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Cardiac Disease in Pregnancy

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Cardiac Disease in Pregnancy:

MYTHBUSTERS!



Goals and Objectives

- Review normal cardiovascular physiology in pregnancy
- Dispel myths and review guidelines about cardiac disease in pregnancy
- Learn the levels of referral, surveillance, and risk stratification for cardiac disease in pregnancy
- Aortopathies in Pregnancy



“The Birth of Christ” by
Paul Gauguin (1848-1903)



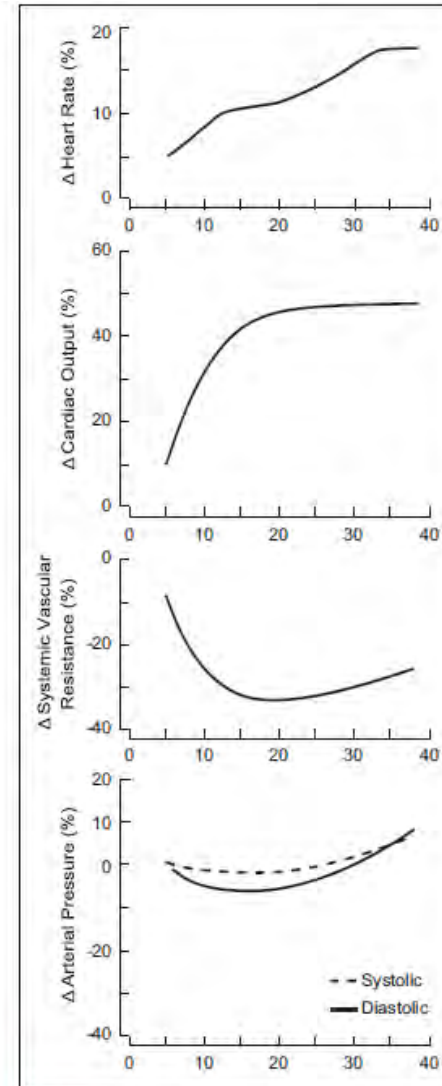
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Hemodynamic Profiles for Nonpregnant & Pregnant Patients in the 3rd Trimester

	Nonpregnant	Pregnant	Change
CO (L/min)	4.3 ± 0.9	6.2 ± 1.0	+43%
HR (beats/min)	71 ± 10	83 ± 10	+17%
SVR (dyne-sec-cm ⁻⁵)	1530 ± 520	1210 ± 266	-21%
PVR (dyne-sec-cm ⁻⁵)	119 ± 47	78 ± 22	-34%
CVP (mm Hg)	3.7 ± 2.6	3.6 ± 2.5	NS
COP (mm Hg)	20.8 ± 1.0	18.0 ± 1.5	-14%
PCWP (mm Hg)	6.3 ± 2.1	7.5 ± 1.8	NS
COP-PCWP (mm Hg)	14.5 ± 2.5	10.5 ± 2.7	-28%

Normal CV Hemodynamics in Pregnancy



On to the...

MYTHBUSTERS!



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Myth

- Ischemic heart disease is the most common form of cardiovascular disease in pregnant women...

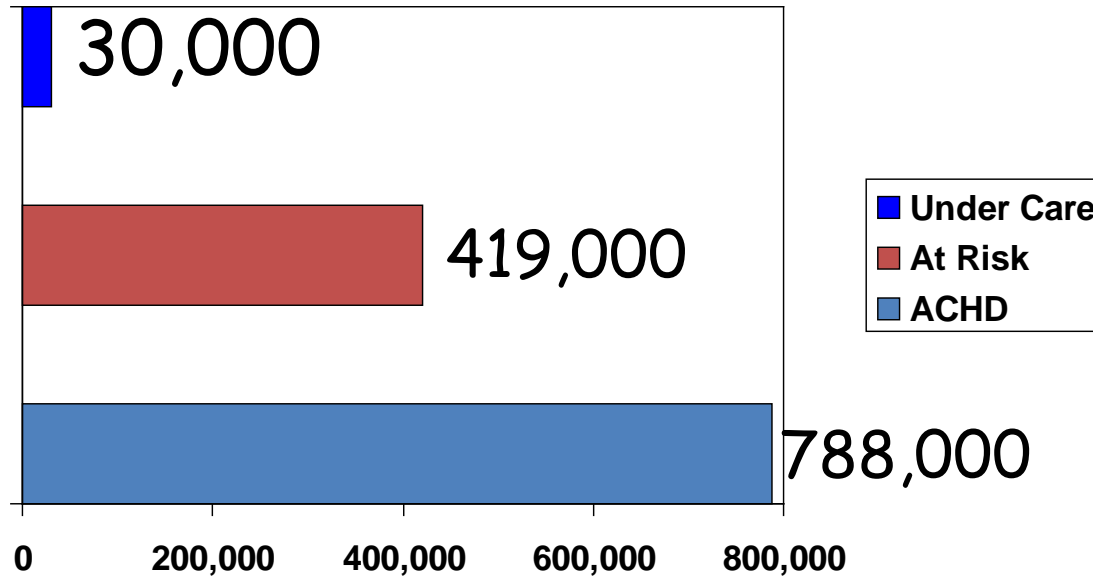
FALSE!



