Physiologic Changes during Pregnancy and Labor

INSTRUCTOR: Luann Beacom, FNP, MPH, MSN

Original Outline by: Susan A. Merica-Jones PDA, CNM

OBJECTIVES

1. Discuss the impact of physiologic changes during pregnancy.
2. Learn common discomforts during pregnancy.
3. Identify potential etiologies or “differential diagnoses” related to the common discomforts of pregnancy.
4. Discuss the physiologic changes during the labor process.

PHYSIOLOGIC CHANGES DURING PREGNANCY

- Reproductive
- Gastrointestinal
- Respiratory
- Renal
- Hematologic
- Musculoskeletal
- Cardiovascular
- Integumentary
- Metabolic changes
- Endocrine

Objective 1
COMMON DISCOMFORTS DURING PREGNANCY

- Nausea / vomiting
- Round ligament
- Joint pain
- Shortness of breath
- Urinary frequency
- Pruritis
- Back pain
- Heart burn
- Edema
- Headache
- Leukorrhea

POTENTIAL ETIOLOGIES & DIFFERENTIAL DIAGNOSES

- Etiologies and Differential Diagnoses
  - Related to the normal discomforts of pregnancy
  - Review & discuss differences in class

PHYSIOLOGIC CHANGES DURING LABOR

- Blood pressure
- Renal functioning
- Metabolism
- Gastrointestinal functioning
- Temperature
- Blood count
- Respiration
PHYSIOLOGIC CHANGES DURING PREGNANCY

OBJECTIVE 1

- Uterus
  - Size & shape increase
  - Position
  - Dextra-rotary
  - Contractility
    - Braxton-Hick's
  - Blood flow
    - Increases 20 fold
  - Cervix
    - Shape & friability

REPRODUCTIVE SYSTEM

- Vagina
  - Increase discharge & sensitivity
- Breasts
  - Development of colostrum
  - May increase in size
- Pelvic floor
  - Increase in size

CERVICAL CHANGES

Nullipara

Multipara
CERVICAL CHANGES: WITHIN INITIAL 6 WEEKS

"Presumptive" Sign of Pregnancy:
- Chadwick's sign
- Bluish/purplish discoloration of vulva, vaginal mucosa, cervix
- Due to increased vascularity

"Probable" Signs of Pregnancy:
- Goodell's sign
- Softening of cervix
- Hegar's sign
- Softening of lower uterus

Note: Bladder & urethral elongation
CARDIOVASCULAR SYSTEM

- **Heart**
  - Increased Size
  - Position changes
  - Heart sounds
  - Murmurs, Audible S3, Split S1

- **Cardiac output**
  - Increased stroke volume and heart rate

- **Circulation**
  - Blood volume
  - Increase by 40 – 50%
  - Physiological anemia
  - BP changes
  - 26 to 29 weeks = lowest BP

CARDIOVASCULAR & HEMATOLOGICAL CHANGES

- **Increases:**
  - Heart rate by 10-15 bpm
  - Volume by 40-50%
  - Mostly plasma
  - Cardiac Output by 30-50%
  - RBC mass by 17%
  - WBC's especially 2nd and 3rd trimesters
  - Clotting factors

- **Decreases:**
  - BP especially 2nd trimester
  - Hgb & Hct
    - Especially 2nd trimester
    - Results in physiological anemia of pregnancy

RESPIRATORY SYSTEM

- **Anatomical changes**
  - Diameter, circumference & costal vertebral angle all increase
  - Diaphragm displacement
  - Thoracic replaces abdominal breathing
  - Upper respiratory changes
  - Vascularity increases
    - Nasal/sinus stuffiness
PULMONARY FUNCTION CHANGES

- Respiratory rate
  - Unchanged or slightly increased
- Total lung capacity
  - Unchanged or slightly decreased
- Oxygen consumption
  - Increased by 15-20%
- Total volume
  - Increased by 30-40%
- Inspiratory capacity
  - Increased
- Vital capacity
  - Unchanged

BASAL METABOLISM CHANGES

- Increases
  - 15-20%
  - At onset of pregnancy
  - Resolves 5-6 days postpartum

- Effects
  - Heat intolerance
  - Perspiration
  - Increase in sleep
  - Metabolic acid-base changes

- Basal metabolism changes
  - Increases
    - 15-20%
    - At onset of pregnancy
    - Resolves 5-6 days postpartum
  - Effects
    - Heat intolerance
    - Perspiration
    - Increase in sleep
    - Metabolic acid-base changes
**ACID-BASE BALANCE CHANGES**

