The Parturient with Cardiac Disease

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Maternal Cardiac Disease: a historical perspective

- Mothers with complex congenital heart disease are new to my generation
- Babies with these syndromes are living to adulthood and reproducing
- In 1980 there were approximately 300,000 adults with congenital heart disease in the USA and 1.4 million are anticipated by 2020

More History

- 1950s- Cardiopulmonary bypass and advances in surgery and anesthesia changed the survival of children with complicated heart disease from a few days to decades to normal life expectancy.
- The first of these children are now at the end of their childbearing years.
- They were advised not to attempt childbirth.
- Many did not follow that advice.

Organization

- General considerations
- Evaluation of risk
- Individual lesions
- Specific Obstetrical Concerns

General considerations
"Normal" Signs and Symptoms in Pregnancy

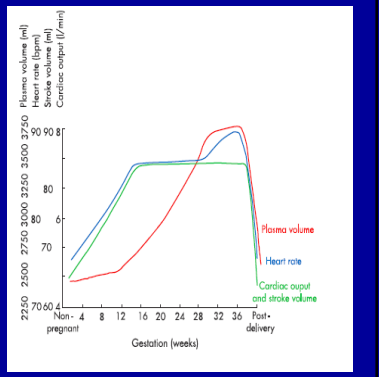
Symptoms
- Dyspnea on exertion
- Dizziness/fatigue
- Palpitations
- Orthopnea
- Edema
- Chest pain

Physical Exam
- Basilar pulmonary crackles
- S3 gallop (> 75%)
- Systolic flow murmur (> 90%)
- JVD
- Edema
- CXR: cardiomegaly, PVC, pericardial effusion
- ECG: LAD or RAD, ST, APCs, VPCs, atrial arrhythmias

Maternal Physiology

- Cardiac Changes
- Cardiac Output- +50%
- Stroke Volume +25%
- Heart Rate +25%
- Ejection Fraction- increased
- SVR -20%

Most changes begin at 5-6 weeks gestation and plateau by 24 weeks.



Thorn SA. Pregnancy in Heart Disease. Heart 2004; 90: 450-456

Evaluation of risk
Who is at risk?

Low Risk (0.1-1%) –

- Most Definitively Repaired Lesions
- Simple Left to Right Shunt
- Mitral Valve Prolapse
- Bicuspid Aortic Valve
- Aortic Regurgitation
- Mitral Regurgitation
- Pulmonary Stenosis (mild/moderate)
- Pulmonary Regurgitation

Cardiac disease in pregnancy. Curr Opin Obstet Gynecol 2002; 14;137-143.

Intermediate Risk (1-5%)

- Artificial Valves
- Single Ventricle (Fontan Physiology)
- Systemic Right Ventricle (Switch Procedure)
- Cyanotic lesions
- Mitral Stenosis
- Aortic Stenosis (mild/moderate)
- Severe pulmonary Stenosis

High Risk (5-30%) –

- NYHA III or IV
- Severe Ventricular Dysfunction
- Severe Aortic Stenosis
- Marfan's Syndrome (with aortic valve lesion - aortic dilatation)
- Pulmonary Hypertension (mortality 30-50%)

Risk Factors

- Prior Cardiac Event
- pulmonary edema,
- arrhythmia (requiring treatment),
- NYHA III/IV,
- cyanosis,
- left heart obstruction,
- left ventricular dysfunction.

- Probability of cardiac morbidity

0 risk factors 5%

1 risk factor 27%

2 risk factors 75%

Prospective multicenter study of pregnancy outcomes in women with heart disease. Circulation 2001;104;515-521.

General Considerations

- Endocarditis- (antibiotic prophylaxis)
- Systemic embolism- Intravenous lines should be free of air bubbles and air should not be used to detect a loss of resistance in the epidural space.
- Good IV access
- Arrhythmia- EKG and pulse oximetry should be considered during active labor.
- Early epidural to reduce catecholamine's and increase in cardiac output associated with labor +100%!

