Peripartum Cardiomyopathy

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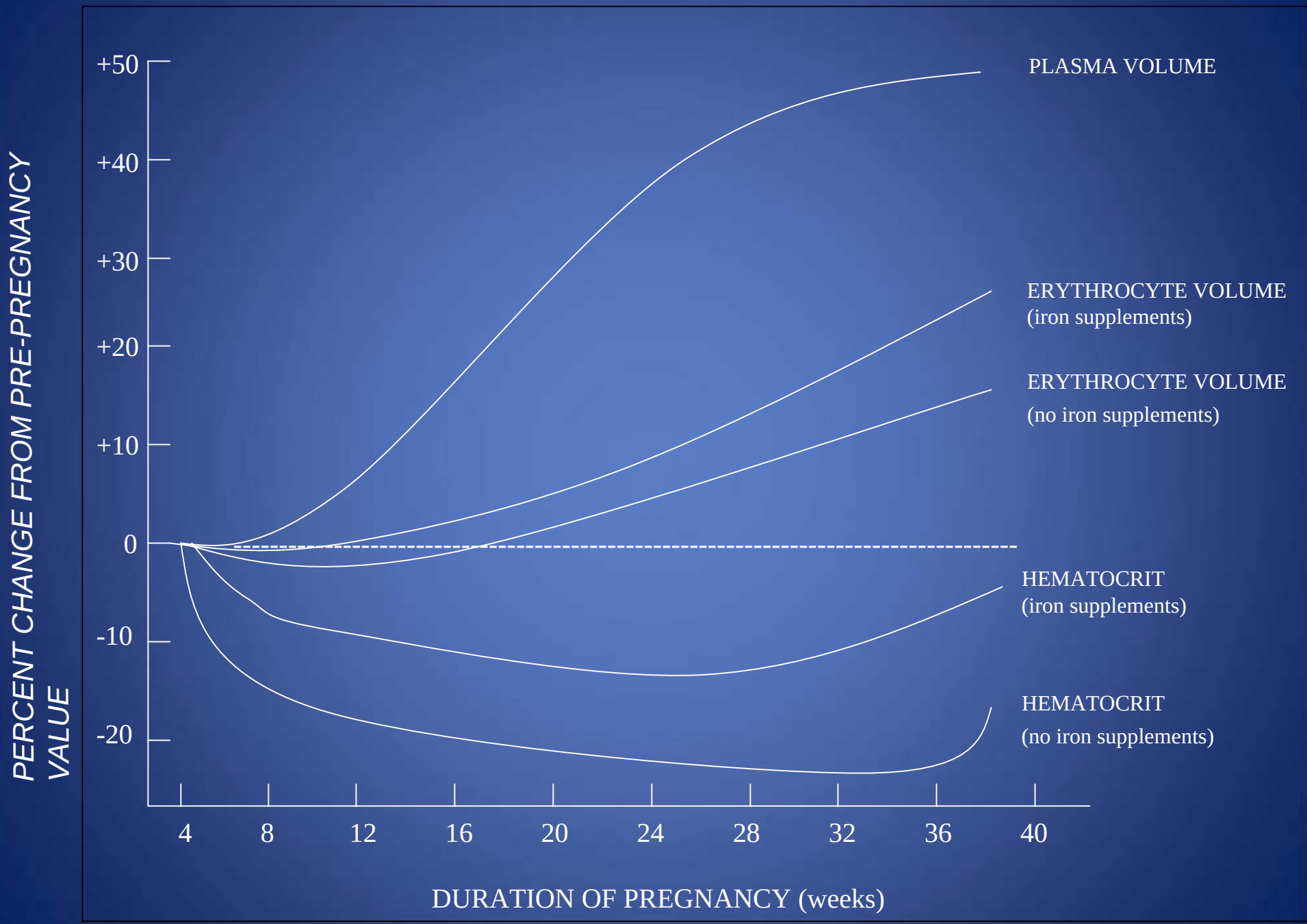
Cardiac Implications of the Hemodynamic Changes of Pregnancy