Epidemiology

- 0.2-4% Western world pregnancies complicated by cardiovascular disease
 - ~7% w/ hypertensive disorders (events)
- ~80% of CV disease is **congenital disease**
 - ~40% shunt lesions
 - ~15% of non-Western CV disease is CHD
- ~75% of non-Western CV disease is **rheumatic**

Adult Congenital Heart Disease (ACHD) Patients in the US



*In 2017: Estimates show > 1.3 Million ACHD pts
And.. Adult CHD pts > Ped CHD pts*

Myth

- Mechanical heart valves are not a big deal...

FALSE!



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Mechanical Heart Valves

- Prosthetic valves: high risk of thrombo-embolism
 - Caution: older MVR or prior thrombus
- Decision about anticoagulant management → risk assessment
 - Valve type
 - Position
 - History of thrombo-embolism
- Patient preference

Table 4 Multivariable model for the composite endpoints of cardiac and neonatal complications corrected for maternal age and parity

	Odds ratio (95% CI)	P-value
Cardiac complications		
History of arrhythmias	4.3 (1.8–10.2)	0.0011
Other cardiac medication before pregnancy	4.2 (2.1–8.6)	<0.0001
NYHA functional class	2.2 (1.1–4.5)	0.0298
LHO (PG >50 mmHg or AVA <1.0 cm ²)	12.9 (3.9–42.3)	<0.0001
Syst. AV valve regurgitation (moderate/severe)	2.0 (1.0–4.0)	0.0427
Pulm AV valve regurgitation (moderate/severe)	2.3 (1.1–5.0)	0.0287
Mechanical valve prosthesis	74.7 (5.3–1057)	0.0014
Cyanotic heart disease (corrected and uncorrected)	3.0 (1.7–5.0)	<0.0001
Neonatal complications		
Twin or multiple gestation	5.4 (1.9–15.2)	0.0014
Smoking during pregnancy	1.7 (1.2–2.4)	0.0070
Cyanotic heart disease (corrected and uncorrected)	2.0 (1.4–2.9)	0.0003
Mechanical valve prosthesis	13.9 (1.2–157)	0.0331
Other cardiac medication before pregnancy	2.2 (1.4–3.5)	0.0009

AV, atrioventricular; AVA, aortic valve area; LHO, left heart obstruction; NYHA, New York Heart Association; PG, peak gradient; Pulm, pulmonary; Syst, systemic.

Bates SM et al. *Chest* 2008;133:844-86.

Drenthen W et al. *Eur Heart J* 2010; 31:2124 (ZAHARA)

Mechanical Valve Anticoagulation Options

1. LMWH BID throughout pregnancy
 - *Check anti-Xa LMWH 4 hrs after sub-Q injection
 - 4-9% thrombosis
2. UFH throughout pregnancy SQ Q12 h
 - *PTT 50-70 or anti-Xa heparin 0.35-0.70 U/ml
 - 33% thrombosis, 15% mortality
3. UFH or LMWH (as above) until week 13, then warfarin until week 35, then UFH or LMWH until delivery
 - *Addition of low-dose aspirin (75-100 mg/d)
 - 9% thrombosis, 4% mortality

