MAYO CLINIC

Bloom

Heidi M. Connolly
Advanced Echocardiography 2017

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Echo in pregnancy for patients with CHD

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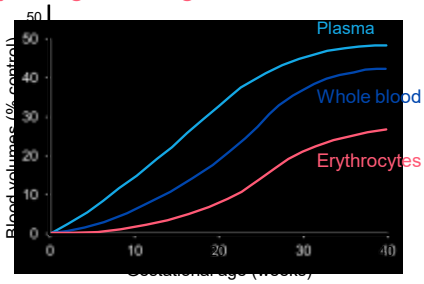
Background

- 2% pregnancies involve maternal CV disease
- CHD is the most common form of HD to affect women of childbearing age
- CV disease does not preclude pregnancy but poses ↑ risk to mother and fetus
- Informed CV evaluation ideal pre-pregnancy

Echo During Pregnancy

- Prepregnancy – establish baseline
- During pregnancy
  - Structure and anatomy
  - Chamber dimension, function, hemodynamics
  - Valve function and vessel dimension
- Strain – no change
- TOE is safe during pregnancy with airway protection
- Agitated saline is generally safe to use during pregnancy
- IV contrast agents have not been studied in pregnancy

Pregnancy
Physiologic Changes



Am J Physiol 1983

Hemodynamic Changes

- >40% ↑ in blood volume
- ↓ in SVR and PVR
- ↑ in HR

} 30% ↑ CO

- Little change in BP

Usually well tolerated

Hemodynamic Changes
Labor and Delivery

- CO ↑ 60-80%
  - HR and BP changes
- Volume changes
  - ↑ blood volume with uterine contraction
  - ↑ venous return
  - Volume loss during delivery

Advise Against Pregnancy

- Severe pulmonary arterial HT
- Severe obstructive lesions
  - AS, MS, PS, HCM, Coarct
- Ventricular dysfunction
  - Class III or IV CHF, EF <40%
  - Prior peripartum cardiomyopathy
- Dilated or unstable aorta
  - Marfan with aorta ≥40-45 mm
- Severe cyanosis

Pregnancy Risk

Regurgitant valve lesions

- Generally well tolerated

Complex lesions

- Assess on case by case basis

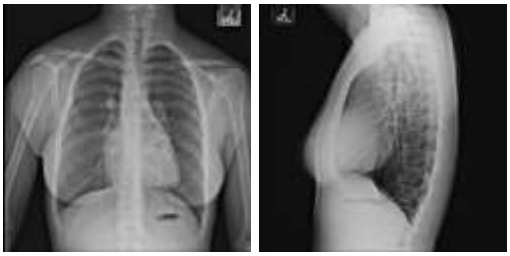
Risk of inheritance

- 3-5% with most CHD
- Genetic disorders

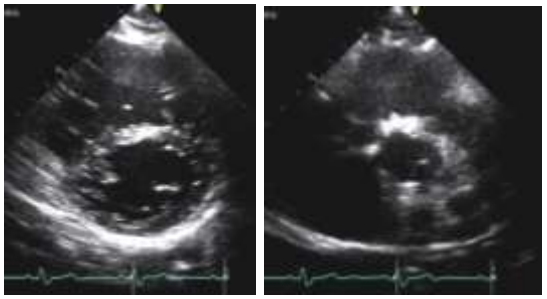
Pre-pregnancy Evaluation

- History, exam, ECG, CXR, med review
- Echo, exercise test, additional imaging
- Cardiac cath – evaluate possible PH
- Genetic considerations

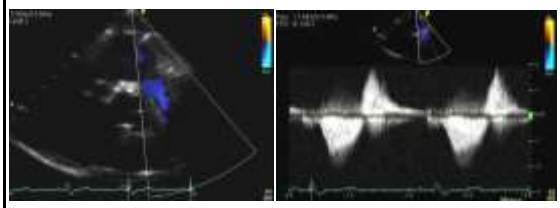
33-Year-Old Female Repaired TOF
Asymptomatic, Wants Pregnancy

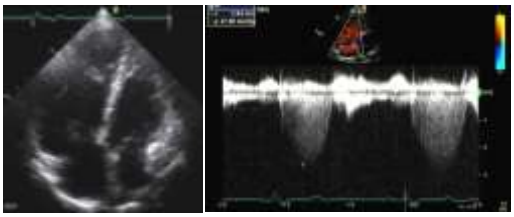


TOF – Prior Repair

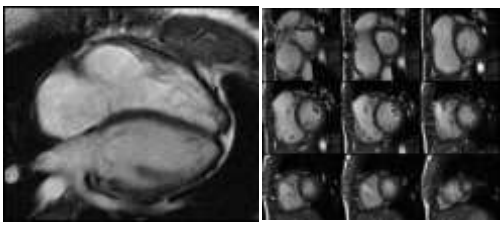


TOF – Prior Repair
What is the problem?





