Normal and Abnormal Labor
Gregory L Goyert, MD

Cardinal mechanisms of labor
- Descent
- Engagement
- Flexion
- Internal rotation
- Extension
- External rotation
- Expulsion

Labor
The Basics
- Pelvic planes
  - Diagonal conjugate
    - Inferior border of symphysis to sacral promontory
  - Pelvic inlet
    - Obstetric conjugate
Labor
The Basics

- Pelvic types
  - Gynecoid
  - Anthropoid
  - Occiput posterior
  - Platypelloid
  - Occiput transverse
  - Android (male)

Labor
The Fetus

- Lies
  - Transverse
  - Oblique
  - Longitudinal
- Longitudinal
  - Breech
    - Complete, incomplete, frank
  - Cephalic
    - Vertex
    - Suboccipitobregmatic
    - Brow
    - Verticomental-largest diameter
  - Face
    - Submentobregmatic

Labor
The Stages

- First stage
  - Latent phase
    - Onset to active phase
      - Avg 12 hrs nullip
      - Avg 6 hrs multip
    - Prolonged:
      - > 20 hrs nullip
      - > 14 hrs multip
  - Active phase
    - Acceleration
    - Maximum slope
    - Deceleration
Abnormal Active Phase Labor

- Nullipara protraction
  - < 1.2 cm/hr dilatation
  - < 1.2 cm/hr descent
- Multipara protraction
  - < 1.5 cm/hr dilatation
  - < 1.5 cm/hr descent
- Active phase arrest (regardless of parity)
  - > 2 hrs no change in dilatation
  - > 1 hr no descent
- Complicates 8-11% of all cephalic labors

Evaluating Abnormal Labor

- Accurate diagnosis crucial
  - Prolonged latent
  - Protraction
  - Arrest

“Normal First Stage Labor”
Another Look

- Data from National Collaborative Perinatal Project
  - 26,838 patients studied 1959-1966
  - Overall cesarean section rate 5.8%, rate of induction 7.1%
  - Observation of “natural process of labor”
- Active phase of labor may start much later
  - 5 cm in multiparas
  - Nulliparas may start active phase even later
- “Inflection points” for multiparas more obvious and much earlier
  - Nulliparas inflection point less distinct and appeared later
- 2-hr threshold for diagnosing arrest may be too short before 6 cm
  - 4-hour threshold may be too long after 6 cm
  - Cervical dilation accelerates as labor advances
Table 2. Spontaneous Labor Progress Stratified by Cervical Dilation and Parity

<table>
<thead>
<tr>
<th>Cervical Dilation (cm)</th>
<th>Parity 0 (5th percentile)</th>
<th>Parity 1 (5th percentile)</th>
<th>Parity 2 or Greater (5th percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–4</td>
<td>1.8 (1.1)</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>4–5</td>
<td>1.3 (1.4)</td>
<td>1.4 (2.3)</td>
<td>1.4 (2.1)</td>
</tr>
<tr>
<td>5–6</td>
<td>0.8 (3.2)</td>
<td>0.8 (3.4)</td>
<td>0.8 (3.4)</td>
</tr>
<tr>
<td>6–7</td>
<td>0.6 (2.2)</td>
<td>0.5 (1.9)</td>
<td>0.5 (1.6)</td>
</tr>
<tr>
<td>7–8</td>
<td>0.5 (1.6)</td>
<td>0.4 (1.2)</td>
<td>0.4 (1.2)</td>
</tr>
<tr>
<td>8–9</td>
<td>0.5 (1.4)</td>
<td>0.3 (1.0)</td>
<td>0.3 (0.9)</td>
</tr>
<tr>
<td>9–10</td>
<td>0.5 (1.4)</td>
<td>0.3 (0.9)</td>
<td>0.3 (0.8)</td>
</tr>
</tbody>
</table>