Oral anticoagulants

➤ Warfarin

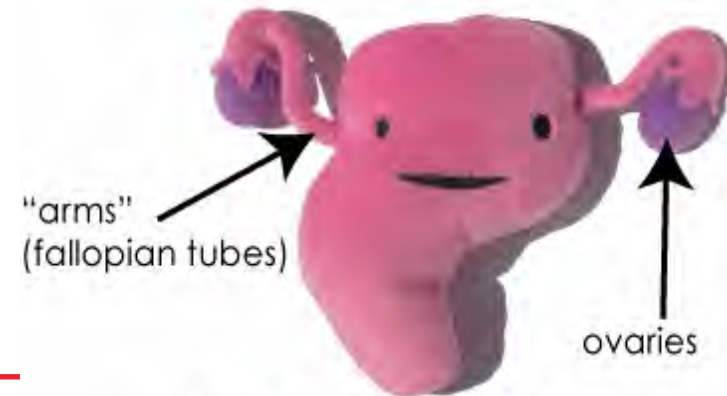
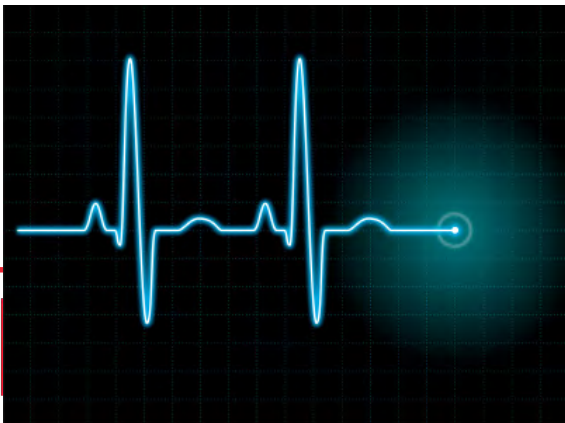
- Preg class X/D (6-12 wk embryogenesis)
 - Preferred 2nd/3rd trimester (I-C)
- Maternal 4% valve thrombosis, 2% mortality
- Obstetric 0.6-10% embryopathy (IIa-C, 1st tri)
 - Warfarin < 5 mg (2.6%) = OK!, >5 mg (8%) IIb-C
- Hospitalize for regimen changes (I-C)
- Delivery on Oral Anti-Coag → C-section (I-C)

➤ N/DOACs: Dabigatran/rivaroxaban--not recommended

Myth

- Beta-blockers for arrhythmias and heart failure inhibit uterine contractions during vaginal delivery...

FALSE!



Small part choking hazard
The ovaries may be pulled off and become a choking hazard.
Keep away from children.

Arrhythmias in Pregnancy: General Principles

- PVCs & PACs are common
- Direct current cardioversion (DCCV) is safe
- Pharmacologic management usually not altered
- Medications may require dosage adjustments because of increased plasma volume, decreased protein binding, & increased renal excretion
- Telemetry during labor

Supraventricular Tachycardia

- Acute episodes
 - Vagal maneuvers → Adenosine (I-C)
 - Fetal monitoring after 24 weeks due to reports of fetal bradycardia
- Frequent, symptomatic episodes
 - β -blockers (I-C, not atenolol III-C)
 - Digoxin (IIa-C), sotalol, flecainide
 - Calcium channel blockers (IIb-C)
- Atrial Fibrillation/Atrial Flutter
 - Look for underlying condition (thyroid)
 - Consider anti-coagulation

Ventricular Tachycardia

- Usually in setting of structural heart disease
- Hemodynamically stable
 - Direct current cardioversion (I-C)
 - Lidocaine, Sotalol, Procainamide (IIa-C)
- Hemodynamically unstable
 - Direct current cardioversion (I-C)
 - β -blockers to suppress recurrence (I-C)
 - **Avoid amiodarone** (class D, **dronedarone** class X) IIa-C
 - Catheter ablation (IIb-C)

Myth

- SBE prophylactic antibiotics are mandatory in congenital heart disease for vaginal delivery or caesarian section...

FALSE!

