A Simple Cervical Length

Preterm Labor & PPROM

Henry L. Galan, MD
Professor
Department of Obstetrics & Gynecology
University of Colorado at Denver Health Sciences Center

Henry L. Galan, MD
Discloses no relevant financial relationships with commercial interests.

Objectives

After this lecture, participants will be able to:
- Describe the technique of cervical assessment by ultrasound
- Discuss the role of ultrasound in detecting women at risk for preterm delivery
- Discuss the role of ultrasound in diagnosis of cervical incompetence
- Discuss the role of ultrasound in multiple gestation
- Outline a management plan following incidental finding of cervical changes on ultrasound

Background

- Premature delivery occurs in 10% of pregnancies
- Prematurity is the single largest cause of perinatal mortality and morbidity
- Accounts for 70% of perinatal mortality in infants without anomalies

Preterm Births

United States: 1985-1998

Note: Preterm is less than 37 weeks gestation.
Source: National Center for Health Statistics, final natality data.

Preterm Births

United States: 1985-1998

Background

- Diagnosis of PTL
  - Made b/w 24-36 weeks
  - Regular uterine ctxs and cervical change
  - In most developed and underdeveloped nations, cervical change is only assessed by digital exam

**Manual Cervical Assessment**

- Subjective & Not very reproducible
  
  (interobserver variability of 52%)
- Not accurate for the internal os
  
  – Limitation: both term & PTL start to shorten and dilate at the internal os
- Nonspecific: 15% primips & up to 35% of multips who deliver at term are 1-2cm dilated by manual exam late in the 2nd trimester

**TVU vs. Digital Exam**

Reliability, reproducibility, validity and clinical use for predicting PTB in women with the diagnosis of PTL is **superior** with TVU


**TVU**

- Detects shortening of the cervical canal b/f it becomes evident with manual exam.
- Confirmed safety and acceptability
- No inoculation of bacteria
- Minimal to no discomfort

Cowan et al. UOG 2000;15:52–5

**Ultrasound Cervical Length Techniques**

- Transabdominal
- Transperineal
- Transvaginal

**Transvaginal Technique**

- Empty bladder
- Insert vaginal probe
  
  – Anterior fornix
- Identify bladder, amniotic fluid, presenting part, and placenta

**Technique**

- Measure cervical length 3 times placing calipers between internal and external os
- Record the shortest length obtained from the best images
- Record any funneling or dilatation.


**Technique**

- Apply gentle fundal pressure for 15 seconds
- Measure the cervix again and note if cervix shortens or if funnel appears.


**Technique**

- Underdeveloped lower uterine segment
- Focal myometrial contraction
- Endocervical polyp
- Poor correlation with digital examination of cervix (e.g. short cx may be dilated)


**Technique**

- How do I measure the cervix that is long and curved??
  - straight line vs. summation of two lines
  
  “The shortest distance between two points is a straight line”

**Pitfalls**

**Pitfalls**

- Short cervix is always straight

**To et al. Ultrasound Obstet Gynecol 2001;17:217**
Preterm Birth and Cervical Sonography

- Meaning of funneling
- Prediction of PTD in asymptomatic patients
- Prediction of PTD in symptomatic patients
- Meaning of amniotic fluid ‘sludge’
- PPROM
- Diagnosis of incompetent cervix

Progression of Funneling “TYVU”

TYVU = Trust Your Vaginal Ultrasound

Zilianti et al. JUM 1996;14:719-24

Natural History of Cervical Funneling in Women at HR for Spontaneous PTB
(Berghella et al. Obstet Gynecol 1997;4:109)

- Funneling:
  - is predictive of PTB, BUT does not add significantly to prediction by CL alone.
  - has greater variability and more subjectivity than CL
  - Can be falsely alarming in at least 2 scenarios:
    - lower uterine contraction
    - if it is only minimal funneling (normal up to 5mm or 25% of CL)
- Concluded:
  - Standard measurement - CL should be recorded as the shortest best length after dynamic changes are considered. No other parameters are more predictive or as reproducible.

Cervical Funneling

Standard Terminology

Funneling & Risk of PTB

Asymptomatic HR Patient

MIXED REPORTS

- “Funnel” predictive and is not predictive:
  UOG 2001;18:204; NEJM 1996;334:967; Ob Gyn 2000;99:222
- “Natural History of Cervical Funneling in Women at HR for Spontaneous PTB”
  - 2nd analysis of a blinded MC observ study NICHD MFMU
  - 590 scans in 183 women; 60% had funneling
  - Documented funneling and CL


Cervical Examination in Prediction of Preterm Delivery in Asymptomatic Patients
Preterm Delivery

• Use of cervical length to predict risk of preterm delivery
  - 2915 women at 24 weeks
  - 2531 women at 28 weeks
  - not selected for risk for preterm delivery

