Pregnancy and Cardiovascular Disease

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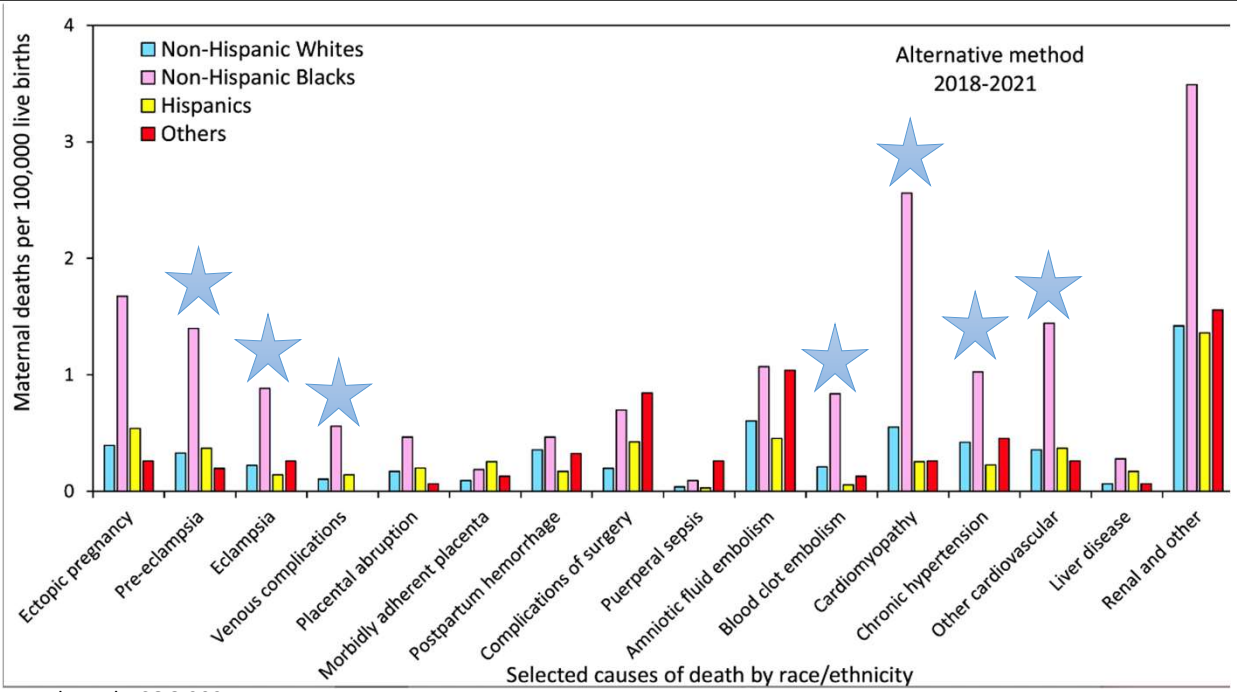
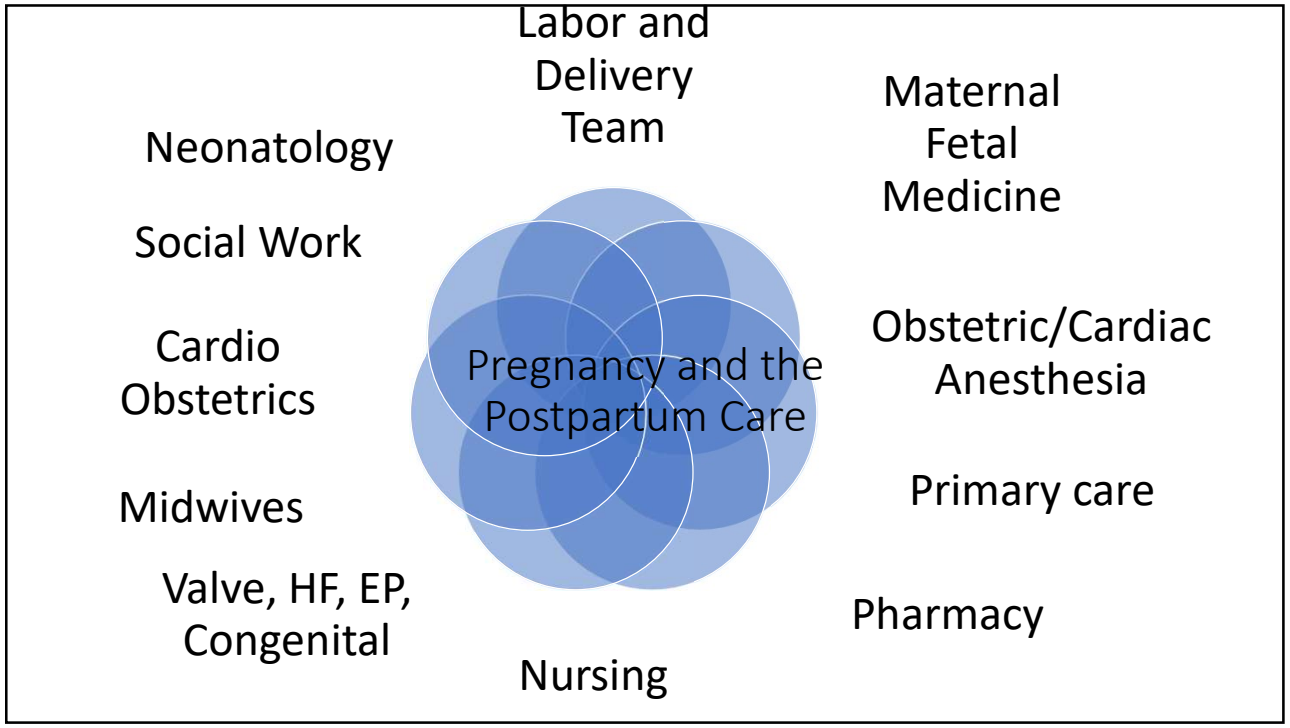


Joseph et al ACOG 2024

1.Maternal mortality in the United States: are the high and rising rates due to changes in obstetrical factors, maternal medical conditions, or maternal mortality surveillance?
2.Joseph, K.S. et al.

The Importance of Cardio-Obstetric Programs

- Patients cared for by cardio-obstetrics team have better outcomes than standard care – specifically surrounding delivery complications
- Benefit is most pronounced for lower socioeconomic status patients



Who are our patients who we counsel against pregnancy (WHO risk IV)?

