Physiologic partograph to improve birth safety and outcomes among low-risk, nulliparous women with spontaneous labor onset

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Presentation Overview
- Background & Significance
- Introduction to Partograph
- Partograph Use Examples

To start...

Birth should be recognized as a normal physiologic process
Providers should advocate for non-intervention in the absence of complications
Scientific evidence should be incorporated into clinical practice

Background and Significance

Why Nulliparous Women?
- Term, nulliparous women carrying singleton, cephalic presenting fetuses are of particular interest when strategizing to improve obstetrical care quality and outcomes (CDC, 2012; ACOG, 2000; Boyle et al, 2012; Main et al, 2004, 2006; Cleary et al, 1996)
- 40% of all U.S. births are to nulliparous women; 1.6 million in 2011 (Martin et al, 2013)
- ~97.98% of the variation in overall cesarean rates between institutions is due to variation in cesareans to low-risk, nulliparous women (Brennen et al, 2009, 2011)
- The course of the 1° labor largely dictates the course and management of subsequent labors

Labor
- “The presence of uterine contractions of sufficient frequency, duration, and intensity to cause demonstrable effacement and dilation of the cervix” (ACOG, 2003)
- 1st Stage = contraction onset → full dilatation
  - Latent phase = contraction onset → ‘active’ dilation onset
  - ‘Active’ phase = ‘active’ dilation → complete dilatation
Friedman's Active Phase: Nulliparae

Nulliparous Labor Curve From 'Active' Labor Onset

Nulliparous 'Active' Labor

- Peisner & Rosen (1986) (n = 1060)
  - Using Friedman's 1.2 cm/hr criteria, low-risk, term, nullipara with intact membranes, cephalic presentation, and spontaneous labor were evaluated:
    - At 3 cm, 75% were not 'active'
    - At 4 cm, 50% were not 'active'
    - At 5 cm, 25% were not 'active'

- Neal et al (In review) (n = 216)
  - Using criteria put forth by the SOGC (1995), i.e., at ≥ 3 cm dilatation, adequate labor involves average dilation of ≥ 0.5 cm/hr over any 4 hr time window:
    - 52.8% did not meet this expectation in the first 4 hrs after admission (average dilatation at admission ~3.5 cm)

'Cervicograph' (adapted)

WHO Partograph

WHO Partograph (adapted)
**WHO Partograph (adapted)**

- In 2007, the WHO changed their definition of active labor onset from 3 cm to 4 cm (WHO, 2007).

![](Image)

**Nulliparous women assessed via partographs with 'alert' and 4-hr 'action' lines**

<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Earliest (cm)</th>
<th>n</th>
<th>Alert Line Crossed</th>
<th>Action Line Crossed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathews et al. (2007)†</td>
<td>India</td>
<td>2</td>
<td>175</td>
<td>19.4%</td>
<td>10.8%</td>
</tr>
<tr>
<td>Mathews et al. (2007)†</td>
<td>India</td>
<td>4</td>
<td>156</td>
<td>17.9%</td>
<td>1.3%</td>
</tr>
<tr>
<td>O' Driac (2008)</td>
<td>Nigeria</td>
<td>6</td>
<td>258</td>
<td>34.8%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Mathews et al. (2007)†</td>
<td>South Africa</td>
<td>1</td>
<td>155</td>
<td>34.4%</td>
<td>19.1%</td>
</tr>
</tbody>
</table>

* Studies of Spontaneous Nulliparous Labor (ξ oxytocin, ξ anesthesia)*

- Kilpatrick & Laros (1989) (n = 2302)
  - regular, painful contractions → full dilation = 8.1 ± 4.3 hrs
- Albers, Schiff, & Gorwoda (1996) (n = 347)
  - 4 cm → 10 cm = 7.7 ± 5.9 hrs (95th %ile = 19.4 hrs)
- Albers (1999) (n = 806)
  - 4 cm → 10 cm = 7.7 ± 4.9 hrs (95th %ile = 17.5 hrs)
- Albers & Larson (2003) (n = 120)
  - 4 cm → 10 cm = 6.2 ± 3.6 hrs (95th %ile = 13.4 hrs)

- Average dilation rates in these studies range from:
  - 0.8-7.0 cm/hr at the mean
  - 0.3-0.5 cm/hr at the statistical limit

**Active Management of Labor (AML)**

- Multifaceted labor management program aimed to shorten nulliparous labor (O’Driacoll et al, 1973, 1993)

**Components:**

- Antenatal childbirth preparation; strict diagnosis of spontaneous labor onset; 1-on-1 labor support; routine amniotomy; routine cervical assessments; oxytocin if dilation is < 1 cm/hr; peer review of assisted deliveries


**‘Slowest-Yet-Normal’ Dilation Rate for Nulliparous Women**

- Summary: Existing literature indicates that 10-18% of low-risk nulliparous women with spontaneous labor onset dilate <0.5-0.64 cm/hr, on average, even after 3 or 4 cm (Zhang et al, 2002, 2010; Philpott & Castle, 1972a, 1972b; WHO, 1994; Orji, 2008; Perl & Hunter, 1992; Albers et al, 1996; Albers, 1999; Jones & Larson, 2003).