Iams et al. NEJM1996:334:567

Preterm Delivery

Mean Cervical Length

• 24 Weeks
  34 ± 7.8 mm nulliparous
  36 ± 8.4 mm multiparous

• 28 Weeks
  32.6 ± 8.1 mm nulliparous
  34.5 ± 8.7 mm multiparous

Iams et al. NEJM1996:334:567

Mid-trimester Cervix

Low Risk Population

<table>
<thead>
<tr>
<th>Authors</th>
<th>n</th>
<th>Cervix (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ayers, 1988</td>
<td>150</td>
<td>52</td>
</tr>
<tr>
<td>Podobnick, 1988</td>
<td>80</td>
<td>48</td>
</tr>
<tr>
<td>Andersen, 1990</td>
<td>125</td>
<td>41</td>
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<tr>
<td>Kushnir, 1990</td>
<td>24</td>
<td>48</td>
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<tr>
<td>Andersen, 1991</td>
<td>77</td>
<td>42</td>
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<td>Murakawa, 1993</td>
<td>177</td>
<td>37</td>
</tr>
<tr>
<td>Zorzoli, 1994</td>
<td>154</td>
<td>42</td>
</tr>
<tr>
<td>Iams, 1995</td>
<td>106</td>
<td>37</td>
</tr>
<tr>
<td>Iams, 1996</td>
<td>2915</td>
<td>35</td>
</tr>
<tr>
<td>Cook, 1995</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Tongsong, 1997</td>
<td>175</td>
<td>32</td>
</tr>
<tr>
<td>Heath, 1998</td>
<td>1252</td>
<td>38</td>
</tr>
</tbody>
</table>

Mean = 41mm

Preterm Delivery

• Cervical length at 24 weeks and risk of preterm delivery
  - 25mm: <10th percentile; 6.2X ↑
  - 22mm: <5th percentile; 9.5X ↑
  - 13mm: <1st percentile; 14X ↑
  - But limited positive predictive value

Iams et al. NEJM1996:334:567

Short Cx in Asympt LR Patients

<table>
<thead>
<tr>
<th>Authors</th>
<th>GA (wks)</th>
<th>PTD Def (wks)</th>
<th>Cut-off (mm)</th>
<th>Preval PTD (%)</th>
<th>Sens (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anderson, 1990</td>
<td>&lt;30</td>
<td>&lt;37</td>
<td>&lt;39</td>
<td>15</td>
<td>76</td>
<td>25</td>
<td>93</td>
</tr>
<tr>
<td>Tongsong, 1995</td>
<td>28-30</td>
<td>&lt;37</td>
<td>≤ 35</td>
<td>12</td>
<td>66</td>
<td>20</td>
<td>93</td>
</tr>
<tr>
<td>Iams, 1994</td>
<td>&lt;24</td>
<td>&lt;25</td>
<td>≤ 20</td>
<td>4</td>
<td>23</td>
<td>26</td>
<td>97</td>
</tr>
<tr>
<td>Heath, 1998</td>
<td>23</td>
<td>&lt;32</td>
<td>≤ 15</td>
<td>1.5</td>
<td>58</td>
<td>52</td>
<td>99</td>
</tr>
<tr>
<td>Hassan, 1999</td>
<td>14-24</td>
<td>&lt;32</td>
<td>≤ 15</td>
<td>3.6</td>
<td>8</td>
<td>47</td>
<td>97</td>
</tr>
</tbody>
</table>

Cervical Length at 23 Weeks’ of Gestation: Prediction of Spontaneous Preterm Delivery in Singleton Gestations

**CL at 23 Weeks ≤ 15 mm**

*Singleton Pregnancies*

- Present in only 1.7% of population yet captures
  - 90% who deliver ≤ 28 wk
  - 60% who deliver ≤ 32 wk
- 40% risk of delivery ≤ 32 wk
- Risk SPTD increases exponentially with CL ≤ 15 mm

**CL at 23 Weeks ≤ 25 mm**

*Twin Pregnancies*

- Present in only 11% of twin population yet captures
  - 100% who deliver ≤ 28 wks
  - 47% who deliver ≤ 32 wks
- 33% risk of delivery ≤ 32 wks
- Risk SPTD increases linearly with CL ≤ 25 mm

**CL in Predicting SPTD**

*Singletons Vs. Twins*

<table>
<thead>
<tr>
<th></th>
<th>Singletons</th>
<th>Twins</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPTD ≤ 32 wk</td>
<td>1.6%</td>
<td>8%</td>
</tr>
<tr>
<td>Median CL</td>
<td>38 mm</td>
<td>38 mm</td>
</tr>
<tr>
<td>5th %ile</td>
<td>23 mm</td>
<td>19 mm</td>
</tr>
<tr>
<td>1st %ile</td>
<td>11 mm</td>
<td>7 mm</td>
</tr>
<tr>
<td>Best CL cutoff</td>
<td>15 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>Sensitivity ≤ 32 wk</td>
<td>58%</td>
<td>47%</td>
</tr>
<tr>
<td>Risk SPTD ≤ 32 wk</td>
<td>40%</td>
<td>33%</td>
</tr>
<tr>
<td>SPTD with CL &lt; cutoff</td>
<td>Exponential</td>
<td>Linear</td>
</tr>
</tbody>
</table>