- Pulmonary artery hypertension
- LVEF <30%
- PPCM with residual impairment in LVEF
- Severe aortic stenosis
- Marfans with Ao > 4.5 cm
- Bicuspid with Ao > 5.0 cm

Who are our patients who we consider high risk (WHO risk III)?

- Mechanical heart valve
- Systemic right ventricle
- Cyanotic Heart Disease
- Complex Congenital Repair
- Aortic dilation
- Coarction of aorta with residual gradient
- Marfans with Ao <4.5 cm or with aortic root replacement
- Bicuspid with Ao 4.5 – 5 cm

Let's think about the hemodynamic changes of pregnancy for a moment…

Cardiac Output

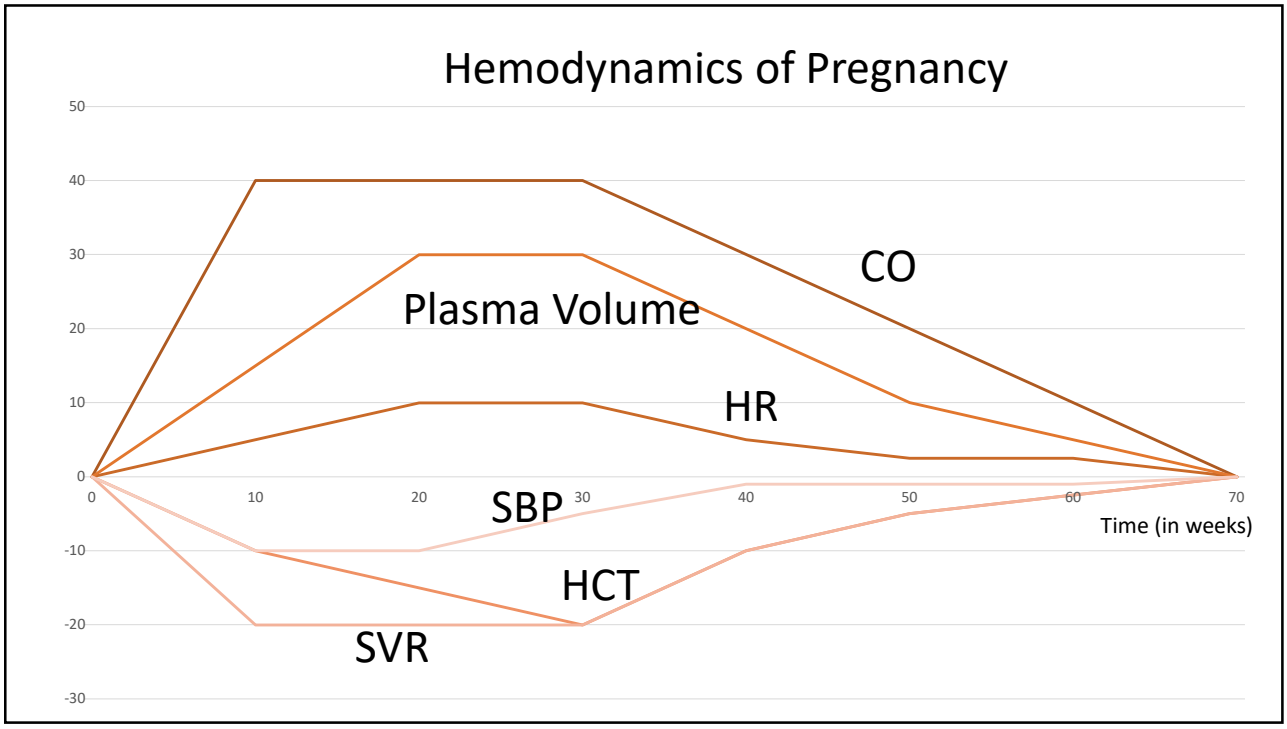
Plasma Volume

Heart Rate

Hematocrit

Systemic Vascular Resistance

Systolic Blood Pressure



Cardiac Indications for C-Section:

"If the patient can Valsalva for a bowel movement, they can Valsalva for a baby"

- Marfans with Ao > 4.5 cm
- Acute or chronic aortic dissection
- Unstable/decompensated heart failure
- Preterm delivery for patient on full dose anticoagulation

Cardiac **Suggestions** for operative vaginal delivery

- Valsalva: decreases preload- important for our preload sensitive states
  - Aortopathy (Ao less than 4.5)
  - Moderate to severe stenotic valvular disease
  - Fontan Circulation (low flow state)
  - Pulmonary Aterial Hypertension

When should we refer pregnant patients to see a cardiologist?

Women's Heart Health Programs

Primary Prevention

- Patients who develop emerging risk factors for heart disease (gestation HTN/DM2, pre-eclampsia/eclampsia, early menopause)
- Patients with premature family history of heart disease (MI in father less than the age of 45, MI in mother less than the age of 55)

Wood, Malissa, and Niti Aggarwal. Sex Differences in Cardiovascular Disease. Elsevier, 2021

Women's Heart Health Programs

Secondary Prevention

- Prior diagnosis of congenital heart disease (bicuspid aortic valve, rhematic heart disease)
- Familial Hyperlipidemia
- Known arrhythmia (supraventricular tachycardia)
- Peripartum cardiomyopathy
- Spontaneous Coronary Artery Dissection
- Cardiac conditions + lactation

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Women's Heart Health Programs

Symptoms concerning for new heart disease

- Difficult to control blood pressure post-partum
- New cardiac arrythmias/Palpitations
- Progressive shortness of breath +- lower extremity swelling
- Chest pain or pressure in pregnancy

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Women's Heart Health Programs

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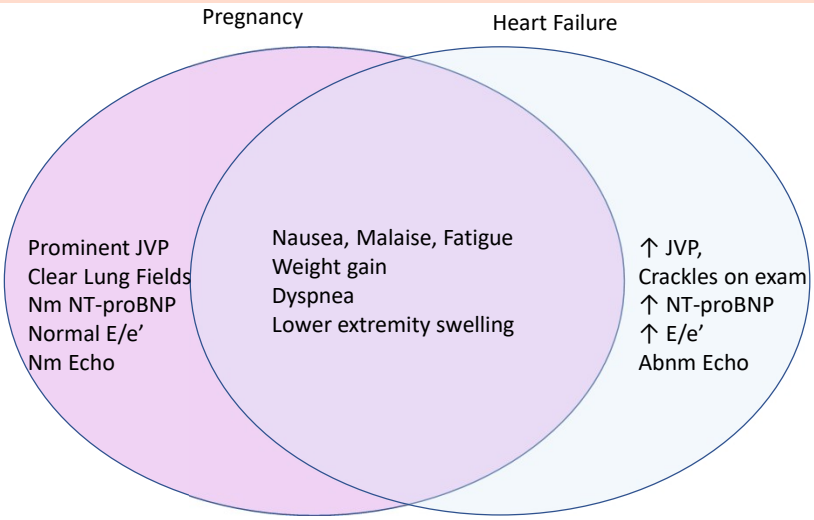
Pregnancy and Shortness of Breath

