Anesthesia & Analgesia for Labor & Delivery

Department of Anesthesiology
University of Colorado Denver Health Sciences Center
(prepared by Brenda A. Bucklin, MD)
"There will be a delay. The stork got tangled up with our Medivac helicopter."
Objectives

• Describe the physiologic changes of pregnancy
• Describe the pain pathways of labor and delivery
• Describe labor analgesic techniques
• Describe anesthesia for cesarean delivery
• Discuss pregnancy-related mortality
Physiologic Changes of Pregnancy

- Cardiovascular
- Pulmonary
- Gastrointestinal
- Renal Hepatic
- Nervous System
# Cardiovascular Changes

<table>
<thead>
<tr>
<th>Intravascular Volume</th>
<th>Increased 35%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Volume</td>
<td>Increased 45%</td>
</tr>
<tr>
<td>RBC Volume</td>
<td>Increased 20%</td>
</tr>
<tr>
<td>Cardiac Output</td>
<td>Increased 40%</td>
</tr>
<tr>
<td>Stroke Volume</td>
<td>Increased 30%</td>
</tr>
<tr>
<td>Heart Rate</td>
<td>Increased 15%</td>
</tr>
<tr>
<td>Peripheral Circulation</td>
<td>No change</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>Decreased 20%</td>
</tr>
<tr>
<td>PVR</td>
<td>Decreased 35%</td>
</tr>
<tr>
<td>CVP</td>
<td>No change</td>
</tr>
</tbody>
</table>
Supine Hypotension Syndrome

Decreased blood pressure associated with supine positioning.

Compression of the Inferior Vena Cava & Aorta with Supine Positioning

Left Uterine Displacement is an important maneuver to relieve it!
Pulmonary Changes-I: Airway

- Capillary engorgement of upper airway mucosa
- Vocal cord, arytenoid edema
- Weight gain: short neck & large breasts
## Pulmonary Changes-II

<table>
<thead>
<tr>
<th>Minute Ventilation</th>
<th>Increased 50%</th>
<th>Increased 40%</th>
<th>Increased 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal Volume</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory Rate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lung Volumes</th>
<th>Decreased 20%</th>
<th>Decreased 20%</th>
<th>No Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expiratory Reserve Volume</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Functional Residual Capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vital Capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Lung Capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Pulmonary Changes-III

| Arterial Blood Gases and pH | Slight Decrease  
| PaO₂  | Decreased 10mmHg  
| PaCO₂ | No Change  
| pH    |  
| Oxygen Consumption | Increased 20% |
Gastrointestinal Changes-I

• Reflux secondary to
  – Displacement of pylorus by gravid uterus
  – Incompetence of physiologic sphincter

• Decreases in motility by progesterone

• Low pH caused by gastrin secreted by placenta
Gastrointestinal Changes-II

Regardless of the time interval since food ingestion, parturients must be treated as a “full stomach”. Pain, anxiety, and opioids can all decrease gastric emptying.
Renal Changes

• Renal blood flow and GFR increased by 50%
• BUN and creatinine concentrations may be decreased by 50%
Hepatic Changes

- Pseudocholinesterase decreased by 25% (unlikely to decrease effects of succinylcholine)
- Coagulation factors are increased
Nervous System Changes

• Decreased anesthetic requirements
  – Decreased MAC produced by sedative effects of increased progesterone
  – Decreased local anesthetic requirements produced by
    • Epidural vein engorgement from uterine enlargement resulting in decreased epidural space and compression of subarachnoid space
    • Increased progesterone
1\textsuperscript{st} Stage: visceral pain from uterine contractions and cervical dilation. Afferent impulses are transmitted by nerves that accompany nerve fibers that enter the spinal cord at T10-L1.