- Progesterone
  - $pCO_2$ falls
  - $HCO_3^-$ falls
  - pH increases (alkaline)

**Facilitates transport**

- $CO_2$ from baby
- $O_2$ from mother
  - to baby

**OXYGEN DISSOCIATION CURVE** (BOHR EFFECT)

Moves in favor of the baby

**RENAL SYSTEM**

- Anatomic changes
  - Kidney
    - Renal pelvis dilates
    - Ureters
      - Dilate
      - Elongate
      - Compression
    - Bladder
      - $<$ tone...capacity
- May lead to...
  - Urinary frequency
  - Urinary tract infection (UTI) susceptibility
**RENAL FUNCTION PURPOSE**

- Electrolyte/pH balance
- Extracellular fluid volume
- Waste products
- Essential nutrients

**RENAL CHANGES**

- **Increased**
  - Glomerular filtration rate by 30-50%
  - Renal plasma flow by 30%
  - Urinary glucose by 20%

- **Decreased**
  - BUN
  - Creatinine
  - Uric acid

**RENAL METABOLIC CHANGES**

- Selective tubular reabsorption
  - Na+ & H2O
- Selective tubular excretion
  - Glucose
  - H2O (esp. 1st tri)
  - Protein
  - Water soluble vitamins

- Increased blood volume
- Increased thirst especially 1st trimester
  - Physiologic:
    - Glycosuria
    - Edema
    - Proteinuria
GASTROINTESTINAL SYSTEM
- Mouth
  - Gums bleed easily
  - Ptyalism
- Stomach/intestine
  - Increases in Herniation
  - Decreased
  - HCl
  - GI Motility
- Rectum
- Hemorrhoids
- Liver/gallbladder
- Gallstones (cholelithiasis)
- Cholestasis of pregnancy
- Appendix
  - Location
  - McBurney's point moves up & to the right

POSITION OF APPENDIX
- McBurney's point (note how it moves up)

MUSCULOSKELETAL SYSTEM
- Joints
  - Estrogen, Progesterone, & Relaxin
  - Hypermobility
  - Lordosis
- Ligament Stretching
  - Round
  - Uterosacral
  - Backache
- Center of gravity
  - Moves forward
- Abdominal wall
  - Diastasis
  - Assess post-partum
  - Exercises
    - Chin lifts, single leg lifts, abdominal tightening
INTEGUMENTARY SYSTEM
- Striae
- 50-90%
- Collagen
- Genetic
- Pigmentation
- Linea nigra
- Chloasma/melasma
- Oil & sweat increase
- Vascular changes
- Angiomas
- Estrogen
- Racially related
- Palmar erythema
- Edema
- Allergic reactions
- Enhanced

NEUROLOGICAL SYSTEM
- Sensory changes
  - Leg pain
  - Acrodyesthesia of hands (numb/tingling)
  - Carpal tunnel
  - Back pain
  - Lordosis
  - Compression of sciatic nerves
- Tension headache
- Estrogen/hormonal
- Lightheadehness
- Vasomotor instability
- Postural hypotension
- Hypoglycemia
- Muscle cramps
ENDOCRINE SYSTEM

- Pituitary & placenta
  - 20% painless spotting 1st trimester
- Thyroid
  - T3 increases 1st trimester
  - TSH unchanged
- Adrenals
  - Excess Na+
- Pancreas
  - Increased maternal insulin production
  - Results in lower maternal blood sugar levels

DISCOMFORTS OF PREGNANCY
AND DIFFERENTIAL DIAGNOSES

Objectives 2 & 3

Discomforts of pregnancy are typically related to physiologic changes....

....BUT be aware of the differential diagnoses that may actually be abnormal or pathologic processes!
**FIRST TRIMESTER COMPLAINTS & POTENTIAL DIFFERENTIAL DIAGNOSES**

- Breast tenderness
- Premenstrual mastitis
- Urgency/frequency
- UTI
- Nausea/vomiting
- Appendicitis
- Flu
- Hyperemesis

**Key:** Black ink = complaint
Blue ink = differential diagnosis

- Breast tenderness
- Premenstrual mastitis
- Urgency/frequency
- UTI
- Nausea/vomiting
- Appendicitis
- Flu
- Hyperemesis