Increased preload	fluid overload of stenotic valvular lesions or LV dysfunction
Decreased afterload	increases outflow tract gradient in stenotic valvular lesions and decreases in valvular regurgitation
Increased heart rate	decreased ventricular filling time which may impact on forward flow


PERCENT CHANGE FROM PRE-PREGNANCY VALUE
+50
+40
+30
+20
+10
0
-10
-20
4
8
12
16
20
24
28
32
36
40
DURATION OF PREGNANCY (weeks)
PLASMA VOLUME
ERYTHROCYTE VOLUME
(iron supplements)
ERYTHROCYTE VOLUME
(no iron supplements)
HEMATOCRIT
(iron supplements)
HEMATOCRIT
(no iron supplements)

Hemodynamic Changes

Hemodynamic Alteration	Time of Peak Effect	Potential Risks
Cardiac output ↑30-50%	20-24 weeks	Women with limited cardiac function or reserve may develop congestive heart failure
Stroke volume ↑20%	20-24 weeks	Increase preload is a problem for obstructive lesions (mitral or aortic stenosis) or ventricular dysfunction
Heart rate ↑10-20%	Third Trimester	Tachycardia causes palpitations and impairs ventricular filling
Blood volume ↑40%	20-24 weeks	"Physiologic" anemia of pregnancy caused by less increased in erythrocyte mass
Peripheral vasodilatation	Throughout	↓blood pressure; ↓valvular regurgitation
↑Minute ventilation	Second Trimester	Sensation of tachypnea or dyspnea

Heart Failure in Pregnancy

- Due to pregnancy
- Peripartum cardiomyopathy
- Manifestation of pre-eclampsia/toxemia
- Fluid overload(iatrogenic)
- Cocaine use
- Undiagnosed cardiac disease

  ex: coronary anomalies

“Cardiac” signs During Pregnancy

- Neck vein distention
- Systolic murmur (pulmonic area)
- Tachycardia
- Ankle edema

Abnormal Exam Findings During Pregnancy

- **Progressive dyspnea**
- **Angina**
- **Palpitations with lightheadedness**
- **Syncope**
- **Arrhythmia**
- **Exertional syncope**
- **Progressive edema**
- **PND/Orthopnea**
- **Rales**
- **Diastolic murmur**
- **Change in systolic murmur**
- **S3**

Diagnostic testing during pregnancy

ECG, Holter, Event monitor

Echocardiography-safe and used for serial study

Transesophageal echo

Nuclear studies-contraindicated

Cardiac Catheterization-with abdominal shielding

MRI-usually after 18 weeks

Heart Failure and Pregnancy

Peripartum Cardiomyopathy

Incidence:	1/1300- 1/15,000.(1/3,000-4,000)	
Diagnosis	by exclusion (no preexisting disease)	
Clinical Onset:	last month of pregnancy-5 months postpartum, but has been described earlier in pregnancy	
Geography:	Haiti	1/299 live births
	South Africa	1/1000
	USA	1/2,289-4,000
	Nigeria	1/100

Risk Factors

- Maternal Age
- Multiparity
- Multiple Gestations
- Black Race
- Obesity
- Pre-eclampsia
- Hypertension
- Surrogacy

Heart Failure and Pregnancy

Peripartum Cardiomyopathy

Diagnostic Criteria (WHO)

- Cardiac failure in last month or within 5 months postpartum
- No pre-existing cardiac disease
- Echo EF < 45% or FS < 30%
- Echo LVEDD: >2.7 cm

Heart Failure and Pregnancy
Peripartum Cardiomyopathy

Proposed Etiologies

- **Myocarditis**
  - **lymphocytic infiltration**
- **Infection viral**
  - **chlamydia**
- **Abnormal Immune response (antibodies at delivery)**
- **Hemodynamic stress**
  - **relaxin from uterus**
  - **abnormal response**
- **Dietary**
  - **selenium deficiency**
  - **salt ingestion**
  - **thiamine deficiency**
- **Apoptosis**

Heart Failure and Pregnancy
Peripartum Cardiomyopathy

Diagnosis:

Echocardiography

MRI
- late gadolinium enhancement (inflammation)
- guide for biopsy
- limited data
- cannot predict future recovery

Heart Failure and Pregnancy
Dilated Cardiomyopathy

36 pregnancies (39% complication rate)

- 9 heart failure
- 7 arrhythmias
- 1 termination for CHF/NSVT @13 weeks
- 1 TIA

Predictors of adverse events

- Moderate or severe systolic dysfunction
- NYHA lll, lV
- (prior events)

Grewal, etal JACC 2010

Heart Failure and Pregnancy

Peripartum Cardiomyopathy

US/Haiti Experience

Prognosis:

56 women
61 pregnancies

Heart Failure rate:	29.5%
EF < 55% prior:	46.2%
EF ≥ 55% prior:	17.1%

Normal preconception stress echo: no relapse

Fett,etal: Int J Gynecol Obstet, 2009

Heart Failure and Pregnancy
Dilated Cardiomyopathy

Advised against pregnancy if EF < 30%

32 women:

- **11% history of heart failure**
- **67% NYHA l**
- **17% NYHA ll**
- **17% NYHA lll, lV**
- **Mild dysfunction (EF: 45-54%) 50%**
- **Moderate dysfunction (EF: 30-44%) 22%**
- **Severe dysfunction (EF: < 30 %) 28%**
- **84% idiopathic**
- **16 % after chemotherapy (adriamycin)**

36 pregnancies

Grewal, etal JACC 2010

Heart Failure and Pregnancy
LVST Ventricular Non-compaction

Hemodynamic changes of pregnancy and postpartum fluid shifts may precipitate CHF symptoms

Diagnosis by Echo: hypertrabeculation (apex, lateral wall)
focal hypokinesia

Risks: CHF
Arrhythmias
Future pregnancies

Patel, etal J Am Soc Echo 2007

Heart Failure and Pregnancy
Cardiomyopathies

Chaga's disease
- Trypanosoma cruzi
- Dilated Cardiomyopathy
- RBBB.; LAFB

Hypertrophic Cardiomyopathy
- usually well-tolerated*
- arrhythmia risk
- continue meds
- careful fluid adminstration in L&D

Management of the Woman with Cardiac Disease During Pregnancy

- **Periodic Clinical assessment**
- **Maintain volume status**
- **Monitor for anemia**
- **Evaluate febrile illness to detect endocarditis**
- **Serial echocardiography**
- **Evaluation of palpitations to detect arrhythmias**
- **Fetal echocardiography at 22 weeks if family history of congenital heart disease**
- **Anesthesiology evaluation in anticipation of delivery**

Heart Failure and Pregnancy Treatment

Salt and water restriction

DVT prophylaxis (EF < 35%)

Diuretics-for clinical CHF

Vasodilators-

- during pregnancy: hydralazine, amlodipine
- after delivery: ACE inhibitors

Intropic agents:

- digoxin
- dobutamime/dopamine-if clinically indicated

Beta-Blockers

- metoprolol
- carvedilol

Pharmacokinetic Considerations:Pregnancy

- Pregnancy impacts drug absorption, distribution, and elimination
- Renal drug elimination
  - Generally enhanced
  - Up to 50% increase in glomerular filtration rate
  - Renal plasma flow increase between 25% and 50%
- Hepatic drug elimination
  - Can be either increased, decreased, or unchanged
- Volume of distribution
  - Mean increase of 8 L in total body water
  - Decrease in peak serum concentrations

Medications and Pregnancy

Anticoagulant and Antiplatelet Agents			
Drug	**FDA Class**	**Potential Risk in Pregnancy**	**Fetal Effects**
Warfarin	X	Teratogenic, embryopathy, contraindicated	Inactive form
Heparin	B/C	Bleeding; osteoporosis, thrombocytompenia; prosthetic valve thrombosis	No
Aspirin	C/D	Bleeding; early ductus closure	Yes
Thrombolytics: streptokinase; tissue plasminogen activation	B/C	Bleeding; allergy	
Glycoprotein IIB, IIIA		Bleeding	Unknown
Inhibitors:			
Abciximab	C		Unknown
Eptifibatide	B	Nonteratogenic to animals	Unknown
Tirofiban	B	Crosses placenta in animals	Unknown
Clopidigrel	B	Bleeding	Unknown