At first glance…



Cardiac Differential Diagnosis

- Ischemic (MI/SCAD)
- Arrhythmogenic
- Structural
  - Pumping issue
    - Systolic heart failure: Peripartum, Stress-induced, Familial, Hypertrophic
    - Diastolic heart failure
  - Valvular Issue (Stenosis or Regurgitation)
  - Congenital Heart Disease (ASD/PFO, VSD)
- Non-cardiac: TSH, CBC, PE?

Diagnosing Heart Failure In Pregnancy

- Elevated JVP
- ECG +- 3d ECG monitor
- Echo
- NT-proBNP, Troponin

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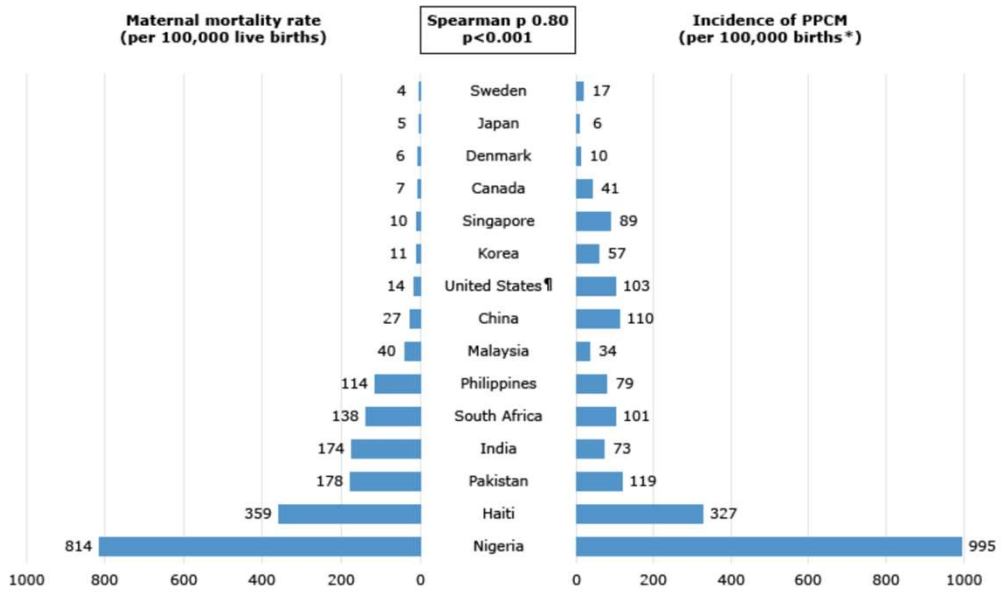
Peripartum Cardiomyopathy