- The problem: Clinician expectation of ‘active’ labor dilation is often much faster than the above rates

**Clinical Dilemma**

- Either many nulliparous women are admitted prior to progressive (active) labor yet held to dilation expectations of ‘active’ labor and/or

- Common expectations of active labor dilation rates (e.g. 1 cm/hr) are unrealistically fast
Consequences of Earlier Admission after Spontaneous Labor Onset
- Admissions at \(<3\) cm (vs. \(>3\) cm)
  - \(\uparrow\) In-hospital labor time, oxytocin use, epidural use, dystocia diagnoses, \& cesarean deliveries
  - \(\downarrow\) Satisfaction with birth experience
  - \(p<0.01\) for all findings
  - (McNiven et al., 1998; Impey et al., 2000; Rahnama et al., 2006)
- Admissions at \(<4\) cm (vs. \(\geq4\) cm)
  - \(\uparrow\) In-hospital labor time, oxytocin use, epidural use, active phase arrest, \& cesarean deliveries
  - \(p<0.01\) for all findings
  - (Holmes et al., 2001; Bailit et al., 2005; Mikolajczyk et al., 2008)

Timing of Admission to Hospital After Spontaneous Labor Onset
- Low-risk, nulliparas at \(\geq37\) wks with a singleton, cephalic fetus admitted for spontaneous labor onset by their provider (n = 216)
  - \(114\) (52.8%) were admitted in pre-active labor
  - \(102\) (47.2%) were admitted in active labor
  - Women in pre-active labor were more likely to undergo:
    - Oxytocin augmentation (84.2% v. 45.1%, respectively; OR 6.5, 95% CI 3.43-12.27)
    - Cesarean delivery (15.8% v. 6.9%, respectively; OR 2.6, 95% CI 1.02-6.37)
  - In addition:
    - All cesareans for dystocia (n = 10) were in pre-active group (\(p<0.01\)) (7 of 10 were performed at \(\leq5\) cm)
    - In-hospital labor time \(>4\) hrs longer in pre-active group (\(p<0.001\))
    - Max temps during labor were higher in pre-active group (\(p=0.026\))
  - (Neal et al, In review)

Consequences of Unrealistically Fast Cervical Dilation Expectations
- \(\uparrow\) diagnoses of dystocia, i.e., “slow, abnormal progression of labor” (ACOG, 2003)
- \(\uparrow\) intervention(s) to accelerate labor with inherent risks
- \(\uparrow\) unnecessary cesareans

Dystocia
- “Slow, abnormal progression of labor” (ACOG, 2003)
- In practice, diagnoses of dystocia are most often based on ambiguously defined delays in dilation beyond which labor augmentation is deemed justified
  - Consequence: Dystocia is known to be “over-diagnosed” (Cunningham et al, 2010)
  - Leading indication for primary cesareans accounting for as much as \(50\%\) of all nulliparous cesareans (ACOG, 2000, 2003; Cunningham et al, 2010)

Oxytocin augmentation
- Dystocia over-diagnosis largely explains why approximately \(50\%\) of nulliparous women with spontaneous labor onset receive oxytocin augmentation during labor (Zhang et al, 2002, 2010; Treacy et al, 2006; Oscarsson et al, 2006)
  - This is concerning because oxytocin:
    - is a “high-alert medication” (ISMP, 2008)
    - is the intervention most commonly associated with preventable adverse perinatal outcomes (Clark et al, 2008, 2009)
    - misuse is involved in half of all paid obstetric litigation claims (Clark, 2008)
  - Any overuse of oxytocin imposes unnecessary risk on the mother and fetus during labor

Cesareans
- U.S. cesarean rates among term, low-risk, nulliparous women with vertex fetus = \(26.4\%\) (CDC, 2013)
  - Dystocia accounts for \(50\%\) of these (~13%) (ACOG, 2000, 2003; Cunningham et al, 2010)
  - 90% of primary cesareans are followed by repeats, thus, the majority of all cesareans are attributable to the diagnosis of dystocia that lead to the first (CDC, 2013)
  - Total cesarean rate in U.S. = \(32.8\%\) (Martin et al, 2013)
    - Highest rate = Louisiana (39.9%), Lowest rate = Alaska (22.4%)
    - Minnesota (26.8%), Ohio (31.2%)
  - The concern: the best birth outcomes occur with cesarean rates of 5-10% while rates higher than 15% are associated with excessive morbidities and mortality (WHO, 1995; Villar et al, 2006, 2007; Lumbiganon et al, 2010)
nulliparous women at ≥ 36 wks with a singleton, cephalic presenting fetus admitted for spontaneous labor onset between 3-5 cm

Another look at dilation rates in ‘active’ labor...