Medications and Pregnancy

Inotropic Agents			
Drug	**FDA Class**	**Potential Risk in Pregnancy**	**Effects**
Digoxin	C	Probably safe; dosing may vary	Yes
Dopamine	C	Unknown	Unknown
Dobutamine	B	Unknown	Unknown
Amrinone	C	Unknown	Unknown
Diuretics			
Thiazide	C/D	Volume depletion, neonatal jaundice, thrombocytopenia	Yes
Furosemide	C	Volume depletion	Yes
Bumetanide	C	Hypovolemia	Unknown
Spironolactone	D	Hypovolemia	Yes
Torsemide	B	Hypovolemia; electrolyte derangement	Unknown

Medications and Pregnancy

B-Adrenergic Blockers			
Drug	**FDA Class**	**Potential Risk in Pregnancy**	**Effects**
Metoprolol	C	Unknown	Yes
Atenolol	D	Intrauterine growth restriction	Yes, causing infant bradycardia
Propranolol	C	Intrauterine growth restriction, bradycardia; hypoglycemia; respiratory depression	Yes
Esmolol	C	Fetal bradycardia	Unknown
Carvedilol	C	Hypotension	Unknown

Medications and Pregnancy

Vasodilators			
Drug	**FDA Class**	**Potential Risk in Pregnancy**	**Effects**
Nitrates	C	Hypotension	Unknown
Sodium Nitroprusside	C	Cyanide toxicity	Unknown
Angiotensin-converting enzyme inhibitors/Angiotensin receptor blockers	D	Contraindicated oligohydramnios; neonatal anuria	Yes, avoid breastfeeding
Hydralazine	C	Fetal distress with decrease in blood pressure rate, thrombocytopenia	Yes
Calcium Channel Blockers			
Diltiazem, verapamil, nifedipine, amiodipine	C	Unknown; possible uterine effects	Yes

Digoxin

Use: pulmonary edema
atrial arrhythmias
mitral stenosis
fetal arrhythmia

Crosses placental

Secreted breast milk

Higher doses may be required in pregnancy

Beta-blockers in Pregnancy

- Adverse fetal effects described with propranolol (treatment of maternal hypertension)
  - bradycardia
  - hypoglycemia
  - polycythemia
  - hyperbilirubinemia
  - intrauterine growth retardation
  - prolonged labor
  - fetal death (one case)
- Adverse fetal effects described with atenolol (treatment of maternal hypertension)
  - lower birth weight

Hydralazine

- Use:
  - congestive heart failure
  - afterload reduction

- Adverse effects:
  - palpitations
  - flushing
  - headache
  - orthostasis
  - angina
  - hypotension with reflex tachycardia
  - fetal thrombocytopenia

ACE-INHIBITORS

- Contraindicated in second and third trimesters!

Labor and Delivery

- General management recommendations
- SBE prophylaxis controversy
- Hemodynamic monitoring
- Mode of delivery
- Postpartum care and concerns

Management of Labor and Delivery
General Management

- Left lateral decubitis position
- Shortened second stage of labor
- Antibiotic prophylaxis
- Mode of delivery determined by obstetric indications
- Anesthetic management varies with cardiac disease

Management of Labor and Delivery Functional Class I & II Patients

General management
Clinical observation
Adequate analgesia
Maintain volume and blood pressure

Management of Labor and Delivery

Functional Class III & IV
Pulmonary Hypertension
Cardiomyopathy

Oxygen administration
Hemodynamic monitoring
Monitor at least 24 hours post-partum
Prophylactic heparin until ambulatory

Monitoring During Labor & Delivery

Indications: Invasive HemodynamicMonitoring

- NYHA III & IV
- Poor ventricular function
- Mitral stenosis
- Aortic stenosis
- Pulmonary hypertension
- Pulmonary edema/PPCM
- Severe hypertension