LABOR: How Long Is Too Long?

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Overview
- Labor Curve
- Protracted labor/active phase arrest
  - Clinical implications
  - Management options
- Prolonged second stage of labor
  - Risk factors
  - Associated maternal/neonatal outcomes
  - Management options

Labor: Mode of Delivery


Total and primary cesarean rate and vaginal birth after previous cesarean (VBAC): United States, 1989–2004

<table>
<thead>
<tr>
<th>Year</th>
<th>Total cesarean</th>
<th>VBAC</th>
<th>Primary cesarean</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>26.0%</td>
<td>20.7%</td>
<td>20.6%</td>
</tr>
<tr>
<td>2001</td>
<td>26.0%</td>
<td>20.7%</td>
<td>20.6%</td>
</tr>
<tr>
<td>2002</td>
<td>26.0%</td>
<td>20.7%</td>
<td>20.6%</td>
</tr>
<tr>
<td>2003</td>
<td>26.0%</td>
<td>20.7%</td>
<td>20.6%</td>
</tr>
<tr>
<td>2004</td>
<td>26.0%</td>
<td>20.7%</td>
<td>20.6%</td>
</tr>
</tbody>
</table>
Labor: Mode of Delivery

- U.S. 2006: Cesarean delivery 31.1%

![Graph showing cesarean delivery rates by age of mother, United States, 1990-2005.](image)


Labor

ACOG: the presence of uterine contractions of sufficient intensity, frequency, and duration to bring about demonstrable effacement and dilation of the cervix

- Labor dystocia
  - slow, abnormal progression of labor
    - leading indication of primary cesarean in US
    - 60% of all CD attributable to labor dystocia

Objectives

- First stage of labor
  - Definition
    - “normal” labor progression
    - “abnormal” labor pattern
  - Management options

- Second stage of labor
  - Define “normal” vs. “prolonged” second stage
  - Management options
    - Expectant management
    - Operative delivery
**Labor**

ACOG: the presence of uterine contractions of sufficient intensity, frequency, and duration to bring about demonstrable effacement and dilation of the cervix

![ACOG Practice bulletin. Dystocia and augmentation of labor. No 49; Obstet Gynecol 2003 Friedman EA. Primigravid labor. Obstet Gynecol 1955](image)

**Friedman: Labor Curve**

- Rate of cervical dilation
  - Nulliparas: 1.0cm/hr
  - Multiparas: 1.2cm/hr
- Protracted active labor: <1.2cm/hour
- Active phase arrest: no dilation for 2 hours
- Protracted descent: <1cm/hr
- Arrest of descent: no decent for 1 hour

![Friedman EA. Primigravid labor. Obstet Gynecol 1955 Friedman EA, Sachtleben MR. Dysfunctional labor. Obstet Gynecol 1961](image)

**First Stage of Labor**

- Kilpatrick 1989: Length of first stage (mean, 95%ile)
  - Nulliparas
    - without anesthesia: 8.1 hrs (16.6 hrs)
    - with anesthesia: 10.2 hrs (19.0 hrs)
  - Multiparas
    - without anesthesia: 5.7 hrs (12.5 hrs)
    - with anesthesia: 7.4 hrs (14.9 hrs)
- Albers 1999: mean active phase
  - Nulliparas: 7.7 hrs (17.9 hrs)
  - Multiparas: 5.6 hrs (13.8 hrs)


**First Stage of Labor**


![Zhang et al. Reassessing the labor curve in multiparous women. Am J Obstet Gynecol 2002](image)
First Stage of Labor