Multidisciplinary team

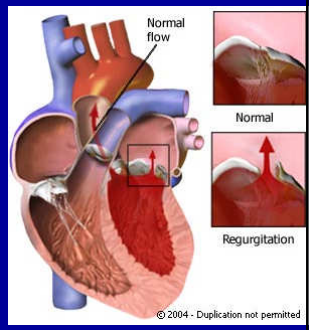
- An obstetrician comfortable with these patients
- Anesthesiologist with familiarity with caring for patients with cardiac disease
- A cardiologist with familiarity with pregnant patients and requirements for labor and delivery
- Nursing skilled with advanced monitoring and use of vasopressors
- Care and consultation should begin prior to parturition.

Individual lesions
Shunt Lesions- small ASD, VSD, PDA

- What do you want to know?
- What is the shunt fraction?
- Small left to right are usually not problematic
- However… hypoxia, hypercarbia, and acidosis will lead to increased PVR which can cause shunt reversal and put patient at risk for systemic embolism.

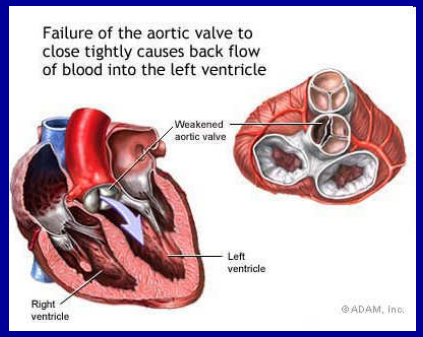
Regurgitant Lesions:
Mitral Insufficiency

- Usually do well because increased blood volume and low SVR reduce fraction of blood that flows backward (shunt fraction).
- Atrial arrhythmia- afib
- Ventricular dilatation and failure from sustained volume overload.
- What do you want to know?
- What is their EF? Arrhythmia?

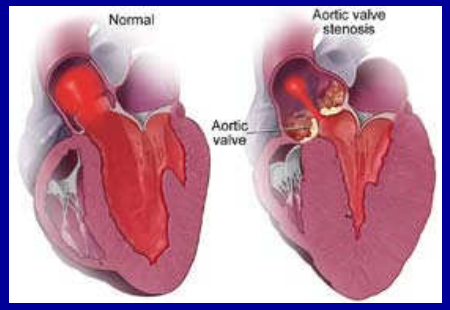


Regurgitant Lesions:
Aortic Insufficiency

- At risk for ventricular failure from chronic volume overload
- Keep full
- Reduce afterload (epidural)
- Is the left ventricle dilated?



Aortic Stenosis

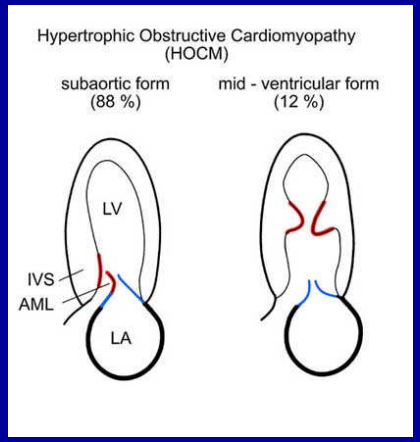


What is the valve area?
Does the patient have syncope, chest pain, or pulmonary edema?

Aortic Stenosis: Goals

- Symptomatic Aortic Stenosis may be one situation when valve replacement/repair during pregnancy is indicated.
- Dyspnea, angina and syncope are severe signs of ischemia.
- Mild/moderate aortic stenosis: reduced or fixed cardiac output.
- Highly dependent on maintenance of SVR.
- May consider arterial line for careful blood pressure control and phenylephrine or norepinephrine prior to loading epidural

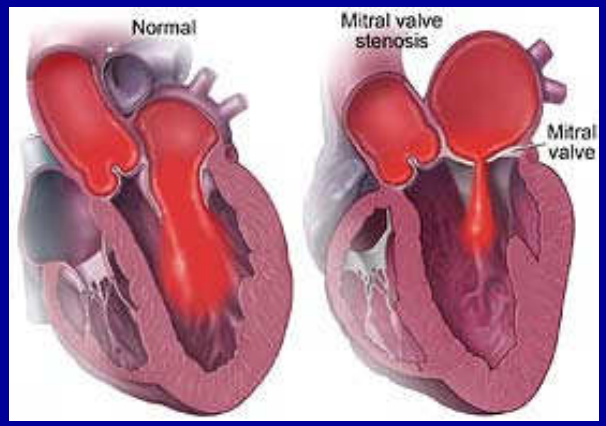
Hypertrophic Cardiomyopathy



HOCM - Goals

- Management similar to aortic stenosis except that obstruction is dynamic and worsens with higher heart rate and cardiac output.
- Limit increases in heart rate- beta blockers, digoxin, carefully loaded epidural
- Monitor for arrhythmia