**SECOND TRIMESTER COMPLAINTS AND POTENTIAL DIFFERENTIAL DIAGNOSES**

- Pruritis
  - Cholestasis
  - Palpitations and Faintness/syncope
  - Cardiac condition
- Food cravings
  - PICA
  - Heartburn
  - Epigastric pain

- Food cravings
  - PICA
  - Heartburn
  - Epigastric pain

**SECOND TRIMESTER CONT'D**

- Constipation
  - Bowel obstruction
  - Varicosities
  - Deep vein thrombosis
  - Leukorrhrea
  - Bacterial vaginosis or yeast infection
- Headaches
  - Pre-eclampsia
  - Round ligament pain
  - Kidney stones
  - Abruption
  - Appendicitis
  - Pre-term labor

- Headaches
  - Pre-eclampsia
  - Round ligament pain
  - Kidney stones
  - Abruption
  - Appendicitis
  - Pre-term labor
THIRD TRIMESTER COMPLAINTS AND POTENTIAL DIFFERENTIAL DIAGNOSES

- Dyspnea/SOB
- Respiratory or cardiac condition
- Insomnia
- Mental illness
- Back pain
- Preterm labor
- Kidney stones
- Frequency/urgency
- UTI
- Perineal discomfort
- Varicose veins
- Breastfeeding
- Preterm labor
- Edema (along with other symptoms)
- Preeclampsia
- Heartburn/nausea
- Gallstones
- Preeclampsia

NORMAL PHYSIOLOGIC CHANGES DURING LABOR

OBJECTIVE 4

- Blood Pressure
  - May increase
- Temperature
  - Increases
- Cardiac changes
  - Increases
- Respiratory Rate
  - Increases
- Renal System
  - Increases
- Gastrointestinal
  - Decreases
- Hematological
  - Increases

NORMAL PHYSIOLOGIC CHANGES IN LABOR

Areas of Physiologic Assessment

- Blood Pressure
  - May increase
- Temperature
  - Increases
- Cardiac changes
  - Increases
- Respiratory Rate
  - Increases
- Renal System
  - Increases
- Gastrointestinal
  - Decreases
- Hematological
  - Increases
HEMODYNAMIC CHANGES OVERVIEW: INTRA & POSTPARTUM

- **Intrapartum**
  - Pain
  - ↑ HR + BP
  - Pushing
  - Cardiac output changes
  - Valsalva
  - ↑ & ↓ preload/ cardiac output (CO)

- **Postpartum**
  - ↑ CO by 30%
  - Autodiuresis
  - ~ 24-48 hrs PP
  - Return to pre-pregnancy physiology
  - 6-8 weeks

HEMATOLOGICAL CHANGES DURING LABOR

**Increases:**
- Hgb
- Stress response/dehydration
- Clotting factors
- Plasma fibrinogen
- WBCs increase to 15,000 by birth

**Decreases:**
- Clotting time
- Glucose level

BLOOD PRESSURE CHANGES DURING LABOR

**May increase due to:**
- Uterine contractions
  - Systolic 10 - 20 mm Hg
  - Diastolic 5 - 10 mm Hg
- Fear; tension, pain

**May decrease due to:**
- Supine hypotension
- Post epidural anesthesia
- Hemorrhage
TEMPERATURE CHANGES DURING LABOR

- Elevated
  - Not greater than 1 – 2 degrees F (or 0.5 – 1 degrees C)
  - If higher, evaluate for:
    - Dehydration
    - Chorio-amnionitis
    - Epidural-related increase

RESPIRATORY CHANGES DURING LABOR

- Elevated
  - Especially if pain & fear present

- Avoid hyperventilation
  - Additional respiratory alkalosis
  - Decreased oxygenation to baby
  - Place O2 mask on mom if she is hyperventilating

RENAL SYSTEM CHANGES DURING LABOR

<table>
<thead>
<tr>
<th>Polyuria</th>
<th>Proteinuria</th>
<th>Ketones</th>
<th>Diuresis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine 15 – 30 ml/15 min or 100 ml/4 hrs</td>
<td>Trace or less in 1/3 to 1/2 of women</td>
<td>Never normal</td>
<td>1-3 days postpartum</td>
</tr>
</tbody>
</table>
### GASTROINTESTINAL CHANGES DURING LABOR

- **Decreased:**
  - Motility and absorption
  - Secretion of gastric juices
  - Absorption of liquid NOT affected

- **Increased:**
  - N/V especially during transition