Evaluating Abnormal Labor

- **Powers**
  - Montevideo units
    - Strength of contractions in mm of mercury times frequency of contractions per 10 minutes
  - Before active phase arrest can be diagnosed
    - Latent phase completed (> 5 cm)
    - Contractions of > 200 Montevideo units > 2 hrs
  - Quantitative measurement not linked to improved perinatal outcome or lower cesarean birth rates

- **Passenger**
  - Fetal weight, position, attitude, asynclitism

- **Passage**
  - X-ray pelvimetry not clinically useful
  - Clinical pelvimetry may be helpful
Recommendations for the Safe Prevention of the Primary Cesarean Delivery

- **First stage of labor**
  - A prolonged latent phase (eg, greater than 20 hours in nulliparous women and greater than 14 hours in multiparous women) should not be an indication for cesarean delivery.
  - Slow but progressive labor in the first stage of labor should not be an indication for cesarean delivery.

ACOG/SMFM Obstetric Care Consensus: Reaffirmed 2016

- Cervical dilation of 6 cm should be considered threshold for the active phase of most women in labor. Before 6 cm of dilation is achieved, standards of active phase progress should not be applied.

- Cesarean delivery for active phase arrest should be reserved for women at or beyond 6 cm of dilation with ruptured membranes who fail to progress despite 4 hours of adequate uterine activity, or at least 6 hours of oxytocin administration with no cervical change.

ACOG/SMFM Obstetric Care Consensus: Reaffirmed 2016

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**Labor**

**Second Stage**

- Complete dilatation to delivery
  - Average 50' in nullipara
  - Average 20' in multip
- Prolonged second stage
  - > 2 hrs nullipara (3 hrs w/epidural)
  - > 1 hr multipara (2 hrs w/epidural)
- 2014 Study of 42,000+ vaginal deliveries looking at epidural
  - Normal neonatal outcomes
  - 95th %tile with epidural
    - Nulliparous: 4 hours; multiparous: 3 hours
    - Consistent with 2012 NICHD workshop recommendations
- Duration of second stage not linked to adverse perinatal outcome

Cheng et al. Obstet Gynecol March 2014

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Cheng et al. Obstet Gynecol March 2014
Recommendations for the Safe Prevention of the Primary Cesarean Delivery

- Second stage of Labor
  - A specific absolute maximum length of second stage of labor beyond which all women should undergo operative delivery have not been identified
  - If maternal-fetal status allows:
    - > 2 hours of pushing in G1+ patients
    - > 3 hours of pushing in G2 patients
  - Longer duration may be appropriate for certain circumstances including epidural or fetal malposition

ACOG/SMFM Obstetric Care Consensus: Reaffirmed 2016

Treating Abnormal Labor

- Amniotomy
  - Literature mixed regarding benefit

- Oxytocin
  - Octapeptide stored in posterior pituitary
  - In-vitro half-life 3-5 minutes
  - In-vivo steady-state concentration 20-40 minutes
  - Low-dose vs. high-dose protocols
    - Low-dose, standardized protocols safer
      - Less tachysystole, lower doses of oxytocin required

Treating Abnormal Labor

- Dilute oxytocin via infusion pump
  - Clear documentation of indications
  - Careful and continued fetal assessment

- Major adverse effect is tachysystole
  - > 5 contractions per 10 minutes
  - Contractions lasting > 2 minutes
  - Hyperstimulation implies fetal compromise versus tachysystole
    - Not a currently favored term
Oxytocin
New Perspectives

- Drug most commonly associated with adverse OB events
  - Designated as high-alert medication
  - Institute for Safe Medication Practices
  - Only 11 other medications so designated
- Pharmacologic considerations
  - Onset of activity of a given dose is slow
  - Steady-state level reached > 40 minutes
  - Unpredictable ‘therapeutic index’
  - Harmful effects of drug mediated by dose-related impact on uterine activity and fetal compromise from tachysystole
- Supports concept that if 2 protocols achieve equivalent clinical results, protocol with lower infusion rate preferable

Most previous oxytocin guidelines were vague
- Initial infusion rates vary 200-300%
- Perinatal outcomes not improved with aggressive infusion protocols
- With high-dose infusions, tachysystole occurs in up to 50% of patients and cesarean section for fetal compromise occurs twice as often when compared to low-dose protocols
- Infusion protocols that increase infusion rate at intervals of less than 30 minutes...are inappropriate
- Once contraction patterns described previously have been achieved, failure of subsequent labor progression over an appropriate time period should lead to cesarean section rather than to the administration of more oxytocin
- “In virtually any aspect of human endeavor, uniformity of approach is associated with improved performance or outcomes.”