- **Rate of dilation (cm/hr)**

<table>
<thead>
<tr>
<th>Cervical dilation</th>
<th>From</th>
<th>To</th>
<th>Median (5%, 95%ile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2cm</td>
<td>3cm</td>
<td>0.3</td>
<td>(0.1, 1.8)</td>
</tr>
<tr>
<td>3cm</td>
<td>4cm</td>
<td>0.4</td>
<td>(0.1, 1.8)</td>
</tr>
<tr>
<td>4cm</td>
<td>5cm</td>
<td>0.6</td>
<td>(0.2, 2.8)</td>
</tr>
<tr>
<td>5cm</td>
<td>6cm</td>
<td>1.2</td>
<td>(0.3, 5.0)</td>
</tr>
<tr>
<td>6cm</td>
<td>7cm</td>
<td>1.7</td>
<td>(0.5, 6.3)</td>
</tr>
<tr>
<td>7cm</td>
<td>8cm</td>
<td>2.2</td>
<td>(0.7, 7.1)</td>
</tr>
<tr>
<td>8cm</td>
<td>9cm</td>
<td>2.4</td>
<td>(0.8, 7.7)</td>
</tr>
<tr>
<td>9cm</td>
<td>10cm</td>
<td>2.4</td>
<td>(0.7, 8.3)</td>
</tr>
</tbody>
</table>

- **Data Collection**
  - Friedman EA. Primigravid labor. Obstet Gynecol 1955

First Stage of Labor

- **Impact of parity on length of first stage**

<table>
<thead>
<tr>
<th>Parity</th>
<th>Median Length of First Stage (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Para 0 (n=2,645)</td>
<td>383 min</td>
</tr>
<tr>
<td>Para 1 (n=1,839)</td>
<td>293 min</td>
</tr>
<tr>
<td>Para 2 (n=750)</td>
<td>300 min</td>
</tr>
<tr>
<td>Para 3+ (n=355)</td>
<td>313 min</td>
</tr>
</tbody>
</table>

- **Median length of first stage by race/ethnicity**
  - 14,719 nulliparas, and 12,802 multiparas

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>Nulliparas</th>
<th>Multiparas</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>10.0 hrs</td>
<td>5.9 hrs</td>
</tr>
<tr>
<td>Black</td>
<td>9.5 hrs</td>
<td>6.0 hrs</td>
</tr>
<tr>
<td>Latina</td>
<td>10.3 hrs</td>
<td>6.3 hrs</td>
</tr>
<tr>
<td>Asian</td>
<td>10.3 hrs</td>
<td>5.7 hrs</td>
</tr>
<tr>
<td>p-value</td>
<td>&lt;0.001</td>
<td>p=0.001</td>
</tr>
</tbody>
</table>

- **Vahratian et al.** The impact of parity on course of labor in a contemporary population. Birth 2006
- **Greenberg et al.** Are there ethnic differences in length of labor? Am J Obstet Gynecol 2006
**First Stage of Labor**

- Length of first stage >18 hrs by age categories
  - 16,899 nulliparas, and 15,077 multiparas (1980-2001)

<table>
<thead>
<tr>
<th></th>
<th>Nulliparas</th>
<th>Multiparas</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;20 yrs</td>
<td>12.9 %</td>
<td>5.2 %</td>
</tr>
<tr>
<td>20-24 yrs</td>
<td>14.1 %</td>
<td>5.1 %</td>
</tr>
<tr>
<td>25-29 yrs</td>
<td>15.2 %</td>
<td>5.0 %</td>
</tr>
<tr>
<td>30-34 yrs</td>
<td>19.6 %</td>
<td>5.1 %</td>
</tr>
<tr>
<td>35-39 yrs</td>
<td>21.2 %</td>
<td>5.4 %</td>
</tr>
<tr>
<td>≥40 yrs</td>
<td>20.2 %</td>
<td>5.3 %</td>
</tr>
<tr>
<td>p-Value</td>
<td>p=0.001</td>
<td>p=0.99</td>
</tr>
</tbody>
</table>


**First Stage of Labor**

- RCT: 432 epidural; 437 meperidine

<table>
<thead>
<tr>
<th>Interval (admission to delivery)</th>
<th>Epidural</th>
<th>Meperidine</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>mean (SD) ≥10 hrs</td>
<td>7.2 ±3.9 hrs</td>
<td>5.7 ±3.3 hrs</td>
<td>p=0.001</td>
</tr>
<tr>
<td>Mean (SD) ≤9 hrs</td>
<td>89 (21%)</td>
<td>39 (9%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Oxytocin augmentation</td>
<td>139 (32%)</td>
<td>102 (23%)</td>
<td>p=0.04</td>
</tr>
<tr>
<td>Chorioamnionitis</td>
<td>98 (23%)</td>
<td>21 (5%)</td>
<td>p=0.001</td>
</tr>
<tr>
<td>Spontaneous vaginal delivery</td>
<td>352 (81%)</td>
<td>407 (93%)</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>39 (9%)</td>
<td>17 (4%)</td>
<td>p&lt;0.002</td>
</tr>
</tbody>
</table>

