Obstetric Complications:
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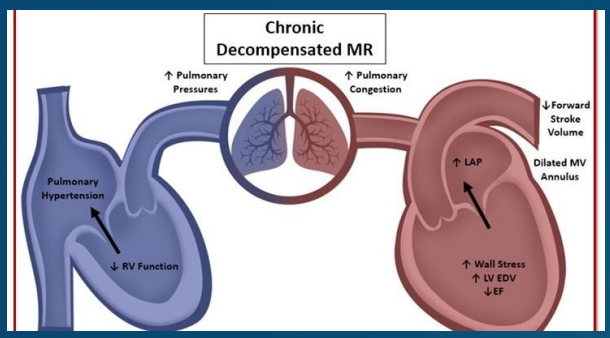

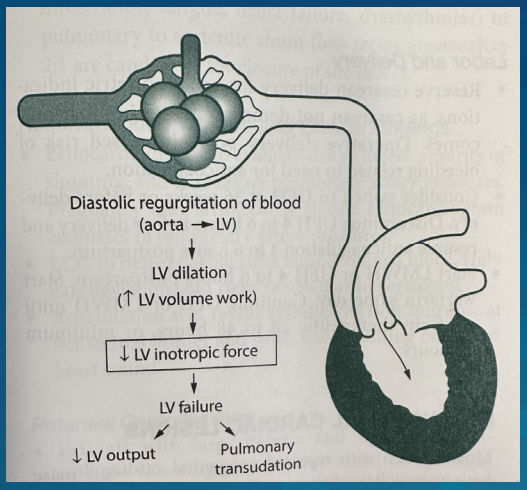

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REGURGITANT LESIONS

- Mitral regurgitation
  - Causes: mitral valve prolapse, rheumatic heart disease
  - Rare risks: pulmonary edema, arrhythmia (Afib)
- Aortic regurgitation
  - Causes: bicuspid aortic valve, aortopathy with annular dilation
- Severe symptomatic MR/AR or LV dysfunction = 20-25% risk of HF in pregnancy
- Fetal risk is low
- Considerations:
  - Volume – maintain euvolemia (pulmonary edema is rare)
  - Pressure – avoid increased BP (increases regurgitation)
  - Rate – avoid bradycardia (increases regurgitation)
  - Rhythm – avoid arrhythmia, treat immediately
- Echocardiogram in 3rd trimester at peak volume, baseline ECG (LA enlargement), rhythm monitor if symptoms
- Vaginal delivery preferred

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MITRAL STENOSIS

- Definition: thickening & immobility of the mitral valve; normal MV area 4-6 cm^2
  - Symptoms typically if MVA <2 cm^2, "severe" if MVA <1.5 cm^2, "critical" if <1 cm^2
  - Mean gradient <5 mmHg mild, 5-10 mmHg moderate, >10 mmHg severe
- Incidence: 1:100,000 in the USA (total population)
  - Most common valvular lesion, 2/3 are women
  - Typically due to rheumatic heart disease (S. pyogenes infection)
- Presenting symptoms: dyspnea, palpitations, CP, fatigue, murmur, cough
  - Differential dx: PE, preeclampsia, acute arrhythmia, cardiomyopathy, pulmonary disease
  - Principle features: LA & RV enlargement, diastolic murmur, pulmonary HTN
- Most common complications: pulmonary edema, hypoxia, arrhythmias (Afib, SVT)

MITRAL STENOSIS

- Hemodynamic changes of pregnancy --> symptoms in previously asymptomatic individuals
  - Increased volume, HR, CO --> increased LA pressure
  - 50% of severe MS (valve area <1.5cm^2) will get severe pulmonary edema
- Valve considerations
  - Volume – avoid hypervolemia (pulmonary edema, Afib, RV failure)
  - Pressure – avoid hypotension (preload dependent, decreases cardiac output)
  - Rate – avoid tachycardia (decreased filling time, fixed cardiac output)