Protocol for minimizing failed labor inductions

- Prospective trial of 509 induction patients
- No cesarean permitted before active phase labor unless membranes ruptured and oxytocin infused for at least 12 hours
- Many nulliparas in latent labor at 6 and 9 hours had safe vaginal deliveries and latent phase cesareans for multiparas were eliminated
Active Management of Labor

- Developed in Ireland with excellent results
  - Patient education
  - Strict criteria for diagnosis of labor
  - Strict criteria for diagnosis of abnormal labor
  - High-dose oxytocin infusion
  - Personal nurse in labor
  - Strict interpretation of fetal compromise
  - Peer review of operative deliveries
  - Logistically, proved difficult to implement in US

Nonmedically Indicated Early-Term Deliveries ACOG

- Non-medically indicated delivery is NOT appropriate
- Observe greater rates of morbidity and mortality among neonates and infants delivered electively at 37-39 weeks compared with deliveries at 39-40 weeks
  - Differences are consistent, large, and statistically significant across multiple studies
  - Payment denied for < 39 week elective deliveries
- Documentation of fetal lung maturity does not justify early non-indicated delivery
  - ‘Hard Stops’ at < 39 weeks
  - Most effective process strategy

Normal and Abnormal Labor
Postterm Pregnancy
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Definition of Term Pregnancy
- Early term
  - 37+0 through 38+6
- Full term
  - 39+0 through 40+6
- Late term
  - 41+0 through 41+6
- Postterm
  - 42+0 and beyond

Postterm Pregnancy
Definition
- Pregnancy at or beyond 42 weeks
- 294 days from LMP
- EDC plus 14 days
- Complicated 5.5% of pregnancies in 2011
Postterm Pregnancy
Etiology

- Commonly incorrect gestational age assignment
- When real, usually idiopathic
- Associations
  - Nulliparity
  - Previous postterm pregnancy
  - Male fetus
- Rare causes
  - Placental sulfatase deficiency
  - Fetal anencephaly
  - Fetal adrenal insufficiency

Postterm Pregnancy
Gestational Age Assignment

- LMP may or may not be reliable
- Postterm pregnancies decreased from 9.5% to 1.5% when US used to 'confirm' LMP
- Crown rump length in first trimester (< 14 weeks)
- BPD/FL in 2nd trimester
- Re-date with Ultrasound if:
  - 5 days difference at < 9 weeks
  - 7 days difference at 9-16 weeks
  - 10 days difference at 16-22 weeks
  - 14 days difference at 22-28 weeks
  - 21 days difference at > 28 weeks
- Individualize patient assessment

Postterm Pregnancy
Fetal Risks

- Perinatal mortality (sb + nn deaths)
  - 2-3/1000 deliveries at term
  - 4-7/1000 deliveries at 42 weeks (1.8 OR)
  - 8-10/1000 deliveries at 43 weeks (2.9 OR)
- Calculation may underestimate risk
  - Data use all pregnancies, not ongoing pregnancies
    - Patient delivered at 41 wks not at risk at 42 wks
Postterm Pregnancy
Fetal Risks

- Uteroplacental insufficiency, meconium aspiration, infection, oligohydramnios
- Low umbilical artery pH, low 5-min APGAR, abnormal FHR tracing
  - Increased risk NICU admission
- Higher risk of macrosomia
  - 2.5-10% vs. 0.8-1%
  - Prolonged labor, CPD, shoulder dystocia
- Increased risk of death 1st year of life