**Short Cx in Asympt LR Patients**

*Summary*

- Identifies a population at HR for PTB
- The PPV of a short cervix (~50%) for delivery at <32 weeks warrants close attention.
- >1/3 delivering PT don’t have a short cx
  - ∴ Cx with usg is not a screening tool, but rather a method for risk assessment
Cervical Examination in Patients Presenting with Preterm Labor Symptoms

PTL & Short Cervix

- Pooled Data:
  - Cutoff of 30mm has sufficient sensitivity to identify b/w 70-100% of women delivering PT
  - CL of >30mm had a NPV close to 100% effectively identifying patients not delivery preterm
  - A cut-off of 20mm had the best PPV (70%)  


Fetal Fibronectin

- Clinical Relevan Time Frame (32-33 weeks)

Garrile TJ et al. Contemp Obstet Gynecol 1996;41:77-93

PTL & Short Cervix
Increased Risk of IAI

- 187 patients with PTL sx
- Short cervix (<20mm)
  - Higher PTB (50% v 16%)
  - Higher risk of IAI (19% v 3%)

Gomez et al AJOG 2001;184

Gomez and Romero et al. AJOG 2005;192:350-9
215 pts; PTC and cx dil <3cm: assessed CL, FFN and risk of delivery at 48H, 7D and 14D, and <32 & 35w
Amniotic Fluid Sludge

What is it?

Clinical significance of the presence of amniotic fluid ‘sludge’ in asymptomatic patients at high risk for spontaneous preterm delivery

- 61 patients with sludge & 281 patients without
- Routine usg b/w 13 and 29 weeks

<table>
<thead>
<tr>
<th>Clinical characteristics</th>
<th>No ‘sludge’</th>
<th>‘Sludge’ present</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational age at ultrasound (weeks)</td>
<td>21.6 (17.7–23.5)</td>
<td>30 (32.46)</td>
<td>0.02</td>
</tr>
<tr>
<td>Cervical length at ultrasound (cm)</td>
<td>54.3 (49.8–60.6)</td>
<td>54.2 (49.66)</td>
<td>0.001</td>
</tr>
<tr>
<td>Birth weight (kg)</td>
<td>35.9 (33.3–39.3)</td>
<td>30.7 (24.2–37.9)</td>
<td>0.001</td>
</tr>
<tr>
<td>Vaginal bleeding in the 1st trimester</td>
<td>24.2 (16.66)</td>
<td>31.8 (21.66)</td>
<td>0.001</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcome variables</th>
<th>No ‘sludge’</th>
<th>‘Sludge’ present</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission to NICU</td>
<td>31.8 (21.66)</td>
<td>31.8 (21.66)</td>
<td>0.01</td>
</tr>
<tr>
<td>Septis or suspected sepsis</td>
<td>27.1 (13.48)</td>
<td>27.1 (13.48)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>39.6 (19.48)</td>
<td>39.6 (19.48)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bronchopulmonary dysplasia</td>
<td>12.1 (8.66)</td>
<td>12.1 (8.66)</td>
<td>0.001</td>
</tr>
<tr>
<td>Necrotizing enterocolitis</td>
<td>8.8 (4.45)</td>
<td>8.8 (4.45)</td>
<td>0.001</td>
</tr>
<tr>
<td>Intraventricular hemorrhage</td>
<td>19.1 (9.47)</td>
<td>19.1 (9.47)</td>
<td>0.001</td>
</tr>
<tr>
<td>Composite severe neonatal morbidity</td>
<td>47.9 (23.48)</td>
<td>47.9 (23.48)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Neonatal death</td>
<td>12.2 (6.49)</td>
<td>12.2 (6.49)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
**PTL Symptoms & Short Cervix**

**Summary**

- Cx sonography powerful tool to assess risk
- If CL long and no funnel (<25%), probably best to avoid intervention
- Patient with short cx → ↑ risk of IAI & PTB
  - Benefit from: tocolysis, BMZ, transfer
- HR Patient with sludge → ↑ risk of IAI & PTB
  - Consideration for amniocentesis

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**Cervical Examination in PPROM**

- Flow of fluid in real time

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**PPROM**

Evaluated CL and PPROM: although no increase in maternal/fetal infection with a short CL, there was a shortened latency.