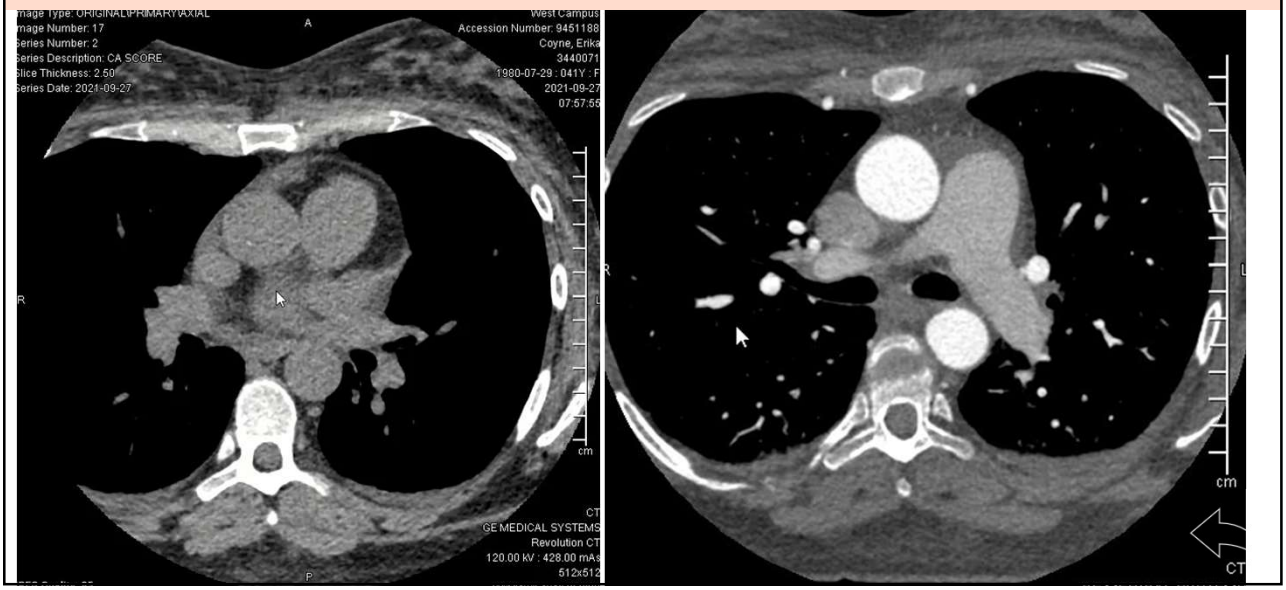
A Worldwide Disease



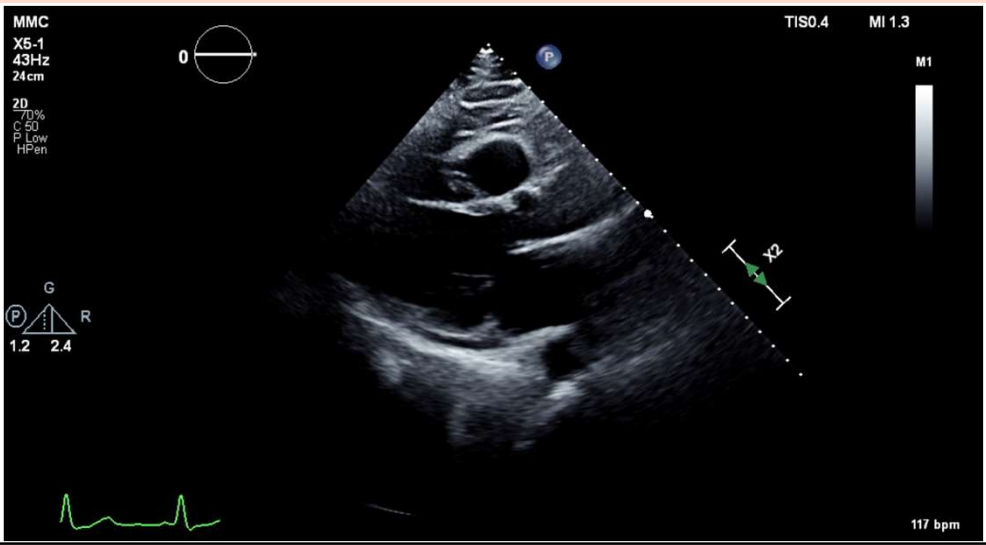
32 year old G4P3 who is 7 days post partum presenting with chest pain and shortness of breath

- Full term delivery, induced c section due to preeclampsia
- Has been on nifedipine for HTN
- Nonproductive cough
- JVP difficult to assess
- Hs Troponin 200, NT-proBNP elevated

Undergoes Coronary CTA



What's her EF? High? Low? Normal?



Which of the following statements is true?

1. Her echocardiogram is normal in the setting of recent pregnancy
2. She has pre-eclampsia
3. She could have a post-partum cardiomyopathy
4. Her mortality rate is low for a subsequent pregnancy

32 year old G4P3 who is 7 days post partum presenting with chest pain and shortness of breath, found to have a reduced EF

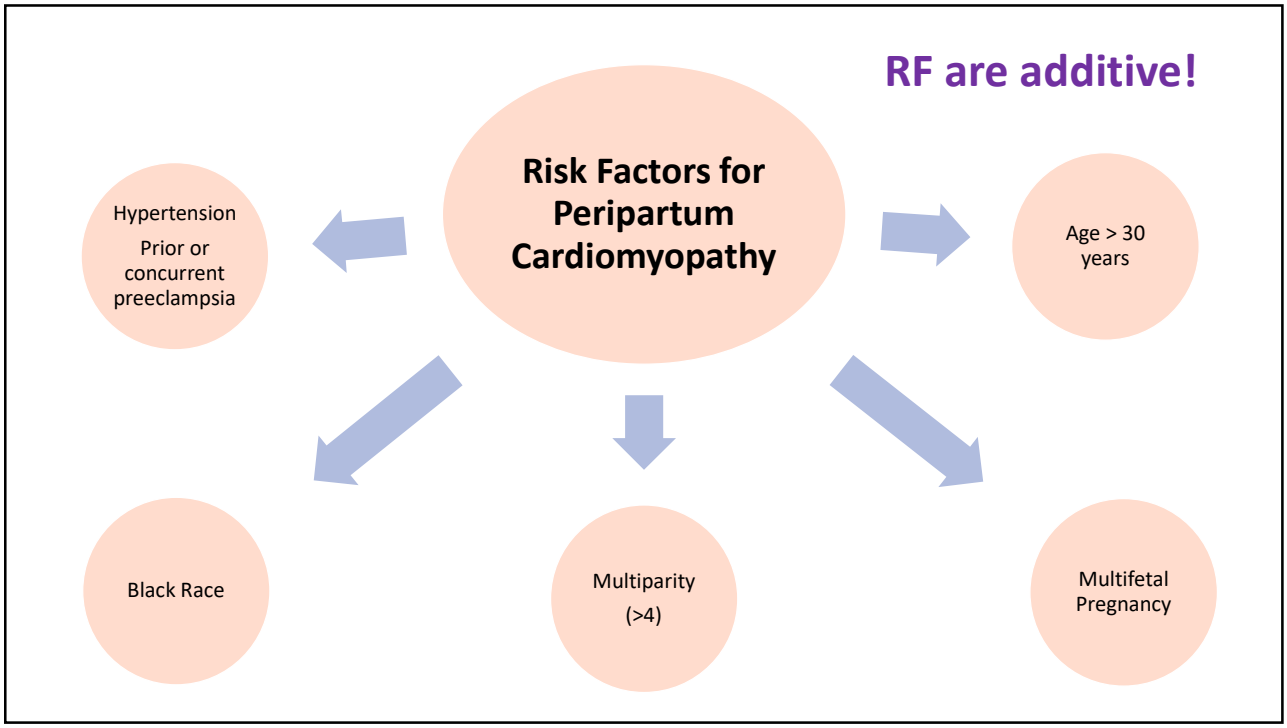
Which of the following statements is true?