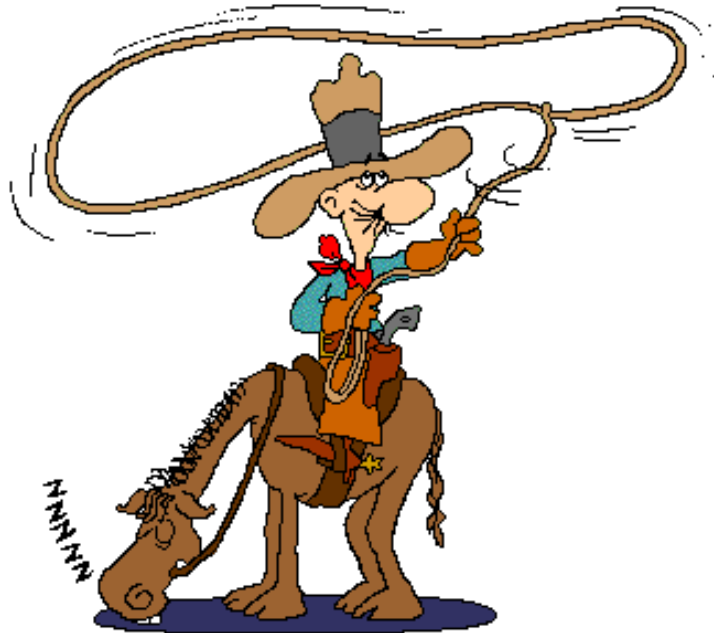




SBE prophylaxis

- Endocarditis is rare: 1/100,000
- Same as non-pregnant state (III-C)
- High risk lesion
 - Prior endocarditis, OHT valvulopathy, prosthetic valve, cyanotic heart disease, repaired x 6 months or residual shunt p repair
- PLUS high risk procedure (ie. dental)
 - Not vaginal, c-section since 1997 guidelines
 - Nor IUD placement or removal

On to CV Genetics in Pregnancy



Myth

- ~~Most congenital heart disease patients should NOT get pregnant!~~

FALSE!



AHA SCIENTIFIC STATEMENT

Management of Pregnancy in Patients With Complex Congenital Heart Disease

A Scientific Statement for Healthcare Professionals From the American Heart Association

ABSTRACT: Today, most female children born with congenital heart disease will reach childbearing age. For many women with complex congenital heart disease, carrying a pregnancy carries a moderate to high risk for both the mother and her fetus. Many such women, however,

Mary M. Canobbio, RN,
MN, FAHA, Chair
Carole A. Warnes, MD,
FRCP, Co-Chair

Pregnancy: Contraindications

- Pulmonary HTN~25-50% maternal mortality
- Severe ventricular dysfunction
 - LVEF <30%, NYHA III/IV sx; residual Peri-partum CMP
- Severe Left Heart Obstruction
 - Symptomatic AS, MS, Coarctation
- Dilated Aortic Root
 - Marfan (aortopathy) AscAo/Root > 4.5 cm (caution: 4cm)
 - BAV (Bicusp Ao Valve) with Asc Ao >5 mm (27/m²)
- * Cyanotic heart disease: 85/90 Rule

Table 6 Modified WHO classification of maternal cardiovascular risk: principles

Risk class	Risk of pregnancy by medical condition
I	No detectable increased risk of maternal mortality and no/mild increase in morbidity.
II	Small increased risk of maternal mortality or moderate increase in morbidity.
III	Significantly increased risk of maternal mortality or severe morbidity. Expert counselling required. If pregnancy is decided upon, intensive specialist cardiac and obstetric monitoring needed throughout pregnancy, childbirth, and the puerperium.
IV	Extremely high risk of maternal mortality or severe morbidity; pregnancy contraindicated. If pregnancy occurs termination should be discussed. If pregnancy continues, care as for class III.

Modified from Thorne et al.⁷²
 WHO = World Health Organization

Conditions in which pregnancy risk is WHO IV (pregnancy contraindicated)

Pulmonary arterial hypertension of any cause
Severe systemic ventricular dysfunction (LVEF <30%, NYHA III-IV)
Previous peripartum cardiomyopathy with any residual impairment of left ventricular function
Severe mitral stenosis, severe symptomatic aortic stenosis
Marfan syndrome with aorta dilated ≥ 45 mm Aortic dilatation ≥ 50 mm in aortic disease associated with bicuspid aortic valve
Native severe coarctation

Adapted from Thorne et al.⁷²
 LVEF = left ventricular ejection fraction; NYHA = New York Heart Association;
 WHO = World Health Organization.

CASE: AORTOPATHY IN PREGNANCY

Marfan Syndrome in Pregnancy:

25 y/o G2P1 Marfan Syn with Aortic Root of 4.3 cm.