<table>
<thead>
<tr>
<th>Cervical Length</th>
<th>≤ 2 cm (n=45)</th>
<th>&gt; 2 cm (n=50)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Multiple (n (%))</td>
<td>23/45 (51.1)</td>
<td>22/49 (44.9)</td>
<td>0.63</td>
</tr>
<tr>
<td>Placental abruption (n (%))</td>
<td>2/45 (4.4)</td>
<td>1/50 (2.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean gestational age at rupture (weeks)</td>
<td>30.4±6.6</td>
<td>28.4±3.5</td>
<td>0.031</td>
</tr>
<tr>
<td>Mean gestational age at delivery (weeks)</td>
<td>36.3±3.5</td>
<td>35.8±2.6</td>
<td>0.19</td>
</tr>
<tr>
<td>Mean interval to delivery (h±SD)</td>
<td>53.4±15.9</td>
<td>246.3±36.7</td>
<td>0.0029</td>
</tr>
<tr>
<td>Apgar 5 min (n (%))</td>
<td>17/45 (38.9)</td>
<td>13/50 (26.0)</td>
<td>0.22</td>
</tr>
<tr>
<td>Placental abruption (n (%))</td>
<td>11/45 (24.4)</td>
<td>22/50 (44.0)</td>
<td>0.19</td>
</tr>
<tr>
<td>Neonatal age (n (%))</td>
<td>5/45 (11.1)</td>
<td>13/50 (26.0)</td>
<td>0.27</td>
</tr>
<tr>
<td>Suspected chorioamnionitis (n (%))</td>
<td>27/45 (60.0)</td>
<td>43/50 (86.0)</td>
<td>0.09</td>
</tr>
</tbody>
</table>

Does TVU increase the risk for infection in PPROM?

- Serial cervical “digital” exams increase the risk for infection in PPROM
  
  Schutte et al. AJOG 1983;146:395-400

- RCT comparing TVU versus no TVU in patients with PPROM:
  
  No difference in chorioamnionitis, endometritis and neonatal infection
  

Cervical Incompetence

Presentation

- Rapid painless effacement and dilatation in second trimester
- Spontaneous fetal loss (fetus/sac)
- Minimal uterine activity
- Increased vaginal discharge
- Spotting
- Pelvic pressure/cramping
- “Heaviness”

Cervical Examination in the Diagnosis of Incompetent Cervix

- Rapid painless effacement and dilatation in second trimester
- Spontaneous fetal loss (fetus/sac)
- Minimal uterine activity
- Increased vaginal discharge
- Spotting
- Pelvic pressure/cramping
- “Heaviness”

Cerclage and Short Cervix – Total Population

Cerclage and Short Cervix – History of PTB

Progesterone & PTB Prevention

- 11 RCT studies included; 2425 patients
- Addressed the use of progesterone to prevent PTB in patients w/:
  - Past history of sPTB
  - Short cervix on usg
  - Multiple pregnancy
  - After presentation for threatened PTL

Progesterone for the prevention of PTB- a systematic review. Dodd et al. Obstet Gynecol 2008;112:127-34
**Progesterone**  
*Prior PTB History*

- Reduction in PTB (4 studies)  
  *Dodd et al. Obstet Gynecol 2008;112:127-34*
  - <37 weeks: 54.9% to 36.3%
  - <35 weeks: 30.7% to 20.6%
  - <32 weeks: 19.6% to 11.4%
  - Need to treat
    - Reduce PTB <37w: 5-6 women
    - Reduce PTB <32w: 12 women

**Progesterone & PTB Prevention**

- No benefit of Progesterone to prevent PTB in patients with:
  - Short cervix on usg
  - Multiple pregnancy
  - After presentation for threatened PTL

*Progesterone for the prevention of PTB- a systematic review. Dodd et al. Obstet Gynecol 2008;112:127-34*

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**Cases**

**Case #1**

- 38 yo G3 P0020 (2 SAB) at 15w
- Referred for “short cervix” after 1° OB provider assessed her for some cramping.
- TV usg: 2.8-2.9cm without funneling

**Management options:**
1. Tocolysis and BMZ
2. Prophylactic Cerclage
3. Serial transvaginal ultrasounds

**Outcome**

- Present with preterm labor with ACD at 33 weeks
- Received BMZ
- Spontaneous labor & delivery at 35w
Case #2

- 22-year-old G1 P0 at 18w 3d
- CC: pelvic pressure, ↑ vag d/c, mild intermittent cramping
- Cx 3cm dil; membranes at os; cx 2.5cm long visually
- Intraamniotic sludge just inside of os

Management options:
1. Tocolysis
2. A/C then tocolysis
3. A/C then emergent cerclage
4. Nothing; expectant management or augmentation

Case #2 – 1 week s/p cerclage

Case #2 – 2 weeks s/p cerclage
Case #2
Outcome

• Over two weeks (now 21w EGA):
  – no clinical IAI
  – 2nd A/C → glucose of 18; neg. cultures
  – 3rd A/C → glucose of 10; neg. cultures
• Cervix opened to 2-3cm with intermittent cramping; patient agreed with and requested augmentation
• How would you treat her in the next pregnancy?

