Myocardial Infarction in Pregnancy

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Society for Maternal-Fetal Medicine
I have no conflicts of interest to disclose
Outline

- Learning Objectives
- Physiology
- Epidemiology and Risk Factors
- Diagnosis
- Treatment
- Management – Labor & Delivery
- Summary
Learning objectives

- Understand risk factors for myocardial infarction during pregnancy
- List the diagnostic strategies of myocardial infarction during pregnancy
- Understand the management of myocardial infarction during pregnancy
Physiology changes in pregnancy to:

- Increase perfusion into the placenta
- Improve oxygenation to the fetus
- Significant cardiovascular changes
- Increase myocardial oxygen demand
Physiology

- Hemodynamics through gestation

Robson et al., 1989; Mabie et al, 1994; Whittaker et al, 1996
Physiology

- Left ventricle measurements through gestation

Robson et al., 1989; Mabie et al, 1994; Whittaker et al, 1996
Cardiac output through gestation

- Nonpregnant: 5.0
- 20-24 weeks: 6.8
- 28-32 weeks: 7.1
- 38-40 weeks: 5.8
- Early labor: 6.2
- Late labor: 7.2
- 2nd stage: 8.9
- Immediately postpartum: 9.3

Changes in Labor

- Labor increases cardiac output further
  - Pain / Anxiety
  - Uterine contractions
  - 300-400 ml autotransfusion

- Second stage
  - Valsalva causes large change in central venous pressure

- Third stage
  - 500 ml autotransfusion
  - Increase preload

Normal ECG findings in pregnancy
- Atrial and ventricular ectopics
- QRS axis leftward shift
- Q-wave (small) and inverted T-wave in lead III
- ST segment depression and T-wave inversion inferior and lateral leads
Epidemiology and Risk Factors
Epidemiology

- Acute myocardial Infarction (AMI)
  - Uncommon to rare- 3–10/100,000 pregnancies
  - 6.2 per 100,000 (95% CI: 3.0-9.4/100,00)
- Pregnant women at 3- to 4- fold risk when compared to nonpregnant
- Most common cause – coronary Atherosclerosis
- Non-atherosclerotic causes
  - Coronary dissection most common

Causes of Pregnancy and Postpartum Associated Myocardial Infarction

- Atherosclerosis (41)
- Coronary Dissection (39)
- Thrombus (15)
- Coronary Artery Spasm (5)
- No Abnormality Identifiable (10)

Prevalence Of Coronary Artery Dissection As Cause of Acute Myocardial Infarction Related To Pregnancy

<table>
<thead>
<tr>
<th>Period</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antepartum</td>
<td>11</td>
</tr>
<tr>
<td>Peripartum</td>
<td>50</td>
</tr>
<tr>
<td>Postpartum</td>
<td>39</td>
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</tbody>
</table>

# Frequency Pregnancy-Related AMI

<table>
<thead>
<tr>
<th>Timing of AMI</th>
<th>Population Size, n</th>
<th>No. With AMI</th>
<th>Percent of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnancy Admission*</td>
<td>13,687,131</td>
<td>626</td>
<td>73</td>
</tr>
<tr>
<td>Postpartum Readmission†</td>
<td>114,368</td>
<td>233</td>
<td>27</td>
</tr>
</tbody>
</table>

AMI = Acute myocardial infarction

*Defined as any discharge record with a pregnancy-related or delivery code

†Defined as any discharge record included a postpartum diagnosis

Location Pregnancy-Related AMI

- Subendocardial (37)
- Anterior (20)
- Other Inferior Wall (15)
- Other Inferior Wall (15)
- Anterolateral (5)
- Unspecified Site (5)
- Inferolateral (3)
- Other (6)
- Unspecified (15)

(X ) = % of cases

Medical Conditions & Risk of AMI

Hypertension

Thrombophilia

Anemia

Diabetes Mellitus

Obesity

Migraine Headaches

Alcohol & Substance Abuse

Smoking

0.5 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Odds Ratio

11.7

22.3

2.0

3.2

2.0

4.2

1.9

6.2

OB Complications & Risk of AMI

- Preterm Labor
  - Odds Ratio: 0.6
  - 95% CI: 0.9

- Antepartum Hemorrhage
  - Odds Ratio: 1.6
  - 95% CI: 2.1

- Pregnancy Assoc. Hypertension*
  - Odds Ratio: 2.5
  - 95% CI: 7.4

- Postpartum Hemorrhage
  - Odds Ratio: 0.2

- Transfusion
  - Odds Ratio: 10.9

- Postpartum Infection
  - Odds Ratio: 7.4

- Fluid & Electrolyte Imbalance
  - Odds Ratio: 10.9

*Preeclampsia, Eclampsia, and Gestational Hypertension

Significant Risk Factors

- Multivariable analysis of significant risk factors

Medical Condition
Hypertension
Thrombophilia
Anemia
Diabetes Mellitus
Smoking
Pregnancy Complication
Preeclampsia
Postpartum Hemorrhage
Transfusion
Postpartum Infection