Plan: C-section on ***Thursday***

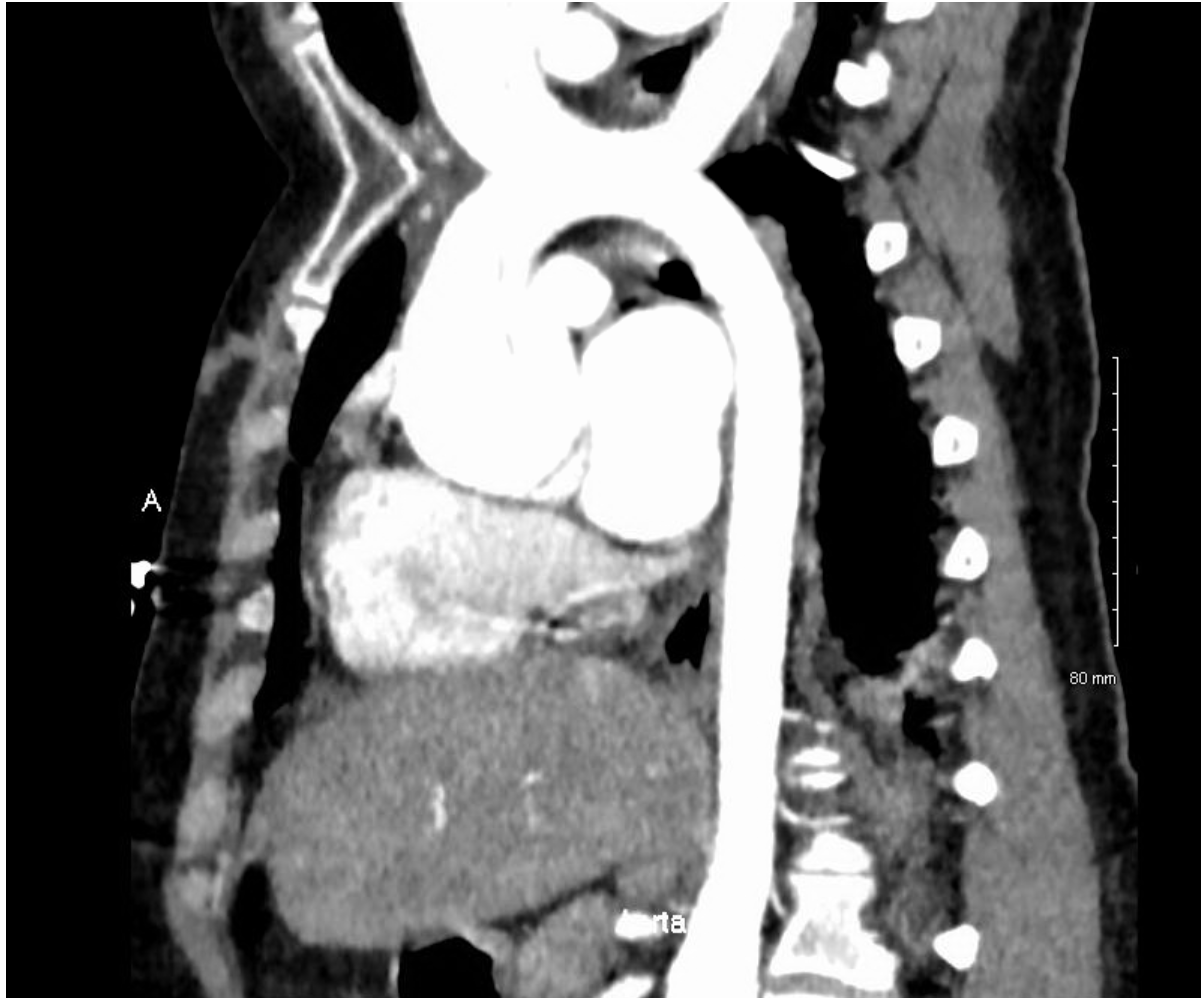
Transfer to ICU after C-section

Hosp Course:

C-section went well on Thu, then transferred to ICU

PartumDay #2 (***Saturday***): Chest Pain & ST Elevation

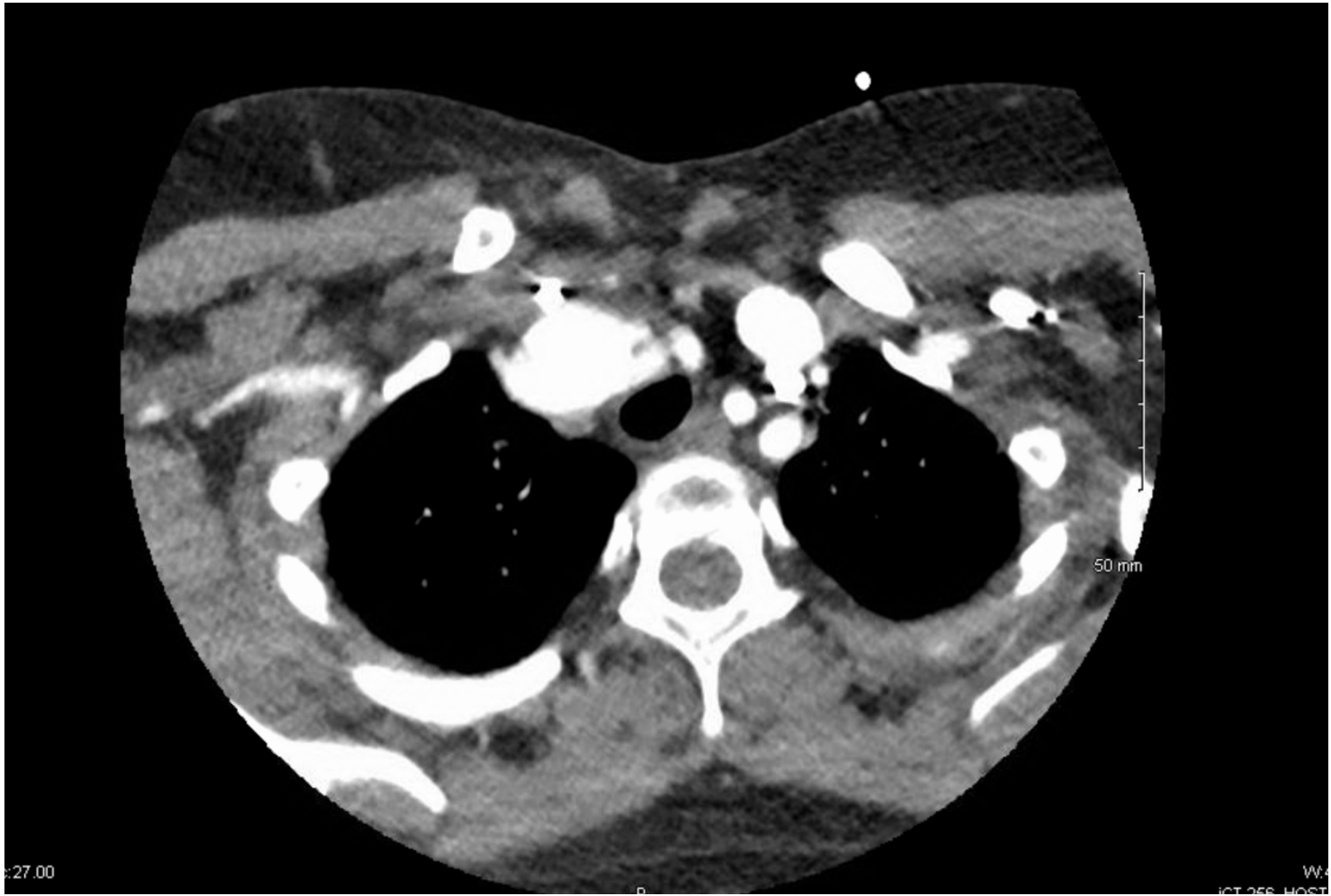
Stat Chest CT showed Acute Asc Ao Dissection



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Antegrade cerebral perfusion: 3+

- ① Sinus node
- ② Left common carotid

Lawesing
LLE

Complications: low / Drains: x / 100

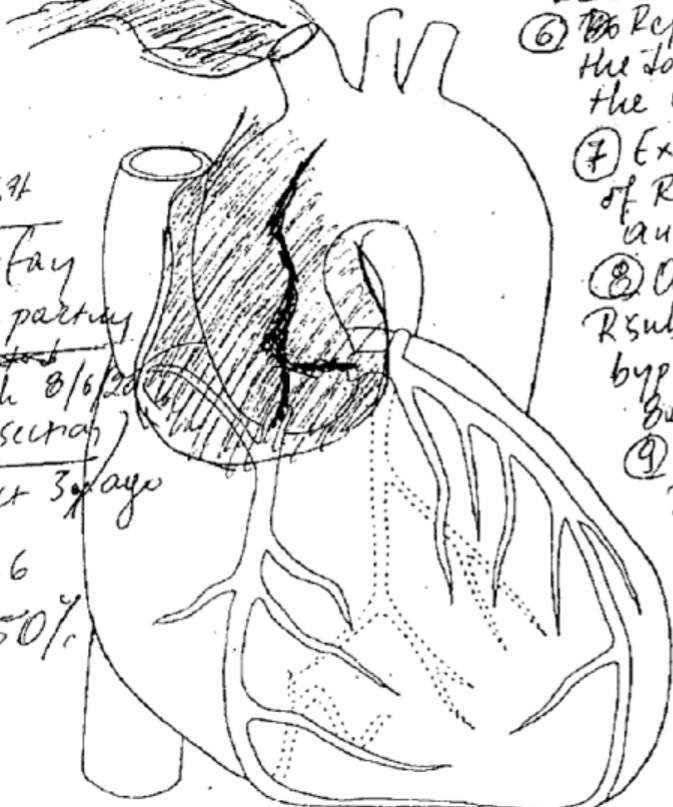
Specimens: AV leaflets - 1 L pleural
Aortic wall