Postterm Pregnancy
Dysmaturity Syndrome

- Complicates 10-20% of postterm infants
- Described by Clifford 1954
- Subcutaneous wasting; skin peeling
- Absent vernix; meconium staining
- Resemble effects of chronic IUGR

Postterm Pregnancy
Dysmaturity Syndrome

- Increases risk for:
  - Umbilical cord compression due to decrease AFV
  - Meconium aspiration
  - Abnormal ante/intra partum FHR
  - Hypoglycemia, seizures, respiratory distress
Postterm Pregnancy
Maternal Risks

- Primarily related to macrosomia
  - Prolonged labor, severe perineal injury
  - Increased risk cesarean delivery

- Often produces substantial anxiety

Postterm Pregnancy
Prevention Strategies

- Early pregnancy dating decreases diagnosis
  - More accurate
  - Rates decreased 9.5% to 1.5%

- Breast/nipple stimulation not effective

- Sweeping/stripping membranes effective
  - 2005 Cochrane review
  - Significant reduction pregnancies > 41 weeks

- Preventative labor induction?

Postterm Pregnancy
Antenatal Testing

- Not an evidence-based practice
  - No RCTs demonstrate efficacy
  - No demonstrated benefit of testing
  - No evidence of adverse impact

- But, given increased risk IUFD at 41 weeks
  - 'Initiation of antepartum fetal surveillance at or beyond 41+0 weeks of gestation may be indicated'
Postterm Pregnancy Antenatal Testing

- No consensus regarding frequency/modality
- Options
  - NST, BPP, CST, modified NSTs
  - Doppler velocimetry not beneficial
- Delivery indicated with fetal compromise or oligo
  - Use of MVP < 2 cm instead of AFI < 5 cm
  - Meta-analysis of RCTs
  - Reduction in unnecessary interventions
- Testing often performed twice weekly

Postterm Pregnancy Management

- Several large multicenter trials
  - 3407 low risk patients at 41 weeks
  - Randomized: induction or expectant mgt
  - Induction group had lower cs rate
    - 21% vs. 24.5%
  - Less non-reassuring FHR tracings
  - Patient satisfaction higher in the induction group

Postterm Pregnancy Management

- Cochrane database review
  - 22 RCT’s of induction at 41 weeks
  - Lower perinatal mortality (RR, 0.31)
  - No increase in CS rate (RR,0.89)
  - Reduced MAS (RR, 0.50)
  - No effect on operative vaginal delivery rate, FHR abnormalities, analgesia use, NICU admission
Postterm Pregnancy Management

- “Induction of labor between 41+0 and 42+0 can be considered. Induction of labor after 42+0 and by 42+6 is recommended given evidence of an increase in perinatal morbidity and mortality.”

Postterm Pregnancy Management
Other Issues

- Patients with prior cesarean section
  - Risk of uterine rupture
    - 1.6/1000 repeat CS and no labor
    - 5.2/1000 spontaneous labor
    - 7.7/1000 induced labor w/o PG
    - 24.5/1000 induced labor w/PG
  - “TOLAC remains an option for women with postterm pregnancies who have not had a prior vaginal delivery”

Postterm Pregnancy Summary
Consistent Scientific Evidence (Level A)

- Late-term and postterm pregnancies are associated with an increased risk of perinatal morbidity and mortality
- Induction of labor after 42+0 and by 42+6 is recommended given the increase in perinatal morbidity and mortality
Postterm Pregnancy Summary

Limited or Inconsistent Scientific Evidence (Level B)

- Membrane sweeping is associated with a decreased risk of late-term and postterm pregnancies
- Induction of labor between 41+0 and 42+0 can be considered

ACOG Practice Bulletin #146, August 2014

Postterm Pregnancy Summary
Consensus/Expert Opinion (Level C)

- Initiation of antepartum fetal surveillance at or beyond 41+0 may be indicated
- A trial of labor after cesarean delivery is a reasonable option in the management of uncomplicated postterm pregnancies

ACOG Practice Bulletin #146, August 2014

Postterm Pregnancy
Questions?