Case #3

• 38yo G2 P0010 at 13 weeks
• Prior SAB at 13w assoc. w/ vag pressure and passage of tissue with “little cramping”
• Patient was told it was due to “incompetent cervix”; requested “cerclage”
• TV usg: 3.8cm long; no funnel; + sludge
• Management?

Management options:

1. Prophylactic cerclage
2. A/C then prophylactic cerclage
3. Serial TV ultrasound – weekly
4. Serial TV ultrasound – every 2 weeks
5. Nothing and re-evaluate at 18-20 week usg

<table>
<thead>
<tr>
<th>GA (wks)</th>
<th>Cx length</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
<td>Cx 3.0cm</td>
</tr>
<tr>
<td>15</td>
<td>Cx 2.6cm</td>
</tr>
<tr>
<td>15 4/7</td>
<td>Cx 1.8cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GA (wks)</th>
<th>Cx length</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Cx 1.6cm</td>
</tr>
<tr>
<td>17</td>
<td>Cx 1.4cm</td>
</tr>
<tr>
<td>18</td>
<td>Cx 1.8cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GA (wks)</th>
<th>Cx length</th>
</tr>
</thead>
<tbody>
<tr>
<td>19</td>
<td>Cx 1.6cm</td>
</tr>
<tr>
<td>20</td>
<td>Cx 1.2cm</td>
</tr>
<tr>
<td>21</td>
<td>Cx 0.7cm</td>
</tr>
</tbody>
</table>
Case #3

- Hospitalized at 22w for A/C and possible 2nd cerclage
- A/C negative; cx 3mm at 23w; no cerclage; BMZ at 24w
- PPROM at 28 4/7w; prolapsed cord at 29w
- NICU on NC; never intubated; A&W now

Case #4

- 42yo G6 P1041 at 15 6/7w; sent for consultation for AMA and serial SABs; asymptomatic
- POB Hx:
  - 1st pregnancy: term, NSVD
  - 2-4th; SABs with D&Cs; negative APLS w/u
- Cx length = 2.4cm

Management options:
1. Emergent cerclage
2. Serial TV usg
3. Tocolysis and BMZ
4. Progesterone & serial TV usg

The referring group had her back the next week and she had the same overall length, but the funnel was more pronounced with 1.6cm of co-apting cervix. Referring provider placed a cerclage.

Case #4

GA (wks)  Cx length
18        Cx 2.5cm
21        Cx 2.7cm

Case #5

- 26yo G1 P0; both her and her mother were born preterm (32 & 34w, respectively)
- VB/spotting until 17w; uterine irritability since 17w
- shortening cx from 2.3cm at 18w, 1.8 at 21w and 9mm at 23 6/7
- Admitted for observation at the community hosp - and transferred to UCH next am with 6mm cx and uterine irritability

Outcome
- Delivered at Term

Management?
Case #5
Management options:
1. Emergent cerclage
2. A/C then emergent cerclage
3. Serial TV ultrasounds
4. Tocolysis and BMZ
5. Tocolysis, BMZ and progesterone

Case #5
• Tocolysis and BMZ; continued uterine irritability
• Facchinetti et al. AJOG 2007;196:453.e1-453.e4
  – RCT; 60 pts after tocolysis; 341mg 17P twice weekly vs placebo
  – 17P group; less shortening and delivered later

<table>
<thead>
<tr>
<th>GA (wks)</th>
<th>Cx length</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Cx 1.8cm</td>
</tr>
<tr>
<td>26</td>
<td>Cx 1.9cm</td>
</tr>
<tr>
<td>27</td>
<td>Cx 1.7cm</td>
</tr>
</tbody>
</table>

Case #5
Outcome
• PTL and delivered at 34 weeks

Case #6
• 30yo G2 P0010 (one prior TAB)
• Evaluated by primary OB provider for some cramping.
• Usg: Cervix long (>3.0cm)
• Cx canal dilated FT to IO & referred for this at 22w

Case #6
22 weeks
Case #6
22 weeks

Are we reassured:
1. Yes
2. No

Case #6
23 weeks
Case #6
23 5/7 weeks

Management options at this periviable window:
1. Emergent cerclage
2. A/C then emergent cerclage
3. Continue serial TV ultrasounds
4. Admit, tocolysis and BMZ

24 5/7 weeks (sequential images)

Asymptomatic

Case #6
26 weeks

Case #6
27 weeks
Case #6
Outcome

• Kept at UCH until 30 weeks and then transferred back to referring physician for delivery at the community hospital.
• Delivered at 35 weeks after PPROM.