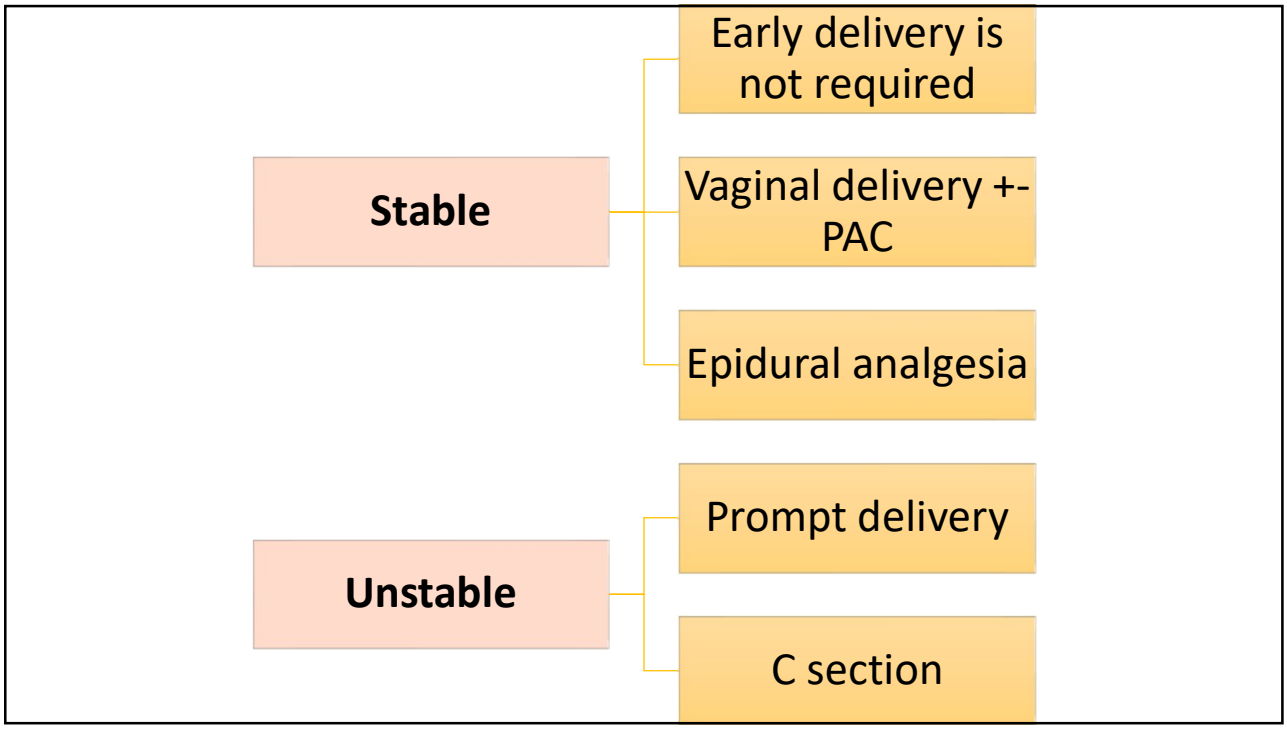
1. Her echocardiogram is normal in the setting of recent pregnancy
2. She has pre-eclampsia
3. **She could have a post-partum cardiomyopathy**
4. Her mortality rate is low for a subsequent pregnancy

32 year old G4P3 who is 7 days post partum presenting with chest pain and shortness of breath, found to have a reduced EF

Peripartum Cardiomyopathy

- HF in last month of pregnancy or within 5 mo of delivery (majority within 1 mo of delivery)
- LV systolic dysfunction < 45%
- No other cause of myocardial failure, no prior cardiac history
- Shared genetic predisposition between peripartum and dilated CMP
- Usually recovered by 6-12 mo
- 6-10% mortality rate (SCD)





Treatment of PPCM

- Similar to our nonpregnant patients
- Guideline Directed Medical Therapy
- Breastfeeding
- Bromocriptine?
- Wearable cardioverter-defibrillator
- Subsequent Pregnancy Recommendations

Some Modifications Required…

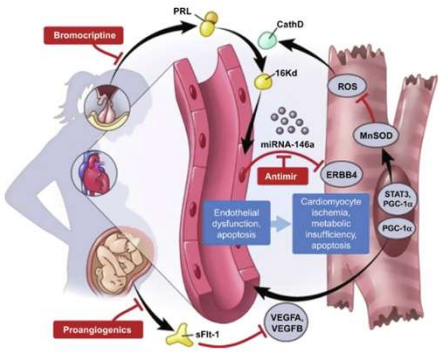
GDMT	Pregnant	Breastfeeding
Beta Blockers		
ACEI/ARB/ARNI		Enalapril, Captopril are safe with lactation ARNIs have not been studied
Mineralocorticoid receptor antagonist		Spironolactone

Breastfeeding

- There is no clear evidence that breastfeeding is prohibitive to myocardial recovery
- It should be encouraged given benefits to both mom and baby
- There are safe and available forms of GDMT for nursing mothers

Bromocriptine

- Small, international case studies have demonstrated some benefit
- Causes lactation suppression
- Europe: Level IIb in combination with AC
- REBIRTH RCT - 2027



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Wearable Cardioverter-Defibrillator

- 30% of mortality associated with PPCM is related to VT/VF
- 2014 study in Germany (N=7) of showed vest terminated all episodes of VF with no inappropriate shocks
- No guidelines on this – shared decision making

Duncker D, Haghikia A, König T et al, Risk for ventricular fibrillation in peripartum cardiomyopathy with severely reduced left ventricular function-value of the wearable cardioverter/defibrillator. Eur J Heart Fail. 2014 Dec;16(12):1331-6.

Subsequent Pregnancy Recommendations

Discuss Early

Patients with persistent LV dysfunction are likely to have further deterioration with a subsequent pregnancy (18% risk of maternal death)

Shared Decision Making

Avoid Estrogen containing contraception due to increase risk of thromboembolic events and HTN

Patients with recovered EF have a 31% risk of relapsed HF but are low risk for maternal death

Peripartum Cardiomyopathy Take Home Points

- PPCM is increasingly common in the United States and worldwide
- RF are additive and include h/o HTN + preeclampsia, race, age, number of prior pregnancies,
- GDMT can be tailed to patient's lactation wishes
- Bromocriptine is promising in mice but still experimental in humans
- Subsequent pregnancy recommendations should be individualized

Women's Heart Health Programs

Symptoms concerning for new heart disease

- Difficult to control blood pressure post-partum
- New cardiac arrythmias/Palpitations
- Progressive shortness of breath +- lower extremity swelling
- **Chest pain or pressure in pregnancy**

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Pregnancy and Chest Pain

THE BIG SIX

- Acute Myocardial Infarction
- Cardiac Tamponade
- Aortic Dissection
- Pulmonary Embolism
- Tension Pneumothorax
- Esophageal Rupture