Systematic Reviews: Epidural increases length of labor, malposition, augmentation, operative VD but not cesarean

- Rama et al. RCT epidural vs IV analgesia during labor. Obstet Gynecol 1990
- Halpern et al. Effect of epidural or parental opioid analgesia on labor progression. JAMA 1998

**First Stage of Labor**

- Factors associated with duration of first stage
  - Increasing maternal age
  - Race/ethnicity
  - Parity
  - Epidural anesthesia
  - Cervical dilation at first assessment
  - Timing of SROM
  - Chorioamnionitis
  - Macrosomia

Gross et al. Influence of fixed and time-dependent factors on duration of normal 1st stage labor. Birth 2000

**First Stage of Labor**

- 397 nulliparas with induction of labor
  - Longer latent phase: increased risk of cesarean delivery
  - Latent phase >18 hours: majority of induced labor results in cesarean delivery

Simon et al. When has an induction failed. Am J Obstet Gynecol 2005
First Stage of Labor

- Length of first stage: OA compared to OP position

![Graph showing the percentage of deliveries vs. Length of 1st Stage of Labor (hour)](image)


First Stage of Labor

- ACOG: consider oxytocin administration when a patient has protracted or arrest of labor
  - Goal: to effect uterine activity sufficient to produce cervical change and fetal descent while avoiding uterine hyperstimulation and fetal compromise

QUESTION

30 y.o. G1P0 at 39+ weeks admitted in active labor (SVE 5cm/100%/0). 3 hours later she progressed to 8cm/100%/0. 2 hours after that, she remains unchanged. What’s next??

- Oxytocin augmentation
- Expectant management
- Cesarean delivery

![Histogram showing the distribution of outcomes](image)

First Stage of Labor

- Criteria for arrest requiring delivery
  - Latent phase is completed
  - Uterine contraction >200 Montevideo units for 2 hours without cervical change

![Graph showing the criteria for arrest](image)
**First Stage of Labor**

- **Rouse 1999**: Active phase arrest
  - Oxytocin for at least 4 hrs if contraction >200MV units
  - Oxytocin for at least 6 hrs if contraction <200MV units

<table>
<thead>
<tr>
<th></th>
<th>Nulliparas (n=288)</th>
<th>Multiparas (n=254)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean maternal age</td>
<td>20 yrs</td>
<td>23 yrs</td>
</tr>
<tr>
<td>Mean maternal weight</td>
<td>78 kg</td>
<td>81 kg</td>
</tr>
<tr>
<td>Mean gestational age</td>
<td>40 wks</td>
<td>40 wks</td>
</tr>
<tr>
<td>Epidural anesthesia</td>
<td>96 %</td>
<td>89 %</td>
</tr>
<tr>
<td>Mean birthweight</td>
<td>3301 gm</td>
<td>3427 gm</td>
</tr>
</tbody>
</table>

* Rouse et al. APA: Oxytocin augmentation for at least 4 hours. Obstet Gynecol 1999

**First Stage of Labor**

- **Rouse 2001**: 501 women with APA
  - Vaginal Delivery: 82 %

<table>
<thead>
<tr>
<th>Nulliparas (n=286)</th>
<th>Vaginal Delivery (n=235)</th>
<th>Cesarean Delivery (n=51)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montevideo units after oxytocin</td>
<td>175 (38-272)</td>
<td>175 (70-272)</td>
</tr>
<tr>
<td>Oxytocin duration* (hours)</td>
<td>3.9 (0.5-14.2)</td>
<td>7.4 (1.7-21.1)</td>
</tr>
<tr>
<td>Sustained 200 MV units</td>
<td>85 %</td>
<td>15 %</td>
</tr>
<tr>
<td>Cervical dilation rate* (cm/hr)</td>
<td>1.4 (0-2.4.5)</td>
<td>0.3 (0-1.4)</td>
</tr>
</tbody>
</table>

