filling of the left atrium and right atrium. There is normal return of the left lower pulmonary vein and left upper pulmonary vein. There is some reflux of dye into the inferior vena cava from the right atrium.,The right ventriculogram demonstrates a heavily pedunculated right ventricle with somewhat depressed right ventricular systolic function. The calculated ejection fraction from the LAO projection is only mildly diminished at 59%. There is no significant tricuspid regurgitation. The neo-aortic valve appears to open well with no stenosis. The ascending aorta is dilated. There is mild narrowing of the aorta at the isthmal area. On some projections, there appears to be a partial duplication of the aortic arch, probably secondary to this patient's style of Norwood reconstruction. There is some filling of the right upper and left upper lobes from collateral blood flow, with the left being more opacified than the right.,The inferior vena cavagram demonstrates normal return of the inferior vena cava to the right atrium.,The ascending aortogram demonstrates trivial aortic insufficiency, which is probably catheter-induced. The coronary arteries are poorly seen.

Again, a portion of the aorta appears to be partially duplicated. There is faint opacification of the left upper lung from collateral blood flow. The above-mentioned narrowing of the aortic arch is again noted.