Mitral Stenosis

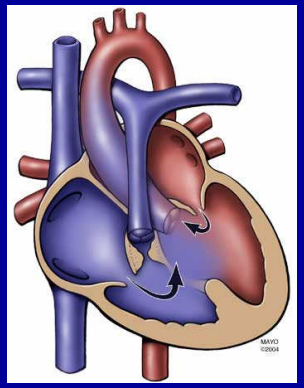


Mitral stenosis goals

- Percutaneous mitral valvuloplasty can be considered during pregnancy for unstable mother.
- Pulmonary edema common in severe lesions from increased blood volume in third trimester.
- Atrial Fibrillation is common and may lead to rapid decompensation.
- Digoxin and beta-blockers are used to control heart rate and diuretics to reduce blood volume and left atrial pressure.
- ? Pulmonary Artery catheter for delivery in severe lesions

Tetralogy of Fallot

- Most common congenital heart syndrome
- VSD,
  RV hypertrophy,
  Overriding aorta,
  Pulmonary stenosis.
- Normally repaired with ventricular septal patch and widening of pulmonary outflow tract

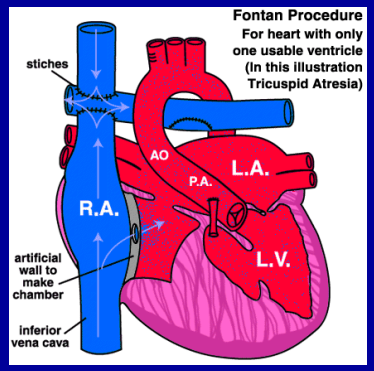


Management of Tetralogy of Fallot

- What do you want to know? How was the lesion repaired? How is the pulmonic outflow tract?
- Asymptomatic patients with successful repairs do well.
- Changes of pregnancy can bring out problems associated with growth after definitive repair.
- VSD can reoccur
- Pulmonary outflow tract can re-stenos (echo in pregnancy)
- High incidence of arrhythmia
- Maintain intravascular volume
- Maintain high right sided filling pressures
- Left Uterine Displacement to maximize venous return

Single Ventricle-Fontan Physiology

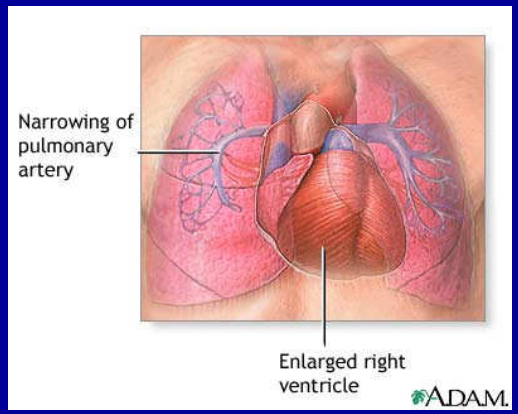
- Single ventricle is made into the pumping chamber.
- All blood flow to lung is passive flow through right atrium and some times artificial chamber.



Fontan- goals

- Usually do well with volume increases of pregnancy.
- What do you want to know? What is EF? History of SVT? Anticoagulation?
- Use of CVP monitoring is controversial because of risk of arrhythmia.
- Very sensitive to sudden decrease in preload because decreases flow to lung and can cause hypoxic vasoconstriction.