*p < 0.0001

Rouse et al. APA: Revisiting the 2-hour minimum. Obstet Gynecol 2001

**First Stage of Labor**

- **Rouse 2001**: 501 women with APA
  - Vaginal Delivery: 95 %

<table>
<thead>
<tr>
<th>Multiparas (n=215)</th>
<th>Vaginal Delivery (n=204)</th>
<th>Cesarean Delivery (n=11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montevideo units after oxytocin</td>
<td>166 (49-289)</td>
<td>188 (98-279)</td>
</tr>
<tr>
<td>Oxytocin duration* (hours)</td>
<td>2.3 (0.2-11.1)</td>
<td>6.9 (1.5-10.0)</td>
</tr>
<tr>
<td>Sustained 200 MV units</td>
<td>94 %</td>
<td>6 %</td>
</tr>
<tr>
<td>Cervical dilation rate* (cm/hr)</td>
<td>1.9 (0-3.12.0)</td>
<td>0.4 (0-0.8)</td>
</tr>
</tbody>
</table>

*p < 0.0001

Rouse et al. APA: Revisiting the 2-hour minimum. Obstet Gynecol 2001
First Stage of Labor

  - 39% (74/191) achieved vaginal delivery

<table>
<thead>
<tr>
<th>Length of Active Phase Arrest (hours)</th>
<th>Spontaneous VD</th>
<th>Cesarean Delivery</th>
<th>aOR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4 hours</td>
<td>4</td>
<td>2</td>
<td>3.27</td>
<td>1.15-4.89</td>
</tr>
<tr>
<td>4-6 hours</td>
<td>11</td>
<td>4</td>
<td>4.47</td>
<td>1.99-10.0</td>
</tr>
<tr>
<td>&gt;6 hours</td>
<td>102</td>
<td>6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compared to APA, 2-hours

ACOG: First Stage of Labor

- Extending the minimum period of oxytocin augmentation for APA from 2 hours to 4 hours appears effective
- Reassessment of the fetus
- Intervention is not necessary solely based on time

Summary: First Stage of Labor

- Modern obstetric population may exhibit labor characteristics different from Friedman’s description
- Protracted labor: oxytocin augmentation
- Active labor arrest: extending the “2-hour minimum”
  - 4-hours with adequate uterine contractions

Second Stage of Labor

- Duration of the second stage of labor
  - Nulliparas: 54 minutes
  - Multiparas: 19 minutes
  - Use of regional anesthesia increases the mean duration of second stage by 20-30 minutes

Second Stage of Labor

- ACOG: Prolonged second stage of labor
  - Nulliparas: 2 hours without regional anesthesia
  - 3 hours with regional anesthesia
  - Multiparas: 1 hour without regional anesthesia
  - 2 hours with regional anesthesia

QUESTION

Same 30 y.o. G1P0 at 39+ weeks admitted in active labor, had epidural for pain control, progressed to complete, +1 station. What’s next??

- Start pushing
- Delay pushing


Risk factors associated with a longer duration of second stage:
- Nulliparity
- Short maternal stature
- Increasing birthweight
- Regional/epidural anesthesia
- Fetal occiput posterior position
- Longer first stage of labor
- High station at complete cervical dilation


PEOPLE: 1,864 nulliparas with epidural
12 medical centers: 1994-1996

<table>
<thead>
<tr>
<th>Duration 2nd stage (min)</th>
<th>Delayed Push (n=926)</th>
<th>Early Push (n=938)</th>
<th>RR 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative delivery</td>
<td>17.6 %</td>
<td>22.5 %</td>
<td>0.79 0.66-0.95</td>
</tr>
<tr>
<td>Midpelvic procedures</td>
<td>9.3 %</td>
<td>13.0 %</td>
<td>0.72 0.55-0.93</td>
</tr>
<tr>
<td>Low-pelvic procedure</td>
<td>3.5 %</td>
<td>3.8 %</td>
<td>0.93 0.58-1.49</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>5.0 %</td>
<td>5.7 %</td>
<td>0.88 0.60-1.29</td>
</tr>
<tr>
<td>3rd/4th degree lac</td>
<td>9.3 %</td>
<td>9.5 %</td>
<td>NS</td>
</tr>
<tr>
<td>EBL&gt;500ml</td>
<td>17.6 %</td>
<td>16.8 %</td>
<td>NS</td>
</tr>
</tbody>
</table>