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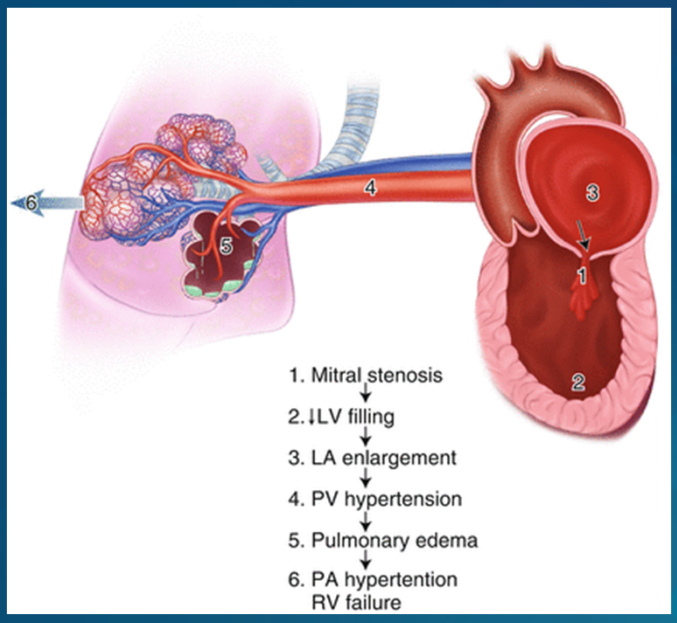

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MITRAL STENOSIS – PREGNANCY MANAGEMENT

- Activity restriction (if severe & symptomatic), salt restriction, diuretics
- Echocardiogram Qtrimester
- Rate control is paramount for all MS patients
  - Beta blockade
  - If Afib - consider anticoagulation
- Severe symptomatic MS – balloon valvuloplasty after 1st TM
- Delivery:
  - Vaginal delivery often preferred --> assisted 2nd stage for moderate/severe MS
  - Maternal mortality is greatest during labor & immediate postpartum --> autotransfusion & sudden increase in preload leads to pulmonary edema

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AORTIC STENOSIS

- Definition: thickening & immobility of the aortic valve; normal AV area 3-4 cm^2
  - "Mild" if AVA >1.5 cm^2, "Moderate" if AVA 1.0-1.5 cm^2, "Severe" if AVA <1 cm^2
  - Can also determine severity by mean pressure gradient
- Incidence:
  - Bicuspid aortic valve = most common etiology
  - For bicuspid valve --> fetal echocardiogram, TTE screen for 1st degree relatives, evaluation of the aorta due to associated aortopathy
- Presenting symptoms: Exercise-induced SOB, CP, dizziness, syncope
- Most common complications: Heart failure, atrial arrhythmia, pulmonary edema
  - Fetal risks: preterm birth, low birth weight (FGR increased if severe AS)

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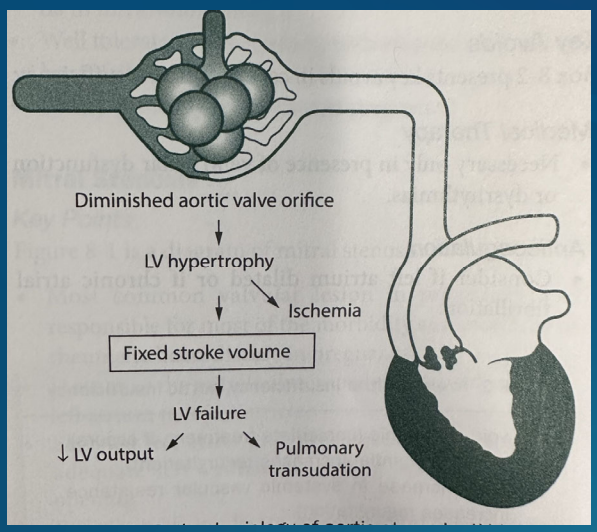