Cardiac MR



RV EF = 46%
Severely dilated RV, end-diastolic volume of 161 mL/m2

Risk Assessment

- CARPREG
  Siu SC et al: Circulation 2001
- ZAHARA
  Drenthen et al: Eur Heart J 2010
- WHO Classification

What would you suggest?

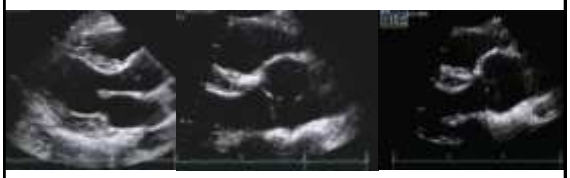
1. Intervention prior to pregnancy
2. OK to proceed with pregnancy
3. Not sure

The patient meets criteria for intervention on the basis or right heart size

Marfan Syndrome

- Unpredictable maternal risk
  - Dissection, rupture, IE, CHF
- Risk based on
  - Preexisting medial changes
  - Changes with pregnancy-Physiologic, hormonal
- Fetal risks - 50% inheritance
  - Autosomal dominant

25-Year-Old Female with Marfan
Pregnancy Counseling



Aortic root = 41 mm

What would you suggest?

1. Operation prior to pregnancy
2. OK to proceed with pregnancy
3. Not sure

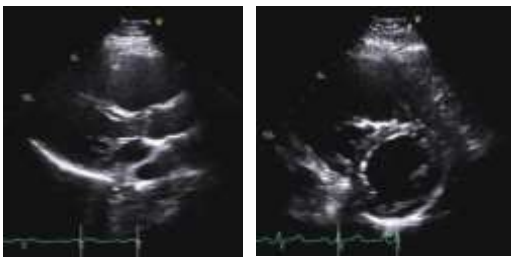
Preconception Counseling

- In addition to routine obstetric screening
  - Detailed CV history, FH, medications and exam
  - Echo – aorta and valves
- Aortic imaging
  - Aorta >45 mm → no pregnancy
  - Aorta ≤40 mm → reasonable if low risk
  - Aorta 40-45 mm → individualize
- Genetics, prenatal diagnosis

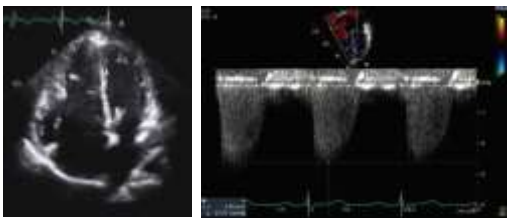
Pregnancy Management

- During pregnancy
  - Beta-blocker
  - Regular aortic imaging (individualize), fetal echo
- Peripartum
  - Facilitated vaginal delivery
  - C-section for aorta >40 mm or increasing size
  - Endocarditis prophylaxis
- Postpartum
  - FU - dissection risk persists
  - Future evaluation of lactation risk
- Similar for other aortic disorders

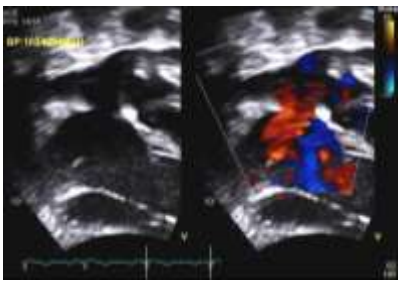
35-Year Old Female with Murmur
Asymptomatic – 18 Weeks Pregnant



35-Year Old Female with Murmur
Asymptomatic – 18 Weeks Pregnant



35-Year Old Female with Murmur
Asymptomatic – 18 Weeks Pregnant



What would you suggest?

