Interpreting Maternal and Fetal Lab Values

Leslee Goetz RNC, MN
Swedish Medical Center
Leslee.goetz@swedish.org

Objectives

- Discuss common laboratory tests used in pregnancy and values that reflect need for additional evaluation, infection and or disease
- List clinical implications of abnormal laboratory values

Common Labs Used During Pregnancy

- Complete blood count CBC
  - Baseline screening tool
    - Anemia
    - Infection
    - Clotting Disorders
  - Complete Metabolic Panel CMP
    - Screening tool for organ function
      - Diabetes
      - Liver or Kidney Disease
      - Hypertensive disorders

Common Labs

- Urinalysis UA
  - Urologic Conditions
    - Urinary tract infection
    - Cystitis
    - Kidney disease
  - 24 hour urine
    - Kidney function
      - Protein
      - Creatinine

Complete Blood Count

- Erythrocytes
  - Hemoglobin
  - Hematocrit
  - Mean corpuscular volume = MCV
  - Mean corpuscular hemoglobin = MCH
  - Mean corpuscular hemoglobin concentration - MCHC
  - Red cell distribution width = RDW

Erythrocytes
Platelets

- Thromocytes
  - Platelet count
  - Mean platelet volume

White Blood Cells

- Leukocytes
  - Granulocytes
  - Neutrophils
  - Eosinophils
  - Basophils
  - Non-Granulocytes
    - Monocytes
    - Lymphocytes

Normal CBC Values

<table>
<thead>
<tr>
<th></th>
<th>Non-Pregnant</th>
<th>Pregnant</th>
</tr>
</thead>
<tbody>
<tr>
<td>RBC</td>
<td>4.2-5.4 mm³</td>
<td>3.8-4.4 mm³</td>
</tr>
<tr>
<td>WBC</td>
<td>4800-10,400/mm³</td>
<td>6600-12,000/mm³</td>
</tr>
<tr>
<td>HCT/HGB</td>
<td>0.47-0.51</td>
<td>0.37-0.48</td>
</tr>
<tr>
<td>MCV</td>
<td>80-100 fl</td>
<td>70-90 fl</td>
</tr>
<tr>
<td>MCH</td>
<td>27-34 fl</td>
<td>23-31 fl</td>
</tr>
<tr>
<td>MCHC</td>
<td>30-35 fl</td>
<td>30-35 fl</td>
</tr>
<tr>
<td>RDW</td>
<td>11.6-14.6%</td>
<td>Slight increase</td>
</tr>
<tr>
<td>Platelets</td>
<td>150,000-400,000/mm³</td>
<td>No change</td>
</tr>
</tbody>
</table>

Normal WBC Values

<table>
<thead>
<tr>
<th></th>
<th>Non-Pregnant</th>
<th>Pregnant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segs</td>
<td>53-79%</td>
<td>Increase</td>
</tr>
<tr>
<td>Bands</td>
<td>0-10%</td>
<td>Increase</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>13-46%</td>
<td>Increase slightly</td>
</tr>
<tr>
<td>Basophils</td>
<td>0-1%</td>
<td>Decrease slightly</td>
</tr>
<tr>
<td>Lymphs</td>
<td>13-46%</td>
<td>No change</td>
</tr>
<tr>
<td>Monos</td>
<td>3-9%</td>
<td>No change</td>
</tr>
</tbody>
</table>

CBC with Differential

- Bands, Segs, Monos, Lymphs, Eos, Basos

Clinical Indications

- Stress Response
- Contraction
- Infection
  - Bacterial
  - Viral
- Chorioamnionitis

Differential is used to identify the presence of infection.

"Left shift" describes an elevation in band neutrophils suggesting a bacterial infection.

An elevation in monocytes represents chronic inflammation and or stress response.

An elevation in lymphocytes signals a viral infection, a decrease is noted with the use of corticosteroid therapy.
Anemia

Iron Deficiency Anemia
- Approximately 80% of anemia in pregnancy is due to iron deficiency
  - Lab Values
    - MCV < 80
    - RDW > 16%
  - Additional tests to confirm iron deficiency anemia
    - Serum iron < 35
    - TIBC > 430
    - Ferritin < 100
    - TSAT% < 20%

Acute Abdomen
- Acute abdomen
  - Cholecystitis
  - Pancreatitis
  - Appendicitis
  - Liver disease
    - Pre-eclampsia
    - Fatty liver