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AORTIC STENOSIS

- Hemodynamic changes of pregnancy --> increased volume precipitates symptoms
- Valve considerations:
  - Volume – avoid hypervolemia (pulmonary edema), avoid hypovolemia (coronary ischemia)
  - Pressure – avoid hypotension
  - Rate – avoid bradycardia (decreases cardiac output)

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AORTIC STENOSIS – PREGNANCY MANAGEMENT

- Activity restriction (if severe & symptomatic)
- Echocardiogram Qtrimester
- Serial growth US +/- fetal testing
- Severe symptomatic AS – balloon valvotomy or valve replacement should be considered
- Delivery:
  - Maintain euvolemia
  - Vaginal delivery preferred, assisted 2nd stage --> consider c-section for severe AS

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VALVULAR INTERVENTION IN PREGNANCY

Timing and feasibility

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WHEN TO INTERVENE?

- Pre-pregnancy valve intervention[1,2]
  - Symptomatic severe AS or asymptomatic severe AS with LV dysfunction
  - Symptomatic severe MS or asymptomatic severe MS with high embolic risk, pAFib
  - Severe PS
  - Severe AR or MR with LV dysfunction
  - Severe symptomatic PR with RV failure
- Exercise testing & invasive hemodynamics to guide valve intervention[2]
- Valve choice
  - Mechanical valve – lifelong anticoagulation (warfarin), higher thrombosis risk, higher durability
  - Bioprosthetic valve – early deterioration requiring re-do valve replacement, aspirin only

[1]Bortnick & Levine, Clin Obstet Gynecol 2020
[2]Elkayam et al, JACC Adv 2022

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INTERVENTION IN PREGNANCY

- Severely symptomatic patients with failed medical therapy
- Cardiopulmonary bypass in pregnancy carries high morbidity & mortality[1]
  - Maternal mortality 11.2/100 pregnancies
  - Maternal morbidity 8.8/100 pregnancies (CHF, arrhythmia, bleeding)
  - Fetal loss 33.1/100 pregnancies
  - Neonatal complications 10.8/100 pregnancies (malformation, IUGR, respiratory distress)
- Catheter based interventions = safer profile in pregnancy[2]
  - Percutaneous balloon valvuloplasty (mitral, aortic, pulmonic) have all been reported
    - Requires anesthesia, TEE, fluoroscopy
  - Transcatheter valve replacement --> case reports in pregnancy but appears feasible/safe

[1]Jha N et al, Ann Thorac Surg 2018
[2]Elkayam et al, JACC Adv 2022

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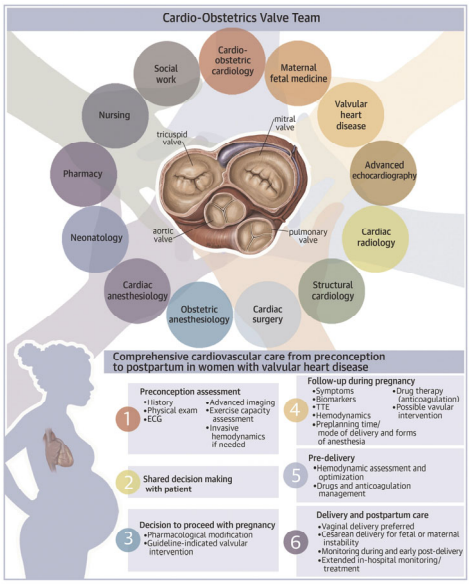
CENTRAL ILLUSTRATION: Multidisciplinary Cardio-Obstetrics Valve Team



Elkayam U, et al. JACC Adv. 2022;1(2):100022.