Clinical Take Home

• Transvaginal US images are the most reproducible for assessment of cervical length
• Cervix shortens and effaces with increasing gestational age
• At 20 weeks
  - mean cervical length is 35 mm
  - 10th percentile is 25 mm

Clinical Take Home

• Risk of preterm birth increased if cervical length <25 mm or funneling of cervix
• Risk of preterm birth low if cervix >35 mm
• Fetal fibronectin does not add anything to the cervix that is >30 mm
• No treatment plan definitively proven effective if cervix <25 mm

Clinical Take Home

• Cervical assessment by ultrasound may be useful adjunct in women
  - at increased risk for preterm delivery
  - with atypical history of cervical incompetence

Clinical Take Home

• At present there is insufficient evidence to support
  - use of ultrasonographic assessment of cervical length as a screening tool in a low risk population
  - cerclage placement solely on the basis of short cervical length on USS

Thank You!
Cervical Incompetence

Fundal Pressure

- Does fundal pressure (FP) aid in the diagnosis of asymptomatic cervical incompetence in the second trimester?
- 2 studies suggest that it may aid in evaluation of incompetent cervix
- Serial CL

Guzman et al 1994; Macdonald et al. UOG, 2001

Cervical Incompetence

- Most histories not “classic”
- Uterine cramps, abdominal pressure, bloody show, watery discharge
- Rarely straightforward
Transabdominal (TA) Technique

- Cervical length assessment by TA ultrasound is inadequate:
  - Presenting part obstructed clear view of cx
  - Often required full bladder to view cx
  - Distended bladder affected length of cx canal
  - Cx not clearly visualized because of long distance
- Transperineal and transvaginal approaches eliminate these problems

Andersen HF. J Clin Ultrasound 1991;19:77

Translabial (Transperineal) Technique

Transabdominal Full bladder Sagittal view

Sagittal View

Ultrasound probe

Anterior Cervix

Pubic Symphysis

Bladder

Posterior Cervix

Translabial (Transperineal) Technique

Sagittal View

Ultrasound probe

Anterior Cervix

Pubic Symphysis

Bladder

Posterior Cervix
Transperineal Technique

- Cervical length can be properly visualized and measured adequately by TP USG in about 80% of patients.
- Pitfalls: Air in the vagina and gas in the rectum
- High correlation b/w cervical length obtained by endovaginal and transperineal exam (R=0.93)

Cicero S et al. Ultrasound Obstet Gynecol 2001;17:335

Technique

- Transvaginal vs. Transperineal USG
  - Prospective comparison of 102 women
  - Poor correlation of methods
  - 10 unable to visualize landmarks with transperineal
  - In 33% difference in measurement >20% of time

Owen et al AJOG 1999; 181:780-3

What does this mean for the TP USG?

PPROM & Labor Progress

Preterm Delivery

- Preterm delivery may be associated with short cervical length in second trimester
- Short cervix in second trimester is not highly predictive of preterm labor
- Cerclage does not appear to decrease risk

PPROM Expectant Management

- NICHD MFMU network
- RCT: abx vs plac; expt manag; 24-32 wks; ≥2 cervical exams
- Secondary analysis: effect of digital cervical exam:
  - No difference for IAI, endometritis, wound inf, infant outcome

<table>
<thead>
<tr>
<th>GA at Enrollment</th>
<th>Exam (n=188)</th>
<th>No Exam (n=696)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROM to Delivery Time</td>
<td>3</td>
<td>5</td>
<td>0.009</td>
</tr>
</tbody>
</table>

**Delivery in 1 week and Cervical Length**

*Threatened Preterm Labor*

- **Graph:**
  - Delivery within 7 days
  - Cervical Length (mm)
  - Data from Tsoi et al. UOB 2003;21:552-55

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**Treatment of PTL**

*Many patients are falsely diagnosed to have PTL!*

- **Points:**
  - Meta-analysis of RCTs for PTL Tx
  - Placebo vs β-adrenergic agents
  - 47% of placebo gp deliver at term

King et al BJOG 1988;5:211-22

---

**Cervical Dilation in a Complete Placenta Previa**

- **Image:**
  - Oyelese et al J Ultrasound Med 2004;23:1233-34

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**Vaginal Progestone Suppository**

*Preterm Delivery*

- **Image:**
  - Oyelese et al J Ultrasound Med 2004;23:1233-34
The Progesterone Story

Vaginal Progestone Suppository
Preterm Delivery
da Fonseca EB et al. AJOG 2003;188:419-24

Vaginal Progestone Suppository
Preterm Delivery
da Fonseca EB, 2004

Intramuscular Progestone
Preterm Delivery
Meis et al. NEJM 2003;188:2379-85

Progestone Levels & Contraction Frequency

Contraction Frequency & Progestone Therapy
Franchin R et al. Fert Steril 2001;75:1136-40
First Uterine Pass Effect

Serum & Tissue Progesterone Levels
8% Vaginal Progesterone Gel

Preterm Delivery
A Major Cause of Perinatal Mortality

Preterm Delivery
What is the predictive value?

Preterm Delivery
What is the predictive value?