Pulmonary Hypertension and Eisenmenger's Syndrome



Primary and Secondary Pulmonary Hypertension

- Eisenmenger's Syndrome-
  Prolonged exposure to left sided pressure and flow through a shunt leads to progressive increase in pulmonary vascular resistance (PVR) and shunt changes from right to left.
- Primary Pulmonary Hypertension
  Increased PVR from vascular hypertrophy of unknown etiology.
  Often presents in 3rd decade
  50% mortality

Pulmonary Hypertension Management

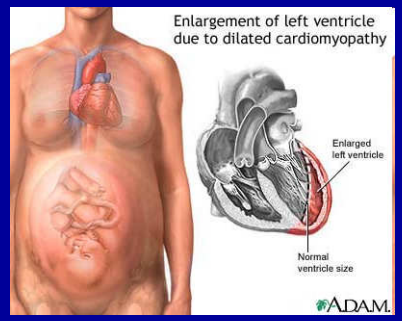
- Pre-delivery right heart catheterization to determine whether the increase in PVR is fixed.
- If not, may be role for nitric oxide, prostacyclin, sildenifil
- Hospitalized in third trimester for oxygen, anticoagulation, and pulmonary vasodilators if indicated.

Pulmonary Hypertension Intrapartum Management

- Keep pulmonary vessels relaxed and maintain right ventricular function
- Oxygen, NO, and prostacyclins
- C-section usually not preferred because of risk of bleeding, infection and postoperative hypoxia.
- Early epidural to limit pain and catecholamine increases (slow administration of local anesthetic with opioid to limit decrease in SVR-vasopressin infusion can be helpful).
- Arterial monitoring
- Central Venous monitoring
- ? Pulmonary Artery Catheter- increased risk of PA rupture, arrhythmia, unclear is information is accurate.

Peripartum Cardiomyopathy

- Affects 1:10,000 pregnancies
- Rule of 1/3- one third will improve, one third will not, one third will get worse
- Most will have 20% decrease in cardiac output in subsequent pregnancies.
- 50% of women who do not recover well have a large decrease in cardiac output in subsequent pregnancies



Ischemic Heart Disease

- Rare- 1/10,000 pregnancies
- ? Will increase with older parturients in their 50s and 60s. We require EKG for women over 50
- Most MI's in pregnancy occur during 3rd trimester, women over 33 years
- Mostly due to vasospasm, thrombus *in situ or coronary dissection*
- Treatment is controversial
- Ischemia does not respond to nitrates and thrombolytic drugs can worsen problem.

Specific Obstetrical Considerations:

- Bleeding
- Oxytocin
- Pulmonary Edema
- Arrhythmia
- Embolism
- Bacterial Endocarditis

Bleeding

- Hemorrhage is the leading cause of maternal death
- Patients with stenotic lesions with fixed cardiac output or Fontan Physiology can not tolerate reduction in volume.
- Patients with pulmonary hypertension can not tolerate decrease in oxygen carrying capacity.
- These patients should be volume resuscitated and transfused early.

Oxytocin

- Oxytocin is a first line drug to prevent post-partum hemorrhage.
- However… oxytocin reduces SVR, mean blood pressure, increase cardiac output and heart rate.
- Consider limiting or omitting oxytocin when cardiac output is fixed and dependent on SVR.

Pulmonary Edema

- Fluid retention in pregnancy
- Fluids given during labor
- Autotransfusion from contracted uterus
- Women with heart disease may have less reserve.
- Mitral stenosis and Fontan high risk for pulmonary edema
- Magnesium increases risk

Arrhythmia

- Increased heart rate by 10-15 bpm is normal in pregnancy
- However, cardiac disease that impairs filling (mitral stenosis) or cardiac output (aortic stenosis, HOCM) are rate sensitive.
- Drugs that may increase rate such as ephedrine and oxytocin should be used carefully.
- Structural lesions in the conduction system predispose to heart block and escape rhythms that may not be well tolerated.
- Cardioversion or pacing may be required.

Embolism

- Very high risk in left-right shunt and pulmonary hypertension, Fontan physiology.
- Atrial fibrillation and artificial valves will be anti-coagulated.
  - Care should be taken in timing of regional anesthesia/analgesia with anticoagulation.
  - An alternative to epidural analgesia may be remifentanil infusion in the setting of anticoagulation.

Bacterial Endocarditis

- All women with structural heart disease are at risk except MVP without regurgitation.
- Prophylaxis is not recommended by AHA for normal vaginal delivery despite documented frequent bacteremia and severe consequences of endocarditis.