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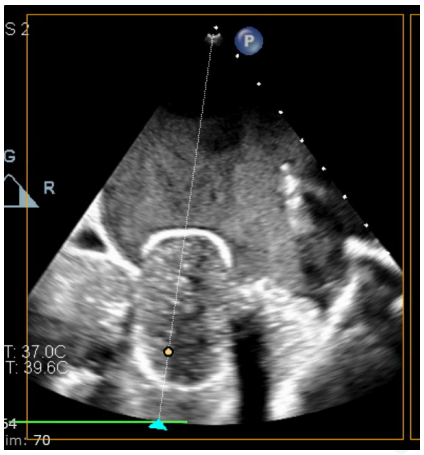
RETURN TO OUR CASE - SEVERE RHEUMATIC MITRAL STENOSIS

- Underwent right heart catheterization & TEE
  - pHTN & severe MS (mean gradient 25 mmHg, MVA 0.6 cm^2)
- Underwent mitral balloon valvuloplasty at 24w2d
  - Post-procedural gradient 5 mmHg, MVA 1.6 cm2
  - Discharged home POD1 from valvuloplasty on metoprolol & digoxin
- Now mWHO II-III (from mWHO IV)
  - Delivery plan 39 weeks, vaginal birth with regional anesthesia
  - Goal euvolemia, run dry, Lasix at delivery
  - Continue metoprolol, digoxin, telemetry in labor



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DELIVERY AND POSTPARTUM

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MODE OF DELIVERY

- Vaginal delivery is preferred
  - Excellent anesthesia – prefer regional
  - Consideration of assisted second stage
- Why?
  - C-section has higher risks of hemorrhage, hemodynamic fluctuations, myocardial oxygen consumption
  - Study of planned delivery for CVOB patients – 276 patients, 76% with planned VD[1]
    - 76.7% SVD, 9.5% operative vaginal delivery (2.3% cardiac indication), 13.8% C-section
    - Similar rate of primary cardiac outcome in VD vs C-section groups (4.3% vs 3.0%, p=1.0)
    - No differences in composite maternal outcome
    - SVD group had lower PPH, lower blood transfusion
    - No neonatal complications
- Cardiac indications for C-section: Decompensated HF, decompensated pHTN, recent warfarin, severe symptomatic valvular stenosis, aortopathy

[1]Easter SR et al, AJOG 2020

ANESTHESIA

- Regional anesthesia is recommended
  - Improves hemodynamics & oxygen consumption in labor
  - Slow dosing strongly recommended to prevent hypotension
    - Hypotension will decrease cardiac output for LVOT obstructive lesions
    - Test dose: risk of severe tachycardia
    - Pre-epidural IVF does NOT fix post-epidural hypotension
- Cardiac monitoring in CVOB
  - Telemetry
  - Arterial line
  - Swan Ganz or PA catheter
  - Typically not required but may be recommended for highest risk stenotic lesions

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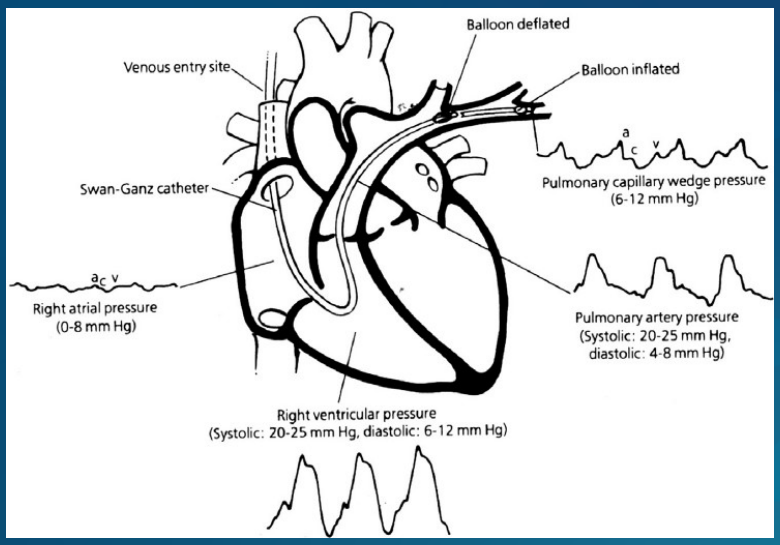