2\textsuperscript{nd} Stage: somatic pain is vaginal and perineal. These impulses travel via the pudendal nerves to S2-4.
Labor Pain versus Other Types of Pain

Pain (PRI) Scores

<table>
<thead>
<tr>
<th>Labor pain</th>
<th>Clinical pain syndromes</th>
<th>Pain after accident</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primiparas (no training)</td>
<td>Causalgia</td>
<td>Amputation of digit</td>
</tr>
<tr>
<td>Primiparas (prepared childbirth training)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiparas (trained and untrained)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic back pain</td>
<td>Pain (non-terminal)</td>
<td>Bruise</td>
</tr>
<tr>
<td>Cancer pain</td>
<td>Phantom limb pain</td>
<td>Fracture</td>
</tr>
<tr>
<td>(non-terminal)</td>
<td>Post-herpetic neuralgia</td>
<td>Cut</td>
</tr>
<tr>
<td>Phantom limb pain</td>
<td>Toothache</td>
<td>Laceration</td>
</tr>
<tr>
<td>Post-herpetic neuralgia</td>
<td>Arthritis</td>
<td>Sprain</td>
</tr>
</tbody>
</table>

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Progress of Labor

[Graph showing the progress of labor with stages: latent phase, active phase, acceleration phase, phase of maximum slope, deceleration phase, second stage. The graph plots cervical dilation (cm) against time (hr).]
Goals of Labor Analgesia

• Provide adequate analgesia with minimal motor block
• Administer low concentrations of local anesthetics
• Opioids reduce local anesthetic concentrations
• Increased local anesthetic concentrations may increase risk for instrumental/operative delivery
Neuraxial Labor Techniques

- Epidural Analgesia
- Single-Injection Opioids
- Combined Spinal-Epidural Analgesia
Epidural Analgesia for Labor

• Excellent pain relief & maternal satisfaction
• Easily converts to surgical anesthetic, even in emergent/urgent situation.
• Avoids use of general anesthesia in most cases
• Negative effects on risk for cesarean delivery have been refuted
• Maternal request is sufficient for placement provided there are no contraindications
Single Injection Spinal Opioids

• Provides rapid onset of analgesia.
• Minimal motor block, even with addition of local anesthetic.
• May be useful in select patients (multiparas) or small community practices without in-house anesthesia coverage.
Single Injection Spinal Opioids

- Not useful for urgent or emergent C/S
- Limited duration
- Respiratory depression, especially after parenteral opioids
- Reports of fetal bradycardia
- Reports of uterine hypertonus
Local Anesthetic Concentrations

Concentration of <.125% bupivacaine +/- opioids reduce risk of motor block in laboring patients.
## Regional Anesthesia for Labor and Vaginal Delivery

<table>
<thead>
<tr>
<th>Area of Anesthesia</th>
<th>Type of Pain Blocked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lumbar Epidural Segmental Standard</td>
<td>T10-L1</td>
</tr>
<tr>
<td>Spinal Saddle</td>
<td>S1-S5</td>
</tr>
<tr>
<td>Pudendal Block</td>
<td>S2-S4</td>
</tr>
</tbody>
</table>
Pain Intensity: Labor and Delivery

A) Early first stage
B) Late first stage
C) Early second stage
D) Delivery

Pain intensity: Mild, Moderate, Severe

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Combined Spinal Epidural

• Analgesia during prolonged labor.
• Converts easily for operative delivery.
• Useful during latent phase of labor.
Combined Spinal Epidural
Anesthesia for Cesarean Delivery

- Regional anesthesia is preferred:
  - There is increased maternal mortality associated with general anesthesia
  - Less neonatal exposure to depressant drugs
  - Decreased risk of maternal aspiration
  - An awake mother
  - Use of spinal or epidural opioids for post-op pain control
Anesthesia for Cesarean Delivery

- Cesarean delivery requires a T4 sensory level
- Spinal anesthesia provides rapid onset of a reliable block
- Epidural anesthesia is preferred when a labor epidural is in place
- Combined spinal epidural anesthesia is used for repeat cesarean deliveries or when the case is expected to be prolonged
However, general anesthesia offers…

• Very rapid, reliable onset
• Control of airway and ventilation
• Potentially less hypotension than neuraxial anesthesia
• Anesthesia in the event of obstetric/hemorrhagic emergencies (e.g. fetal bradycardia, uterine rupture)