Odds Ratio

Diagnosis
Diagnosis

- **Diagnostic criteria same for pregnant as nonpregnant**
  - ECG changes
  - Biochemical markers
  - Symptoms of Ischemia
    - Dyspnea
    - Diaphoresis
    - Chest pain
    - Younger patients do not always have angina
    - Women often do not have retrosternal chest pain

Zimmerman et al.; Alexander, K. P. et al; Roth, A., et al
AMI in pregnancy may have atypical features

- Abdominal/epigastric pain
- Vomiting

Chest pain/Dyspnea in pregnancy

- Preeclampsia
- GERD
Diagnosis

- Severe Signs and Symptoms
  - Cardiogenic shock
  - Arrhythmias
  - Tamponade
  - Sudden cardiac death

- EKG signs/symptoms
  - ST Segment Elevations

- Echocardiography
  - Used for evaluating wall motion
  - Not definitive for ischemia


ECG Findings

- Confusing ECG findings in pregnancy
  - Ectopic beats
  - ST segment depression and T-wave inversion inferior and lateral
    - Confused with NSTEMI (Troponin I would be normal)
  - 25% of cesarean patients have ST depression during and within 30 minutes post procedure
    - Independent of anesthetic
    - ? oxytocin related


Incidence Of ST Depression In Patients Undergoing Cesarean Delivery

S=Skin Incision
D=Delivery of Infant
C=Skin Closure

Biochemical Markers

- Creatinine kinase (CK) and myoglobin
creatinine kinase (CK-MB)
  - High concentration in uterus and placenta
  - Increase 2-fold within 30 minutes of delivery
  - Level peak 24 hrs post delivery

- Cardiac troponin I
  - Only slight increase (0.03) after delivery (still in nl range)
  - Rises within 3 hours of MI
  - Increase in PE & pericarditis
  - False positive with heterophile antibodies

Safe during pregnancy with adequate shielding

- Emergency
- Other strategies non-diagnostic

Considering stenting, etc

Consider brachial or radial artery approach

Cardiologist often reluctant

- 859 cases in pregnancy & postpartum
- 45% were reported to have undergone cardiac catheterization
- Of those, 81% underwent angioplasty, stent placement or cardiopulmonary bypass

Treatment
Cardiology

- Follow recommendations of cardiologist
- Acute phase primarily directed toward the mother - treat similar to the nonpregnant patient

Maternal-Fetal Medicine

- Encourage team to use medications that have been shown to be successful
- Be prepared for perimortem cesarean

Anesthesia
Subacute/Chronic Management

- Similar to nonpregnant
  - More concern of fetal tolerance to maternal medications

- Medications of possible concern
  - Statins
  - Clopidogrel
  - Angiotensin-converting enzyme inhibitors
  - Angiotensin II receptor blockers
  - Direct renin inhibitors
Some consider pregnancy relative contraindication

- Case by case basis
- Clinical experience limited
- Most evidence in PE and valve patients

Do not withhold just because of pregnancy

Pregnancy associated complications

- Maternal hemorrhage (8.1%)- higher near delivery
- Non-lytic associate death (1.2-7%)
- Preterm delivery (2.9%)
- Fetal death (5.8-8%)

Stenting & Intra-Aortic Balloon Pump

- Stenting
  - Same risk as nonpregnant
  - Less bleeding risk
- Intra-aortic balloon pump
  - Documented as being safe

Bredy PL, et al., 2008; Wilson AM, et al., 2004; Garry D, et al., 1996
Coronary Artery Bypass Grafting

- Well-established as therapy for AMI
- Maternal mortality similar to nonpregnant (1.7%-3%)
- Fetal considerations
  - Mortality 9.5% to 19%
    - Related to maternal condition
    - No relation to gestational age
  - Left lateral recumbent
  - High-flow extracorporeal circuits normothermic/mildly hypothermic
  - Fetal monitoring- not to proceed with cesarean but to maximize placental perfusion

Management – Labor & Delivery
Labor & Delivery

- If possible, delay ≥ 2 weeks post MI
  - High mortality
- Vaginal delivery usually preferred
  - Decreased hemodynamic burden
- Avoid ergots
- Intensive care for 48 hours postpartum
Labor & Delivery

- Supplemental oxygen
- Left tilt
- Continuous ECG
  - ± Arterial catheter
  - ± Pulmonary catheter
- Anesthesia - early epidural
  - Avoid tachycardia
  - Avoid hypotension
  - Ephedrine vasopressor of choice

Hankins GD, et al; Roth, A et al; Dufour et al
Next Pregnancy

- Risk assessment includes
  - Left ventricular function
  - Coronary anatomy
  - Ongoing ischemia
  - Elapsed time - at least 1 year

Summary
Summary- AMI in pregnancy

- Pregnancy physiology increases cardiac strain
- Medical and pregnancy complications increase the risk of AMI in pregnancy
- AMI may have atypical features
- Diagnostic criteria same for pregnancy
- Treatment similar and should not be withheld
Evidence

- Bernal JM, Miralles PJ. Cardiac surgery with cardiopulmonary bypass during pregnancy. Obstet Gynecol Surv 1986;41:1-6. (Level II-3)
Evidence

Evidence


Evidence

Evidence

Thank You for Your Attention!

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