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FLUID SHIFTS WITH DELIVERY

- Delivery predisposes to fluid overload[1]
  - IVC compression relieved
  - Autotransfusion 500cc from uterus
  - Mobilization of 3rd spaced fluids to venous system
- Mitral stenosis
  - Keep HR 90-100 bpm – beta blockade (maintain LV filling)
  - PCWP ~14 mmHg (if invasive monitoring in place) - diuretics as needed intrapartum
  - IV Lasix with delivery – risk of flash pulmonary edema with autotransfusion
  - MS patients are better "dry"
- Aortic stenosis
  - Avoid bradycardia – caution with beta blockade
  - PCWP ~14-17 mmHg (if invasive monitoring in place)
  - AS patients are better "wetter" -- pulmonary edema is better than coronary hypoperfusion

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[1]Clark SL et al, AJOG 1985

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MANAGEMENT OF HEMORRHAGE

- Common medications may need to be modified in women with CVD
  - Remember: Hemorrhage is poorly tolerated with significant CVD
  - Consider risk/benefit

- IM oxytocin
- Tranexamic acid
- Misoprostol
- Tamponade devices
- Transfusion + diuresis

TABLE 6 Obstetric Medications and Considerations for Women With High-Risk CVD

Medication	Indication	Side Effects	Considerations
Oxytocin (Pitocin)	Labor augmentation Prevention of postpartum hemorrhage	Hypotension Decrease in peripheral vascular resistance Large bolus can cause sudden decrease afterload and reflex tachycardia Rare reports of ischemia	Avoid bolus in complex CVD when possible Consider use as a dilute solution in a continuous IV infusion
Terbutaline	Stop premature labor, prolonged or frequent uterine contractions	Hypertension and tachycardia (1% to 10%)	Extreme caution, contraindicated
Methylergonovine (Methergine)	Stop postpartum hemorrhage	Vasoconstriction leading to hypertension and myocardial ischemia	Avoid if possible with chronic hypertension, pre-eclampsia, aortopathies, ischemic heart disease
Carboprost tromethamine (Hemabate)	Prostaglandin used for refractory postpartum uterine bleeding or pregnancy termination	Hypertension	Avoid in women with vascular disease or aortic aneurysms; pulmonary hypertension; significant shunt lesions

CVD = cardiovascular disease; IV = intravenous.

JACC Focus Seminar 2021

SUMMARY

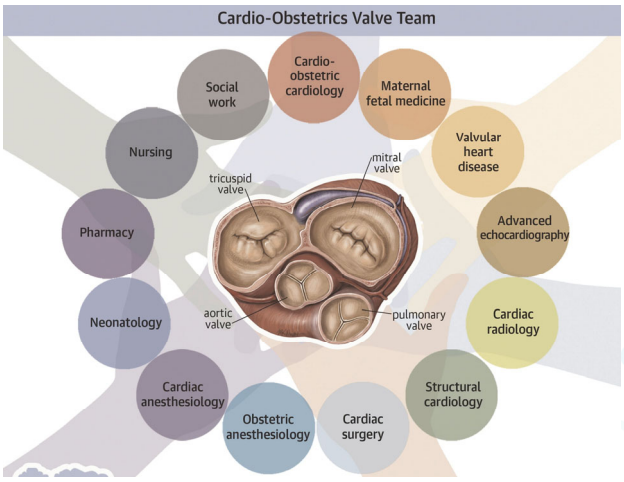
Valvular heart disease is a leading cause of cardio-obstetric morbidity & mortality

Regurgitant lesions & right sided lesions are typically well tolerated in pregnancy

Left sided stenotic lesions have fixed cardiac output & carry higher risk

Valve interventions should occur prior to pregnancy in selected high-risk groups

Multidisciplinary cardio-obstetric care throughout pregnancy, delivery, & postpartum optimizes maternal & fetal outcomes



Elkayam et al, JACC Adv 2022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THANK YOU!
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