Cc

PHIIPSA

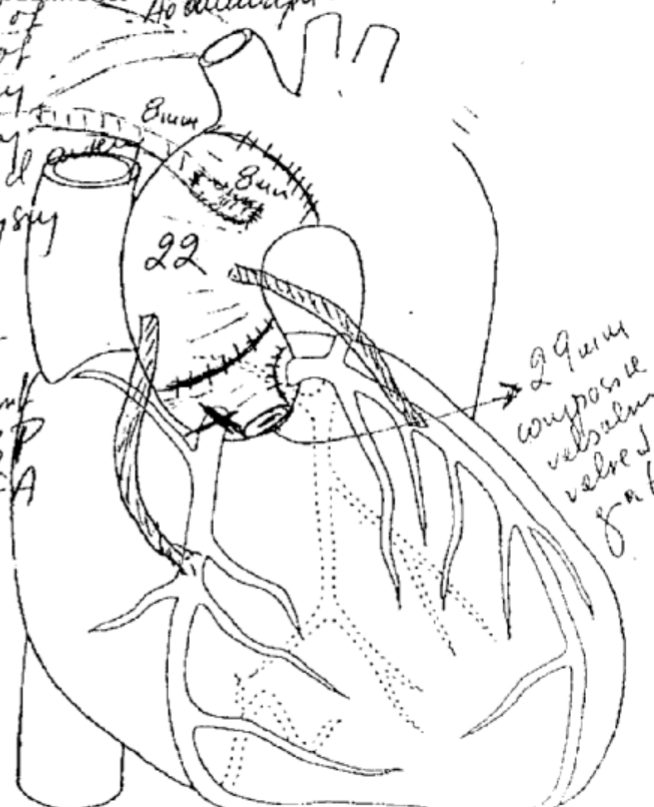
- Max Fay
- post partum
- birth 8/6/20
- C-section
- C-section 3 days ago

CR = 0,6
EF = 50%



PREOPERATIVE DIAGNOSIS AND OPERATIVE FINDINGS

- ⑥ Repair of the base of the aorta
- ⑦ Excision of R subcl aneurysm
- ⑧ Aorta R subcl bypass
- ⑨ IABP R CFA



PROCEDURE DESCRIPTION



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Aortopathies in Pregnancy, I

- Marfan Syndrome (MFS)
 - (1:5,000-10,000; AD)
 - *Ao Aneurysm/Dissection*
 - MVP, BAV, PFO, ASD, VSD
 - Genetic testing
 - Sens > 90% for MFS and Loeys-Dietz Syn (LDS)
 - Sens > 16-20% for isolated Thor Ao – Ao Dissection
 - De Novo: 25% MFS, and 33% LDS

Aortopathies in Pregnancy, II

- Ehlers-Danlos Syndrome (EDS)
 - Classic EDS (1:20,000; AD)
 - MVP, TVP, Ao Aneurysm
 - Genetic testing: sens – 50%
 - Vascular EDS (1:200,000; AD)
 - MVP, Ao Dissection
 - Genetic testing: sens – 95%
 - Cardiac Valvular EDS (rare; AR)
 - Genetic testing: unknown