Direct Vagina-to-Uterus Transport

Vaginal Application of Gel


Preterm Delivery
A Major Cause of Perinatal Mortality

Following USS in second trimester
- 6877 retrospective cohort
- PTD < 32 wks
- <25 mm 13 X increase PTD (32%)
- 15 mm 24 X increase PTD (48%)

Hasson et al, AJOG 2000;1821:1458
Andrews et al, Obstet Gynecol 2000;95:222
Taipale et al, Obstet Gynecol 1998;92:902
Hibbard et al, Obstet Gynecol 2000;96:972

Preterm Delivery
What is the predictive value?

- Second trimester USS <25 mm length cervix
- Second trimester FFN
- Delivery before 35 weeks

Iams et al, AJOG 2001;184:652

Preterm Delivery
What is the predictive value?

- USS
  - 40% sensitivity
  - 15% positive predictive value

- FFN
  - 20% sensitive
  - 20% positive predictive value

Iams et al, AJOG 2001;184:652
Cervical Incompetence

- "Classic history"
- Repetitive, acute, painless, second-trimester losses without preceding bleeding or contractions


Cervical Incompetence

- Criteria for diagnosis in women with atypical history
  - Cervical length <5th – 10th percentile (20-25 mm)
  - Funnel >30% of total length of cervix

Multiple Gestation

- Twins 2% of deliveries
  - Preterm delivery rate 50%
  - 4 - 5 X rate of perinatal mortality vs. singleton
-Triplets 0.1 – 0.3% of deliveries
  - Mean gestational age at delivery 33 weeks
  - Perinatal mortality rate 20%

Multiple Gestation

- Increasing prevalence of higher order multiples
- Little advances in prevention or detection of preterm labor

Multiple Gestation

- Retrospective study of 85 twin pregnancies
- Screening USS exam at 24 – 26 weeks
- Delivery >34 wks: cervical length 36 ± 6 mm
- Delivery <34 wks: cervical length 27 ± 8 mm

Imseis et al, AJOG 1997:177:1149

Multiple Gestation

- Cervical length > 35 mm at 24 – 26 weeks
  - 97% deliver > 34 weeks
- Cervical length < 35 mm at 24 – 26 weeks
  - 31% deliver <34 weeks

Imseis et al, AJOG 1997:177:1149
Multiple Gestation

- Prospective study of 65 twin pregnancies
- Ultrasound examination in second trimester
- 20% cervical length <30 mm; 62% PTD <35 wks
- 6% cervical funneling; 75% PTD <35 wks
- 35% cervical length > 35 mm; 4% PTD < 35 wks

Yang et al, Ultras Obstet Gynecol 2000;15:288

Multiple Gestation

- Prospective study 131 twins
- Longitudinal evaluation of cervical length 15 – 28 weeks
- <20 mm length between 15 – 20 weeks
  - 80% delivery <32 weeks (PPV)

Guzman et al, AJOG 2000;183:1103

Multiple Gestation

- Retrospective study 32 triplet gestations
- Serial cervical length assessment 10, 20, 24, 28
- Comparison to gestational age-matched singletons

Ramin et al, AJOG 1999;180:1442-5

Multiple Gestation

- Average cervical length in triplets is shorter at each gestational age as compared to singletons
  - 25 ± 8 mm vs. 35 ± 8 mm at 24 weeks

Ramin et al, AJOG 1999;180:1442

Multiple Gestation

- No cervical length considered “low risk” for preterm delivery in this triplet pregnancy population

Ramin et al, AJOG 1999;180:1442

Multiple Gestation

- Statistically significant difference in cervical length between patients delivered before and after 33 weeks
  - 30 ± 3 mm vs. 33 ± 11 mm at 20 wks
  - 21 ± 6 mm vs. 27 ± 9 mm at 28 wks

Ramin et al, AJOG 1999;180:1442
Multiple Gestation

- Triplets
- Prospective study triplets
- Cervical length <25 mm 15 – 20 wks
  - 100% positive predictive value delivery <28 wks

Guzman et al, AJOG 2000;183:1108

Multiple gestation

- Triplets
- Prospective study 43 triplets
- Cervical length 22 wks
- Delivery before 33 weeks
  - <25 mm 50% sensitivity
  - <15 mm 33% sensitivity

To et al, Ultras Obstet Gynecol 2002;16:515

Multiple Gestation

- Cervical length assessment
  - May prevent initiation of unnecessary intervention in twins
  - Uncertain role in triplets

Maslovitz S et al J Ultrasound Med 2004;23:1187-91

Clinical Take Home

- In my practice....
  - Weekly transvaginal ultrasound from 14-24 weeks in women with atypical history of cervical USS
  - USS as adjunct to fetal fibronectin in women with contractions and no cervical change to avoid unnecessary intervention
Cervical Assessment Before Induction of Labor

