I have no financial relationships to disclose.

I will discuss off-label use and/or investigational use in my presentation.
Objectives

• Describe changes in cardiovascular physiology in normal pregnancy
• Summarize the epidemiology, diagnosis and prognosis of peripartum cardiomyopathy
• Outline treatment for systolic dysfunction heart failure in the pregnant patient
CV Physiology in Pregnancy

• Blood volume increases by 30 – 50%

• Cardiac output increases by 30 – 60% to 5 – 7 L/minute/m²
  – Increased preload
  – Elevated stroke volume
  – Increased heart rate by 10 – 20 beats/min
CV Physiology in Pregnancy

• During labour
  – 500 mL of blood returns to the maternal circulation with each contraction
  Pain → elevated BP, heart rate and myocardial oxygen consumption

• Increased preload
  – Cardiomyopathy or mitral regurgitation

• Blood loss
  – Aortic stenosis
What is Heart Failure?

Heart Failure is a syndrome defined by:

- an abnormality in cardiac function \textit{and}
- an inability to pump blood at a rate required to satisfy the body’s requirements \textit{or}
- only able to do so at an abnormally elevated diastolic volume
Causes of Heart Failure

- Systolic dysfunction
  - Post-MI
  - Regurgitant valvular pathology
  - Idiopathic
  - Peripartum cardiomyopathy
- “Diastolic dysfunction” or HF with Preserved EF (HFPEF)
  - Hypertension
  - Ischemic heart disease
Hopefully not High Altitude
Pulmonary Edema
Peripartum Cardiomyopathy (PPCM)

- Dilated cardiomyopathy
- Last month of pregnancy to 5 months post-partum

- 1 in 15,000 pregnancies in the US
- 1 in 6000 in Japan
- 1 in 1000 in South Africa
- 1 in 100 in Haiti
Peripartum Cardiomyopathy (PPCM)

• Etiology?
  – limited role for endomyocardial biopsy

• Definition
  1. No demonstrable cardiac disease prior to last month of pregnancy
  2. LV systolic dysfunction
  3. Last month of pregnancy to 5 months post-partum
  4. No other cause for heart failure
Case of Ms. DA

28-year-old female from Somalia, living in Canada for 3 years, G1P0, presenting at 38+ weeks with contractions and BP 154/92

Fairly complete prenatal care but no visits in last 3 weeks
Case of Ms. DA

- placental abruption was suspected.
- contractions increased to a frequency of once/minute
  - variable decelerations in the fetal heart rate.
- Emergent lower-segment caesarean section
  - female infant weighing 2.8 kg with Apgars of 8 and 9
  - abruption was confirmed
Ms. DA Post-partum

- How would you treat her elevated blood pressure?

- Given IV labetalol post-op to improve BP

- But 6 hours post-op...
  BP 170/115, RR 48, SaO₂ 88% on 10L NRB mask
Ms. DA Post-partum

• What do you think is going on?

• What would you like to do?
Ms. DA Post-partum

- Intubated, chest x-ray shows pulmonary edema
- Given IV furosemide
- IV hydralazine and IV nitroprusside in the ICU
- Echo anyone?
Ms. DA’s Echo

- Normal sized heart chambers, no LVH
- Entire mid-portion of LV was akinetic
- LV Ejection fraction 40%
- Valves structurally normal

- Possible mild hypokinesis of the RV
- RVSP 45mm Hg
Ms. DA Post-ICU

• Do you think she has PPCM?

• What medications would you start her on if she’s breastfeeding?
Risk Factors for PPCM

- Age > 30 years
- Multiparity
- African descent
- Multiple fetuses
- Long-term use of oral tocolytic therapy (?)
- Cocaine abuse
Cardiac Meds in Breastfeeding

From drugs for cardiac disorders in pregnancy

(table from pages 356-357, Medical Care of the Pregnant Patient)

– ACE inhibitors
  • Captopril and enalapril

– Beta blockers
  • Labetalol, metoprolol and propranolol

– Furosemide and digoxin, calcium channel blockers

– ARBs - unknown
Back to Ms. DA

• Repeat echo in 2 weeks is similar
• Discharged on enalapril, metoprolol and amlodipine

• Followed-up in heart failure clinic
  – Class I NYHA symptoms
  – 3 months post-partum, MUGA EF 54%
  – 8 months post-partum, echo (N)
Prognosis of PPCM