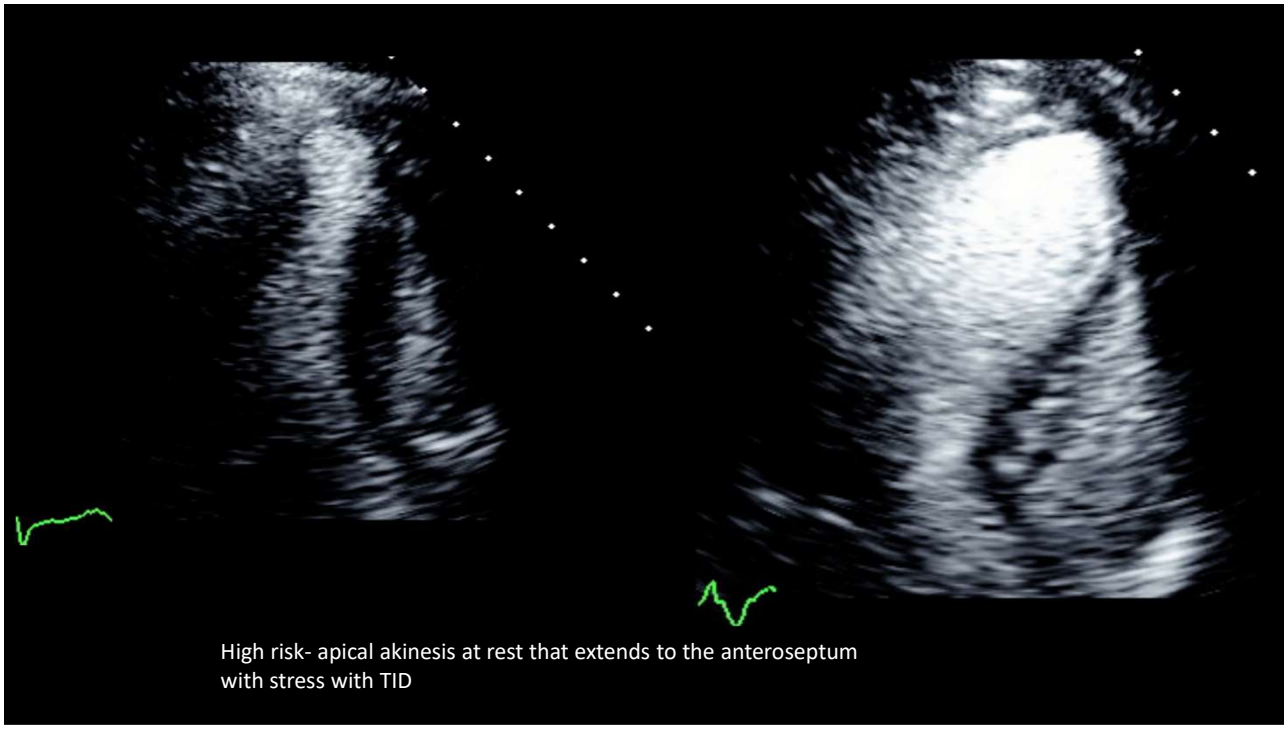
AMI in Pregnancy

Spontaneous Coronary Artery Dissection

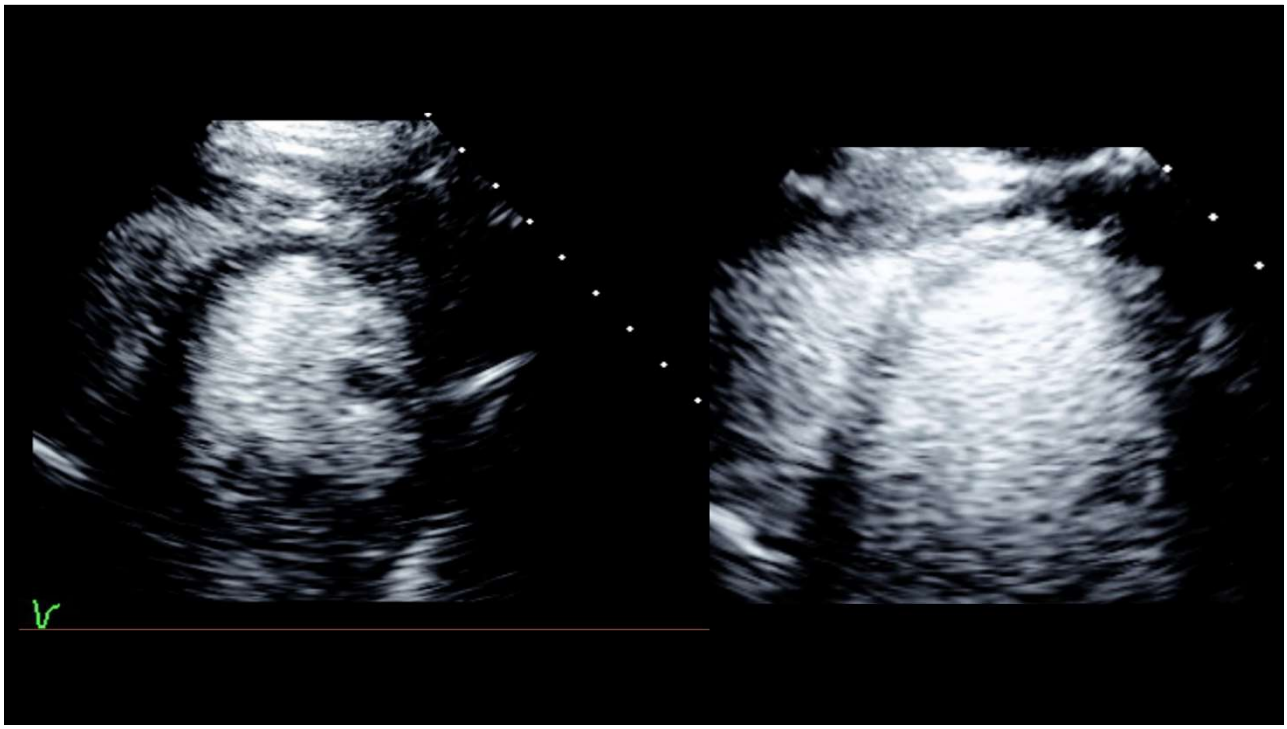
25 year old female with presenting with chest pain and shortness of breath