Loeys-Dietz Syndrome (LDS) in Pregnancy

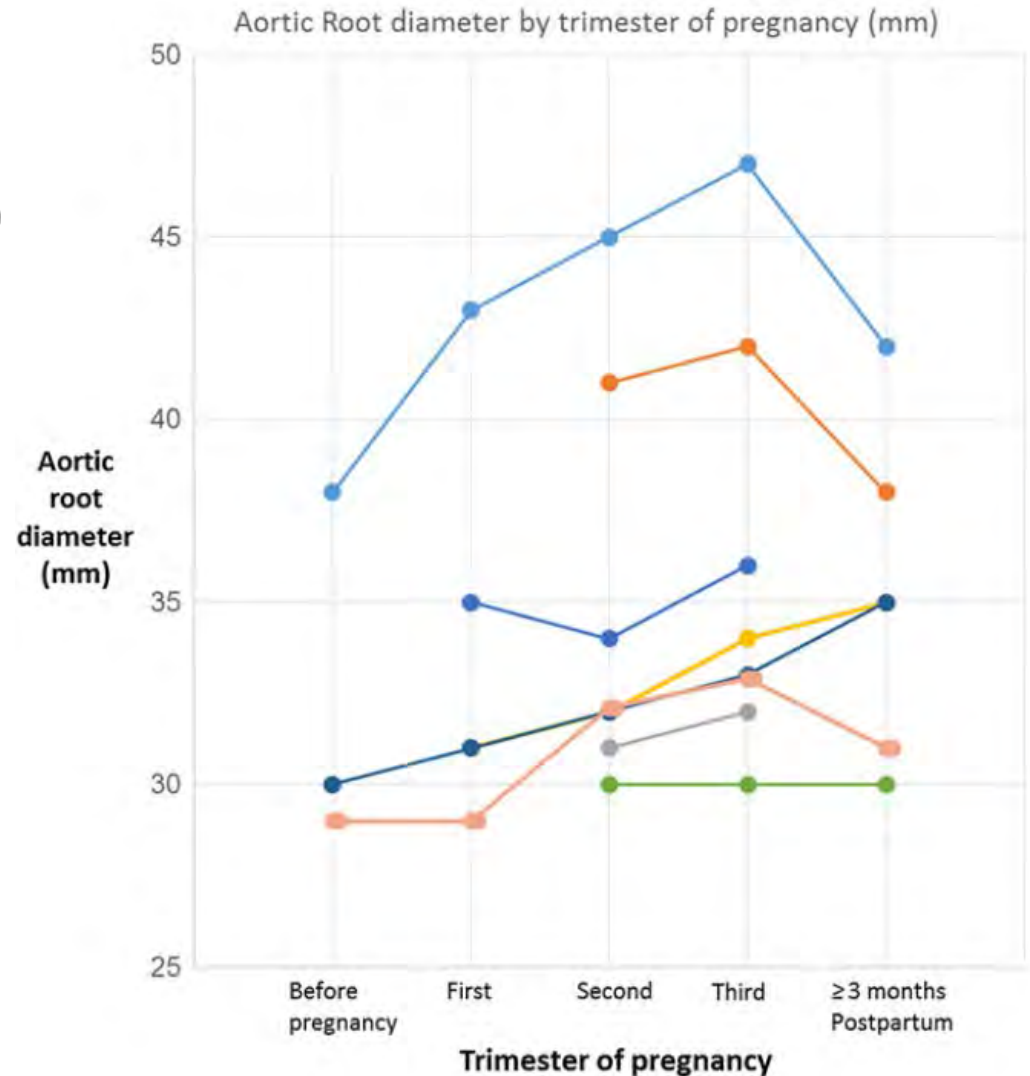
-20 preg

-13 pts

Results:

No dissections

No Ao Surgery



Aortopathy in Pregnancy – Management Pearls

- **Imaging**
 - Echo Q Trimester (Note: weeks 28-32 are key)
- **ECG** – at least once (SR, LVH, and screening)
- **Medical Tx**
 - Beta-blockers
 - Atenolol
 - Best studied, but IUGR noted
 - Metop Succinate (ER/XL) or Bisop or Labetalol

Aortopathy in Pregnancy: Delivery Strategy

- Multi-Disciplinary Approach!
 - ACHD/Adult CD, MFM, OB Anesth, CV Surgery
- ***Ao Aneurysm > 4 cm → Ao Dissection***
 - Indication for C-Section (on Mon-Wed)
 - If Ao < 4 cm, then controlled, 2nd stage assist
- Post-partum
 - ICU stay at least 48h
 - Cardiac telemetry

Contraception Issues

- **Barrier** → unreliable (III-C as monotherapy)
 - OCP may be contraindicated
 - **Low dose estrogen** if low thrombotic potential
 - Medroxyprogesterone → fluid retention (CHF)
 - **IUD's** increased risk of bacterial endocarditis
 - Levonorgestrel – safest, effective CCHD/PHTN
 - Copper – acyanotic or mildly cyanotic
 - **Permanent sterilization:** a risk of the anesthetic
 - BTL (*Essure**** now out per FDA)

Myth

- Most congenital heart disease should deliver in tertiary care and should not deliver vaginally! Don't PUSH it!

FALSE!



Vaginal Delivery (I-C)

- Less bleeding, infxn, thrombosis
- Less expensive
- With severe HTN, epidural and elective instrument (IIa-C)
- Consider CV anesthesia
- Consider C/S for:
 - AAO>45 mm, severe AS, severe CHF, Eisenmenger (IIa-C)
 - Preterm labor on oral anticoagulant (IIa-C), dissection
 - Marfan's with AAO 40-45 mm (IIb-C)



- <70% workload
- Drop in BP
- Drop in Sats



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U.S. News

& WORLD REPORT
**CARDIOLOGY &
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THANK YOU!



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