Second Stage of Labor

- Passive descent vs. Active pushing
  - Meta-analysis of 7 RCTs (n=2,827)

<table>
<thead>
<tr>
<th></th>
<th>Relative Risk</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous VD</td>
<td>1.08</td>
<td>1.01 – 1.15</td>
</tr>
<tr>
<td>Operative VD</td>
<td>0.77</td>
<td>0.77 – 0.85</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>0.80</td>
<td>0.57 – 1.12</td>
</tr>
<tr>
<td>Duration of pushing (hrs)</td>
<td>-0.19</td>
<td>-0.27 – -0.12</td>
</tr>
<tr>
<td>Perineal lacerations</td>
<td>0.88</td>
<td>0.72 – 1.07</td>
</tr>
<tr>
<td>Episiotomies</td>
<td>0.97</td>
<td>0.88 – 1.06</td>
</tr>
</tbody>
</table>


Second Stage of Labor

- ACOG: If progress is being made, duration of the 2nd stage alone DOES NOT mandate intervention by operative delivery
- Once a second stage arrest disorder is diagnosed, 3 management options:
  - Continued observation
  - Operative vaginal delivery
  - Cesarean delivery

QUESTION
Same 30 y.o. G1P0 at 39+ weeks admitted in active labor now complete/+2 station and pushed for 3 hours. Fetal heart tracing remains reassuring. What’s next??

- Continuing pushing
- Operative vaginal delivery
- Cesarean delivery

Second Stage of Labor

Nulliparas

2nd stage 1-3 hours

Cesarean Del | Operative VD | Continued Labor

2nd stage >3 hours

Cesarean Del | Operative VD | Spont. VD
Second Stage of Labor

- 15,759 nulliparas delivered in 2nd stage
  - Mode of delivery by length of second stage of labor

- 6791 nulliparas reached second stage (1996-99)
  - Increased maternal morbidity with prolonged 2nd stage
  - No differences neonatal outcomes

- 5158 multiparas reached second stage (1991-2001)
  - Increased maternal complications
  - Increased neonatal morbidity

- Sung 2007: 239 women delivered by cesarean during the second stage

**Question**
Same woman has now pushed for 3 hours with epidural (SVE complete/+2 station, OP position); fetal heart tracing remains reassuring. What’s next??

1. Cesarean delivery
2. Operative vaginal delivery
3. Manual rotation
4. Expectant management

**Second Stage of Labor**
- Persistent malposition and perinatal outcomes
  - Prolonged second stage of labor
  - Increased maternal and neonatal morbidity
- Factors associated with prolonged second stage
  - Nulliparity
  - Regional anesthesia
  - Fetal occiput posterior position

<table>
<thead>
<tr>
<th>Second Stage &gt;3 hours</th>
<th>OA</th>
<th>OP</th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd Stage &gt;3 hours</td>
<td>8.8%</td>
<td>26.1%</td>
</tr>
<tr>
<td>Spontaneous VD</td>
<td>59.1%</td>
<td>31.0%</td>
</tr>
<tr>
<td>Cesarean delivery</td>
<td>3.4%</td>
<td>21.5%</td>
</tr>
<tr>
<td>3/4th laceration</td>
<td>8.0%</td>
<td>10.0%</td>
</tr>
<tr>
<td>5min Apgar&lt;7</td>
<td>1.9%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Birth trauma</td>
<td>0.8%</td>
<td>1.4%</td>
</tr>
<tr>
<td>NICU admissions</td>
<td>3.1%</td>
<td>5.6%</td>
</tr>
</tbody>
</table>

**Second Stage of Labor**
- Risk of Cesarean delivery
  - aOR=0.02 (95% CI 0.01-0.04)
Summary: Second Stage of Labor

- Length of second stage in itself not an indication for immediate intervention
- Prolonged second stage in nulliparas:
  - Increased maternal morbidity
  - No difference in neonatal morbidity
- Prolonged second stage in multiparas:
  - Increased maternal and neonatal morbidity