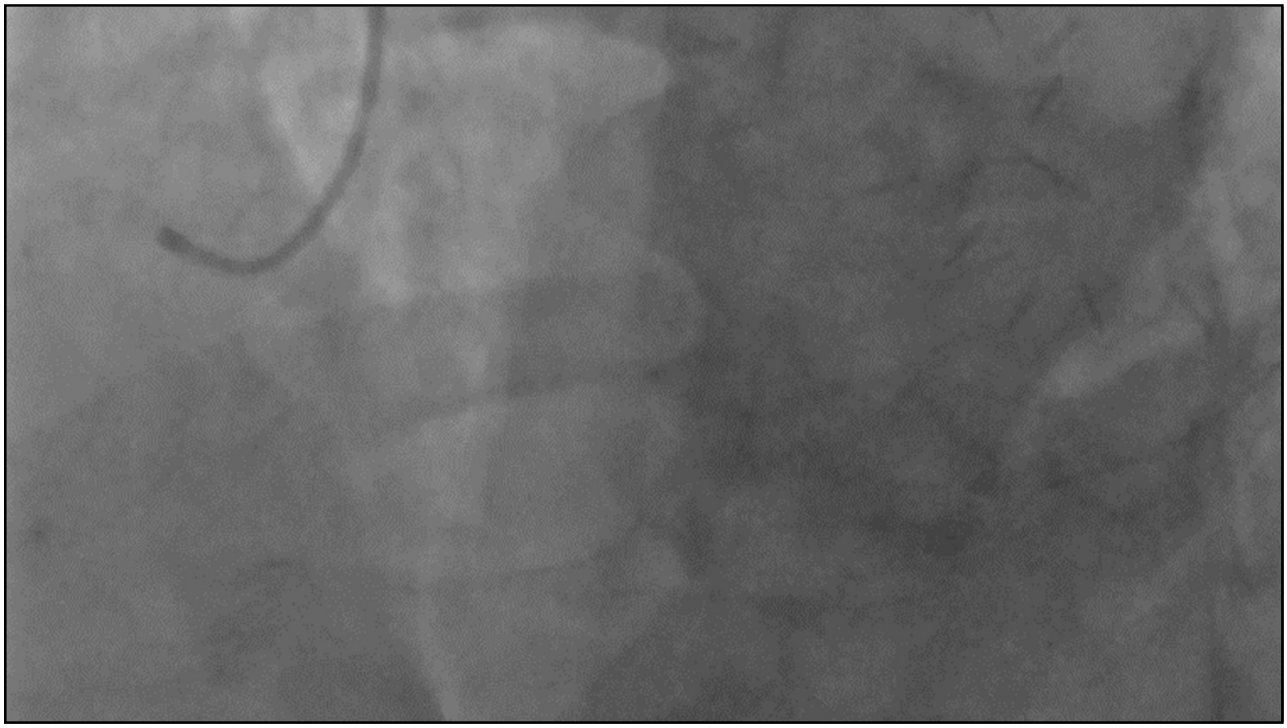
Presented to the ED with new onset diaphoresis, nausea, and neck pain with exertion

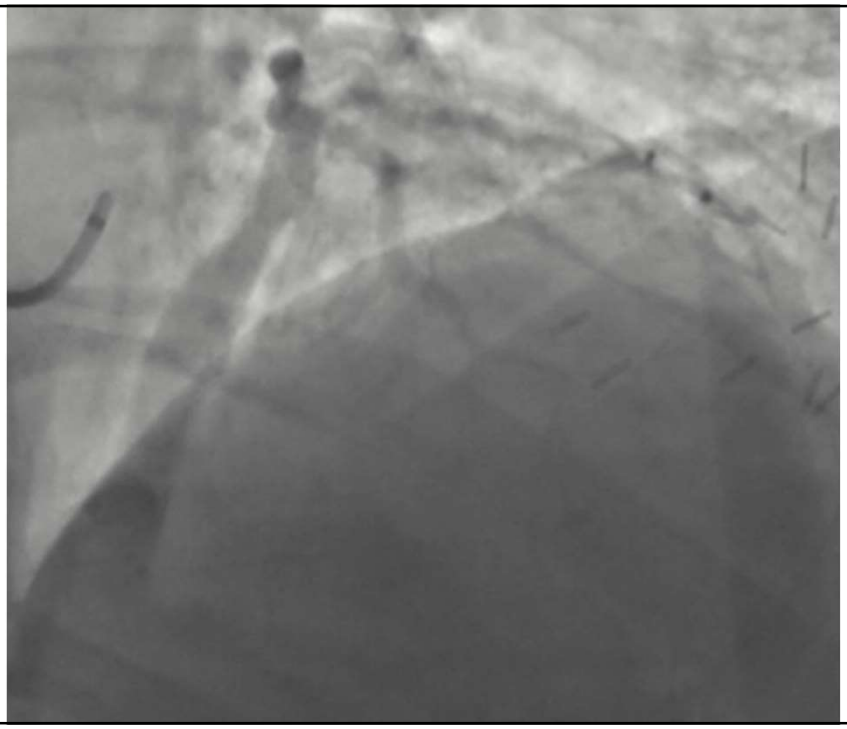
Lab	Value
Creatinine	0.57
Hs-Troponin	<6
Hemoglobin	14.2
Hematocrit	42.4
Platelets	235



High risk- apical akinesis at rest that extends to the anteroseptum with stress with TID

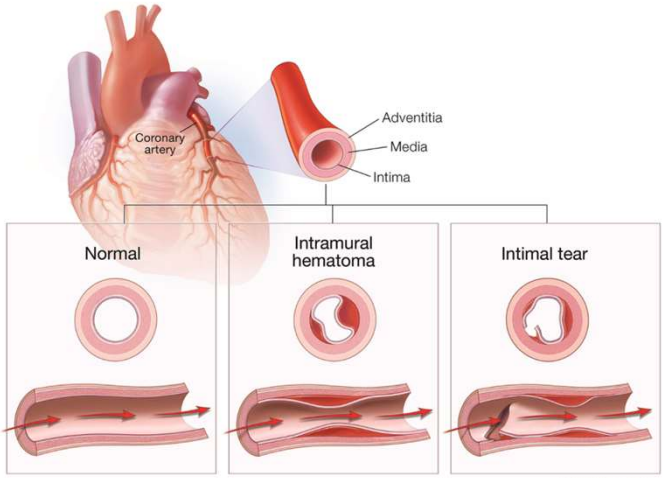






Spontaneous Coronary Artery Dissection (SCAD)

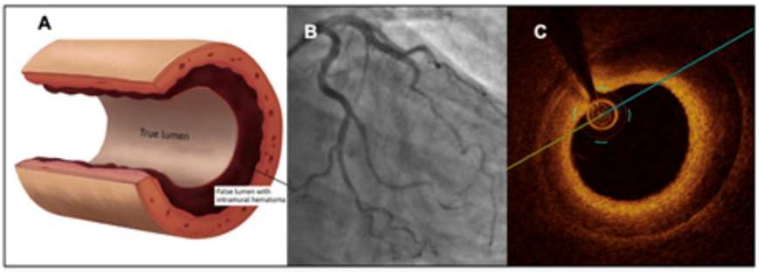
- Nontraumatic, non-iatrogenic separation of the coronary wall
- “Outside in” or “inside out” hypothesis
- Bleeding of the vaso vasorum OR intimal tear
- Creation of a false lumen that causes myocardial ischemia
- 0.4-4% of all AMI
- 25% of AMI for females <50



Offen S, Yang C, Saw J. Spontaneous coronary artery dissection (SCAD): A contemporary review. Clin Cardiol. 2024 Jun;47(6):e24236. doi: 10.1002/clc.24236. PMID: 38859725; PMCID: PMC11165169.