Blood Chemistry
- Electrolytes
  - Sodium
  - Potassium
  - CO2
  - Chloride
- Glucose
- Calcium
- Protein
  - Albumin
  - Total protein
- Kidney
  - BUN
  - Creatinine
  - Uric acid
- Liver
  - ALT (SGPT)
  - AST (SGOT)
  - Bilirubin

Blood Chemistries

<table>
<thead>
<tr>
<th>Non-Pregnant</th>
<th>Pregnant</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUN</td>
<td>13.0 ± 3.0 mg/dl</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.65 ± 0.14 mg/dl</td>
</tr>
<tr>
<td>Uric Acid</td>
<td>4.2 ± 1.3 mg/dl</td>
</tr>
<tr>
<td>ALT</td>
<td>10-40 IU/L</td>
</tr>
<tr>
<td>AST</td>
<td>10-37 IU/L</td>
</tr>
<tr>
<td>LDH</td>
<td>01-180 IU/L</td>
</tr>
</tbody>
</table>
Comprehensive Metabolic Panel

- Clinical indications
  - Pre-eclampsia
  - Diabetic ketoacidosis
  - Hyperemesis/Prolonged nausea and vomiting
  - Kidney Disease
  - Liver Disease

Urinalysis

- Obtaining the specimen
- Urine dipsticks
- Significance of results
- When to culture
- Physiology of pregnancy
- Interpreting the results

Normal Values

<table>
<thead>
<tr>
<th></th>
<th>Non pregnant</th>
<th>Pregnant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Vortex</td>
<td>Vortex</td>
</tr>
<tr>
<td>Clarity</td>
<td>Clear</td>
<td>Clear</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>1.003-1.005</td>
<td>1.003-1.005</td>
</tr>
<tr>
<td>pH</td>
<td>4.5-8.0</td>
<td>4.5-8.0</td>
</tr>
<tr>
<td>Protein</td>
<td>Negative</td>
<td>Trace to 1+</td>
</tr>
<tr>
<td>Blood</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Ketones</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Glucose</td>
<td>Negative</td>
<td>Present at times</td>
</tr>
<tr>
<td>Nitrites</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Leukocyte Esterase</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>RBC</td>
<td>0-5/hpf</td>
<td>0-5/hpf</td>
</tr>
<tr>
<td>WBC</td>
<td>0-5/hpf</td>
<td>0-5/hpf</td>
</tr>
<tr>
<td>Epithelial cells</td>
<td>Few/hpf</td>
<td>Few/hpf</td>
</tr>
<tr>
<td>Bacteria</td>
<td>0-1/hpf</td>
<td>0-1/hpf</td>
</tr>
</tbody>
</table>

Increased risk for urinary tract infections

- Normal physiology
  - Increased bladder volume
  - Urinary stasis in bladder and ureters
  - Decreased bladder and urethral tone
  - Ureterovesical reflux
  - Glycosuria
  - Decreased ability to fight off invading bacteria due to the increase of progestins and estrogens

Renal Function Studies

<table>
<thead>
<tr>
<th>Variable</th>
<th>Non-pregnant Values</th>
<th>Pregnant Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatinine Clearance</td>
<td>85-120 ml/min</td>
<td>120-180 ml/min</td>
</tr>
<tr>
<td>Urine Protein</td>
<td>&lt; 150 mg/24 hr</td>
<td>&lt; 250/400 mg/24 hr</td>
</tr>
</tbody>
</table>
Fetal Surveillance
- Fetal movement
- Non-stress test
- Biophysical profile
- Ultra sound
- Doppler flow studies

Biophysical Profile
- 5 activities
  - Fetal tone
  - Fetal movement
  - Fetal breathing
  - Amniotic Fluid Volume
  - NST
- Score
  - 8-10 reassuring
  - 4-6 non-reassuring
  - 0-2 immediate delivery

Doppler Flow Studies
- Clinical indications
  - Chronic nutritive and hypoxic stress of the fetus
  - Maternal and fetal vasculopathies
- Doppler waveform analysis
  - S/D ratio peak systolic frequency and end diastolic frequency
  - Umbilical artery, umbilical vein, and middle cerebral artery

IUGR Fetus

Umbilical Artery Doppler
- Normal
- Increased
- Absent
- Reversed

Doppler Interpretation
- High or increasing end diastolic flow
  - Close surveillance
  - Management dependant on gestation
- Reversed end diastolic flow
  - Delivery regardless of gestation
- S/D ratio>3.0 or RI > 0.6 for gestations greater than 28 weeks
### Newborn Labs
- Sepsis
  - CBC
    - I/T ratio
- Hyperbilirubinemia
- Newborn Screening

### Questions