1. OK to continue pregnancy
2. Need more information
3. Not sure

Evaluation During Pregnancy

- History, exam, ECG, CXR, med review
- Echo, additional imaging, rare exercise test
- Cardiac cath (rare) – evaluate possible PH
- Genetic considerations
- Follow-up frequency depends on type of CHD

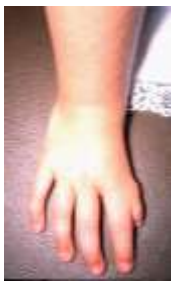
Management of shunt lesions in pregnancy

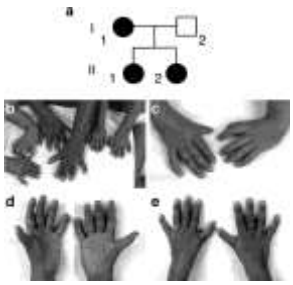
ASD and Pregnancy

- Unrepaired ASD
  - ↑ neonatal risk
  - ↑ pre-eclampsia risk, SGA births
  - ↑ fetal mortality
- L to R shunt may ↑ with CO change during pregnancy, counterbalanced by ↓ PVR
- Paradoxical embolism risk
- Familial types – consider screening

Warnes et al: JACC 2008

ASD – Familial





Holt-Oram Syndrome
Familial ASD with AV conduction defect

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Congenital Valve and Stenotic Lesions

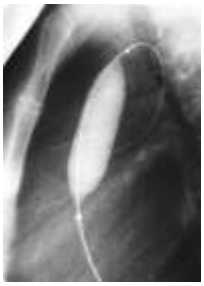
29-Year-Old Female, 10 Weeks Pregnant

Murmur, Dyspnea

Peak gradient 88 mmHg
Mean gradient 51 mmHg

Pulmonic Stenosis

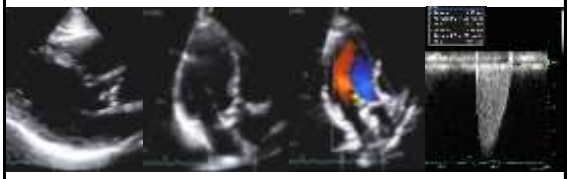
- Pregnancy tolerated unless severe
- No maternal CV events >100 preg
- Outcome
  - Preterm delivery 14.5%
  - Fetal mortality 0.8%
  - Perinatal mortality 4%
  - Recurrent CHD 3%, Noonan
- Percutaneous valvotomy option



Drenthen et al: JACC 2007

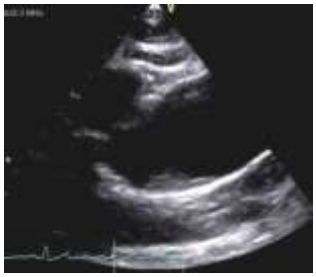
Aortic Stenosis

22-Year Old Female Dyspnea and Murmur
Positive Pregnancy Test



MG 40 mmHg

One More Thing…
Mid-ascending Aorta 46 mm



Aortic Stenosis
Pregnant Patient

Unable to augment CO

Preload and hypotension sensitive

CHF and ischemia

↓ placental perfusion
IUGR, preterm labor

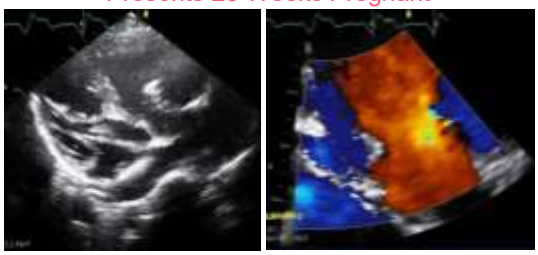
What would you suggest?

1. Operation during pregnancy
2. Monitor during pregnancy
3. Not sure

15 weeks pregnant – treated anemia, monitored closely
AS and aorta stable – tolerated pregnancy well

Complex CHD

42-Year-Old Female Complex CHD
PPM/PFO Closure 3 Years Ago
Presents 20 Weeks Pregnant



Now with atrial flutter and dyspnea

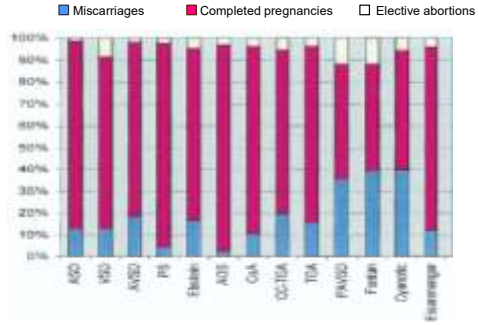
Patient Course

- Anticoagulation with LMWH
- Close OB and CV follow-up
- Heart failure near term
  - Uncomplicated delivery
  - Diuresis
- Transitioned to warfarin post-partum