SCAD: Risk Factors

- Hormone therapy (?IVF, hormone therapy in transgender individuals)
- Acute cardiocirculatory stress
  - Intense exercise (isometric exercise, lifting > 50 lbs)
  - Emotional stress
  - Labor and delivery
  - Reactional drug use
    - Cocaine
    - Amphetamines



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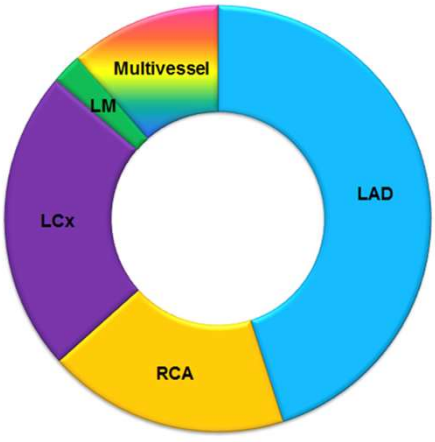
SCAD: Presentation and Diagnosis

- ACS (NSTEMI, STEMI, VT, Shock)
- ECG: STEMI (46%), TWI (22%), normal (16%), STD (6%), Nonspecific ST changes (9%)
- Usually 1 vessel (87%): LAD, Diag, Septal perforator
- Diagnosis via Coronary angiogram
- CT: can miss the dissection plane, not good for diagnosis (yet), good for staging
- All patients with SCAD require head to pelvis imaging to look for FMD



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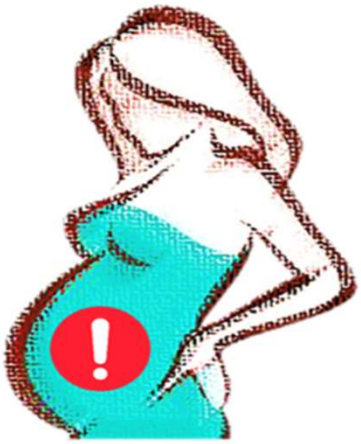
Pregnancy Related SCAD (p-SCAD)

- SCAD is the most common presentation of AMI in pregnancy
- Most common first month post partum
- 1.81 per 100,000 pregnancies
- RF: multiparity, undergone infertility tx, h/o HTN
- More fulminant presentation: STEMI, more proximal disease, multivessel disease, more likely to present with HF or reduced EF
- Frequently requires revascularization
- Death is rare, vaginal delivery preference
- Family planning - risk of recurrence is really unknown and extrapolated from very small case series, expert consensus generally advises against, Avoid estrogen containing contraception



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SCAD: Treatment (Expert Consensus)

PRIOR TO DISCHARGE

- Stop heparin
- 3-5 days inpatient
- Beta blocker (decreases recurrence)
- Plavix (debated, but usually 2-4 wks), ASA indefinitely
- Statin if HLP, GDMT if reduced EF

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SCAD: Treatment (Expert Consensus)

OUTPATIENT

- CT Head/Neck, C/A/P
- Genetic testing if compelling FH or unique presentation
- Cardiac rehab
  - 50-70% max predicted HR
  - No lifting > 30 lbs - 50 lbs (patient dependent)
  - Goal SBP <130 mmHg
  - Avoid abrupt, high intensity exercise, competitive contact sports
  - "You can run a 5K, but don't win it"

SCAD Take Home Points

- Nontraumatic, non-iatrogenic separation of coronary artery wall
- More common in pregnant women/those with CTDz
- Coronary angiogram is the gold standard for diagnosis (even when pregnant)
- P-SCAD is more severe
- Tx is conservative, think about DAPT, BB, statin, GDMT if HFrEF, cardiac rehab

MaineHealth Women's Heart Health Program

- Care For Our Patients
- Education For Health Care Learners & Community
- Research For Our Future

55

Thank you

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References

- Alfonso F, Paulo M, Lennie V, et al. Spontaneous coronary artery dissection: long-term follow-up of a large series of patients prospectively managed with a "conservative" therapeutic strategy. JACC Cardiovasc Interv 2012; 5:1062.
- Davis, M et al. Peripartum Cardiomyopathy. J Am Coll Cardiol. 2020 Jan 21;75(2):207 221.
- Elkayam U, Schäfer A, Chieffo A, Lansky A, Hall S, Arany Z, Grines C. Use of Impella heart pump for management of women with peripartum cardiogenic shock. Clin Cardiol. 2019 Oct;42(10):974-981.
- Elkayam U. Risk of subsequent pregnancy in women with a history of peripartum cardiomyopathy. J Am Coll Cardiol. 2014;64:1629–1636. doi: 10.1016/j.jacc.2014.07.961
- Goland S, Modi K, Bitar F, Janmohamed M, Mirocha JM, Czer LS, Illum S, Hatamizadeh P, Elkayam U. Clinical profile and predictors of complications in peripartum cardiomyopathy. J Card Fail. 2009;15:645–650. doi: 10.1016/j.cardfail.2009.03.008
- Koczo A, Marino A, Jeyabalan A, Elkayam U, Cooper LT, Fett J, Briller J, Hsich E, Blauwet L, McTiernan C, Morel PA, Hanley-Yanez K, McNamara DM; IPAC Investigators. Breastfeeding, Cellular Immune Activation, and Myocardial Recovery in Peripartum Cardiomyopathy. JACC Basic Transl Sci. 2019 Jun 24;4(3):291-300.
- Olson TL, O'Neil ER, Ramanathan K, Lorusso R, MacLaren G, Anders MM. Extracorporeal membrane oxygenation in peripartum cardiomyopathy: A review of the ELSO Registry. Int Cardiol. 2020 Jul 15;311:71-76.
- "Pregnancy Mortality Surveillance System." Centers for Disease Control and Prevention, Centers for Disease Control and Prevention, 23 Mar. 2023, www.cdc.gov/reproductivehealth/maternal-mortality/pregnancy-mortality-surveillance-system.htm#causes.
- Saw J, Humphries K, Aymong E, et al. Spontaneous Coronary Artery Dissection: Clinical Outcomes and Risk of Recurrence. J Am Coll Cardiol 2017; 70:1148.
- Wood, Malissa, and Niti Aggarwal. Sex Differences in Cardiovascular Disease. Elsevier, 2021