• Largest series of 123 cases of PPCM:
  – Transplantation rate 4%
  – Mortality rate 10% at 2 years

• In those who survived:
  – LVEF improved from 28% to 46% by 2 years
  – Over half of women had recovery to EF>50%

Elkayam et al Circ 2005
Prognosis of PPCM

• How did the newborns do?
  – 25% preterm birth
  – 2 stillbirths, 1 neonatal death, 4 newborns with congenital anomalies

• Another study from Johns Hopkins
  – Transplantation rate 7% at 8 years
  – Mortality rate 6% at 5 years

Elkayam et al Circ 2005
Further on with Ms. DA

- What do you advise her regarding future pregnancies?
Subsequent Pregnancy in PPCM

- Depends on whether EF has normalized
- Elkayam’s group found a reduction in EF from 56% to 49% in those with (N) EF
  - One-fifth had reduction of EF of 20%
  - 6/28 developed HF symptoms
- But 36% down to 32% in those with persistent LV dysfunction
  - 3/16 died, 7/16 HF symptoms

Elkayam et al. NEJM 2001
Subsequent Pregnancy in PPCM

Elkayam et al. NEJM 2001
Further on with Ms. DA

- Ms. DA stops her contraception and becomes pregnant
-Visits with obstetrician at 8 weeks and decides to continue with pregnancy
- No recurrent symptoms during pregnancy
-Delivered healthy girl at 39 weeks
Case of Ms. TG

22-year-old female suffered myocarditis at the end of the last flu season
Hospitalized for 2 months with cardiogenic shock but gradually improved
LV EF 35% at the end of the admission, NYHA class II symptoms

“My new partner will be going to Afghanistan, and I would like to become pregnant”
Case of Ms. TG

• What will you advise her?

• If she plans to become pregnant, what about her medications?
Prognosis of pregnancy with known HF

• Subset of multicenter study of pregnancy outcomes with heart disease: 23 patients with DCM (Siu et al. Circ 2001)
  – 7 suffered CHF
  – 1 had a stroke
  – 1 died

• Poor prognostic factors:
  > class II NYHA
  LV EF < 40%
  Obstruction
  HF, stroke/TIA, arrhythmia
Management of pregnancy with Dilated Cardiomyopathy (DCM)

- Assess functional status and presence of congestion
- Echo, within the past year
- Manage medications
- Referral to high-risk obstetrician
Back to Ms. TG

• Doing well since discharge, not congested, can do some light chores around her apartment

• Current medications
  – Metoprolol 50mg bid
  – Lisinopril 20mg daily
  – Furosemide 60mg daily
  – Digoxin 0.125mg daily
Diversion on Drugs in Pregnancy

Approach recommended by Powrie (chapter 4, Medical Care of the Pregnant Patient)

• Question 1: are symptoms self-limited or can they be treated non-pharmacologically?

• Question 2: if medication isn’t given, what are possible outcomes for mother & fetus?
Diversion on Drugs in Pregnancy

• Question 3: what data are available on the safety of the medication in pregnancy
  – Use is generally justifiable
  – Use is justifiable in particular circumstances
  – Use is almost never justifiable

• Question 4: what are the patient’s and physician’s understanding/value about medication use during pregnancy?
Cardiac Meds while Pregnant

From drugs for cardiac disorders in pregnancy
(table from pages 356-357, Medical Care of the Pregnant Patient)

Use is rarely justified:
– ACE inhibitors, ARBs, amiodarone, nitroprusside

Use justified in some circumstances
– Clopidogrel, atenolol, diltiazem, digoxin, diuretics, propafenone, sotalol
Cardiac Meds while Pregnant

Use justified when indicated:
– Aspirin, labetalol, metoprolol, hydralazine, organic nitrates, lidocaine, procainamide, quinidine
Back to Ms. TG

- What would you do with each medication?
- Current medications
  - Metoprolol 50mg bid
  - Lisinopril 20mg daily
  - Furosemide 60mg daily
  - Digoxin 0.125mg daily

- Would you add any medications?
• What would you do with each medication?
• Current medications
  – Metoprolol 50mg bid
  – Lisinopril 20mg daily
  – Furosemide 60mg daily
  – Digoxin 0.125mg daily

• Would you add any medications?
Summary

• PPCM is a rare but serious complication of pregnancy
• Recovery of LV EF is common by 6 months post-partum
• Women with pre-existing cardiomyopathy have cardiac risks during pregnancy
• Pre-conception counselling is very important
References

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