Complex CHD

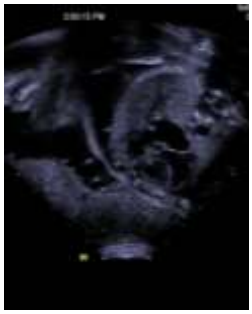
- All patients require
  - Specialized CV consultation prior to pregnancy
  - Close follow-up during pregnancy
- Uncertainty regarding
  - Pregnancy outcome
  - Effect of CHD on mother and fetus

Pregnancy Outcomes



Drenthen et al: JACC 2007

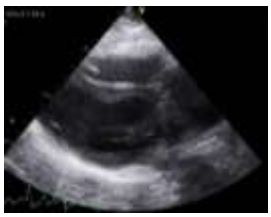
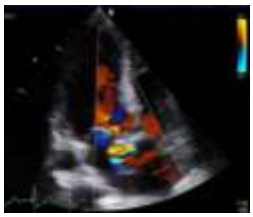
Fetal Echo



Postpartum Care

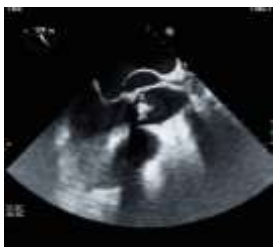
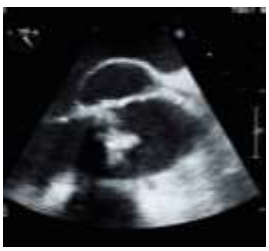
33-Year-Old with BAV and Aortopathy
Prior AVR and Aorta Replacement
Preterm Labor at 32 Weeks

33-Year-Old with BAV and Aortopathy
Prior AVR and Aorta Replacement
Preterm Labor at 32 Weeks

What next?

33-Year-Old – Preterm Labor at 32 Weeks
BAV with Aortopathy – Prior AVR and Aorta

Summary

- CVD 1-2% of all pregnancies
  - CHD most common
- ↑ risk to mother and fetus
- Individual assessment
- Multidisciplinary care
- Echo is mainstay in CV evaluation and FU

Questions and Discussion

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Valve Surgery May be Required During Pregnancy

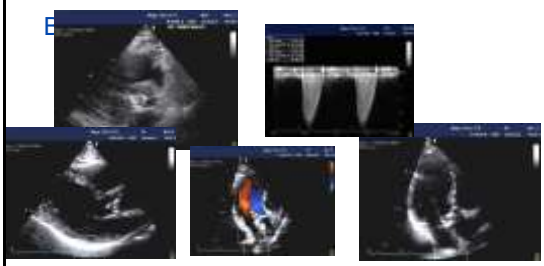
Endocarditis Prophylaxis

- Follow AHA guidelines
  - IE prophylaxis generally not required during uncomplicated delivery
- Not required
  - Isolated ASD
  - 6 months after PDA or VSD closure
- Reasonable in high-risk patients
  - Marfan, cyanotic/complex CHD, valve prosthesis

CV Surgery During Pregnancy

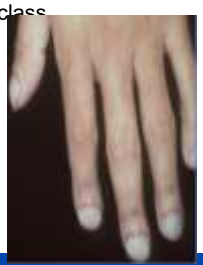
- 21 CV operations during pregnancy (1976 – 2009)
  - Mortality - 3% maternal, 19% fetal
  - Fetal prematurity and death associated with urgent, high-risk surgery, maternal comorbidity, and early GA
  - Emergent surgery confers higher risk of maternal death
- If intervention required
  - 24-28 weeks best
  - Monitor fetus
  - High flow CPB; MAP >60 mm Hg; maintain normothermia
- CT surgery can be performed with relative safety

John et al: Ann Thorac Surg 2011



Cyanotic CHD

- 44 patients - 96 pregnancies
- Adverse fetal outcome associated with ↑ Hb, ↓ O2, type of CHD, functional class
- Fetal outcomes
  - ↑ fetal loss (57%)
  - ↑ Premature birth (37%)
  - ↑ LBW infants
  - ↑ CHD in offspring (5%)
- Maternal outcomes
  - 32% pt CV complications
  - 1 death from endocarditis



Presbitero et al: Circulation 1994

0_2 Saturation and Outcome

Adverse fetal outcomes associated with ↓ O_2

O2 sat (%)	≤85	85-89	≥90
Pregnancies (number)	17	22	13
Live Born (number)	2	10	12
Live Born %	**12**	**45**	**92**

Presbitero et al: Circulation 1994

Outline

- Intro regarding pregnancy
  - Normal echo findings
- Pre-pregnancy screening
  - TOF
  - Marfan
- Management during pregnacy
  - ASD
  - AS/PS
  - Complex CHD
  - Fetal echo