- **Aims:** to describe labor duration and dilation rates beginning with clinical criteria often used as prospective evidence of active labor onset (i.e. 3 – 5 cm dilatation + regular contractions) → 10 cm
- **Databases:** MEDLINE & CINAHL
  - Cross-searched specific keywords, e.g., nulliparous / nulliparous with labor (labor) length / labor (labor) duration / active phase / active labor (labor)
  - Limited to: 1990 – 2008; English (yield = 375 articles)

- **Qualifying Publications (n = 25)**
  - Low-risk, nulliparous women at 36 wks with a singleton, cephalic presenting fetus admitted for spontaneous labor onset between 3-5 cm

Nulliparous Labor from *Criteria* Associated with ‘Active’ Labor Onset

- Zhang et al, 2002
- Neal et al, 2010
- Zhang, Landy et al, 2010

Nulliparous Labor from *Criteria* Associated with ‘Active’ Labor Onset

- Zhang et al, 2002
- Neal et al, 2010

**Physiologic (non-linear) expectation of dilation**

- 95th percentile of cumulative duration of labor from admission among singleton, term, nulliparous women with spontaneous labor onset, vaginal delivery, and normal neonatal outcomes (n = 27,170)

- Physiologic (non-linear) expectation of dilation

- Zhang et al, 2002 hyperbolic curve linearly conceptualized

- Physiologically-Based Partograph

- Our research team has developed a partograph for 'in-hospital' use in assessing the labors of nulliparous women with spontaneous labor onset (Neal & Lowe, 2012)

- We hypothesize that partograph use will:
  - safely limit diagnoses of dystocia during the first stage of labor to only the slowest 10%
  - ↓ oxytocin augmentation rates by ≥ 50%
  - ↓ cesareans performed for dystocia by ≥ 50%

**Introduction to the Partograph**
**Principles of Partograph**

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Active labor onset must be accurately diagnosed before the rate of cervical dilation (cm/hr) is used to assess labor progression.</td>
</tr>
<tr>
<td>2.</td>
<td>Expectations of cervical dilation (cm/hr) for the population must be appropriately-defined.</td>
</tr>
<tr>
<td>3.</td>
<td>Cervical dilation rates progressively accelerate throughout the majority of active labor.</td>
</tr>
<tr>
<td>4.</td>
<td>The time duration necessary to dilate from one centimeter to the next is more variable in earlier active labor than in more advanced active labor.</td>
</tr>
</tbody>
</table>

**Criteria for Partograph Use**

- Spontaneous labor onset
  - regular, painful contractions (≥ 2 in 10 min)
  - complete or near complete effacement
  - membranes intact or ruptured
  - bloody show absent or present
- Initiated with labor and a qualifying cervical exam
  - at 4 cm dilatation if being preceded by cervical change over time (i.e., ≥ 1 cm in ≤ 2 hr window) = earliest start
  - at ≥ 5 cm regardless of the rate of previous cervical change = direct start
- Initiated and continued only when no complications requiring urgent attention through intervention exist

**Partograph for Low-Risk, Nulliparous Women with Spontaneous Labor Onset**

**Documenting Cervical Examinations**

- Cervical exams are crude assessments that rely solely on the clinical experience and proprioceptive skill of the examiner
- Clinicians accurately determine actual cervical dilatation in only half of all cases (Buchmann et al, 2007; Huhn et al, 2004; Phelps et al, 1995; Tuffnell et al, 1989)
  - Accurate to ± 1 cm in 90% of cases
- **On partograph**: dilatations reported as a range are rounded down to the nearest integer dilatation, e.g., “4-5 cm” is rounded to 4 cm.

**Partograph Use Examples**

**Example 1: Labor remaining left of the dystocia line without delay**
Example 2: Labor moving right of the dystocia line

Example 3: Labor remaining left of the dystocia line with delay

The ‘Big Picture’

- More than enough research evidence exists to support the revision of existing ‘active’ labor dilation rate expectations
- Such physiologically-based revision should improve birth safety and outcomes by safely:
  - Detecting dystocia during the first stage of labor
  - Oxytocin augmentation rates
  - Cesareans performed for dystocia
- Midwives can take a lead in this area and our Hallmarks of Midwifery can be the guide

References


References


References
Randolph J. How should we deliver the term, single vertex, vertex term nulliparous woman? The answer is “let nature take its course.” J Reprod Med 1979; 24:179-182.