<table>
<thead>
<tr>
<th>Index</th>
<th>Bishop Score ≥ 4</th>
<th>Cervical Length ≤ 3.1 cm</th>
<th>Presence of Funneling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity, % (n)</td>
<td>51 (47/93)</td>
<td>75 (70/93)</td>
<td>44 (41/93)</td>
</tr>
<tr>
<td>Specificity, % (n)</td>
<td>75 (9/12)</td>
<td>83 (10/12)</td>
<td>67 (8/12)</td>
</tr>
<tr>
<td>PPV, % (n)</td>
<td>94 (47/50)</td>
<td>97 (70/72)</td>
<td>91 (41/45)</td>
</tr>
<tr>
<td>NPV, % (n)</td>
<td>16 (9/55)</td>
<td>27 (9/33)</td>
<td>13 (8/60)</td>
</tr>
</tbody>
</table>


Ultrasound Assessment of Cervical Length in Threatened PTL

- Logistic regression analysis demonstrated that the only significant contributor in the prediction of delivery within 7 days was cervical length < 15 mm
  - OR = 101, 95% CI (12-800), p <0.0001


The Push Against Vaginal Birth
Young D. Birth 2003; 30: 149-152

- What is a women’s chance of having a cesarean delivery in the United States?
  - She's at high risk if she's:
    - too big, too small
    - too early, too late
    - too old, too fearful
    - too tired of being pregnant, too tired of being in labor
    - having twins
    - breech, had a previous cesarean delivery
    - due and so is the weekend, Christmas, Thanksgiving, New Year's Eve
  - She's at high risk if her:
    - doctor is in doubt, scared of a lawsuit
    - too busy, going out of town
    - convinced that a cesarean is always after
- ... the reasons go on

Prediction of Successful Induction of Labor at Term: Role of clinical history, digital examination, U/S of the cervix, and fFN assay

- Conclusion
  - Only obstetric history and digital examination predicted accurately vaginal delivery within 24 hours and were independently associated with labor duration.
  - Fetal fibronectin and ultrasound measurements failed to predict accurately the outcome of induced labor.


Survival According to Gestational Age

**Sens-Spec-PPV-NPV**

<table>
<thead>
<tr>
<th></th>
<th>Test +</th>
<th>Test -</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dz +</td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td>Dz -</td>
<td>B</td>
<td>D</td>
</tr>
</tbody>
</table>

**PPV** = \( \frac{A}{A+B} \)

**NPV** = \( \frac{D}{C+D} \)

**Sensitivity (A/A+C):** The proportion of the diseased patients labeled positive by the test.

**Specificity (D/B+D):** The proportion of the disease-free patients labeled negative by the test.

---

**PTL, Short Cx & Funnel**

- Increases the risk of PTB
  
  Gomez et al, AJOG, 1994; Timor Tritsch, AJOG 1996

- 70 pts; PTL symptoms; wedging
  
  Sens=100% Spec=74%
  
  PPV=59% NPV=100%

  Timor Tritsch, AJOG 1996

**Funneling & Risk of PTB**

*Asymptomatic HR Patient*

**MIXED REPORTS**

- If cervical length replaced by “funnel” increased risk of preterm delivery
  
  - 25% funnel: PTD 25%
  
  - >50% funnel: PTD 79%
  
  - others have assessed funnel width > 5 mm or length > 3mm

  - Berghella et al, UOG 1997:10:161
  
  - Leitich et al, AJOG 1999;181:1465

**Funneling In the Asymptomatic Patient**

**MIXED REPORTS**

- Iams et al; NICHD Prematurity Prevention Trial: Funneling had similar value as cervical length in predicting PTB

- Guzman et al and To et al: Concluded that funneling does not provide any additional diagnostic information over that provided by cervical length in the prediction of PTB in low risk asymptomatic patients.

  UOG 2001;18:204
  UOG 2001;18:200

**Funneling**

- As predictive of preterm birth as shortened cervical length in some studies

- Increased interobserver variability, so less reliable

**Cervical Incompentence**

- In women with “atypical” history
  
  - Serial US between 14 and 24 weeks
  
  - Initially reported using transabdominal US
  
  - Subsequently reported using transvaginal US

  Andersen et al, AJOG 1991164:379
  Guzman et al, Obstetric Gynecology 1994;83:248
Preterm Delivery

Does cerclage decrease risk?

- 168 women at risk for preterm delivery
- USS 14 – 23 wks
- 68 women <25 mm / >25% offered cerclage
- 39 cerclage, 24 no cerclage
- No difference in rate of preterm delivery

Berghella et al, AJOG 1999;181:809

Preterm Delivery

Does cerclage decrease risk?

- 61 patients asymptomatic cervical dilatation on USS in second trimester
- Randomized to McDonald cerclage
- No difference gestational age at delivery (34 wk)

Rust et al, AJOG 2000;183:830

Manual Cervical Assessment

- Identification of women at increased risk
- Early diagnosis of preterm labor (PTL)
- Intervention in women at risk of or in PTL

CERVIX

PTL & Short Cervix

<table>
<thead>
<tr>
<th>Authors</th>
<th>Cut-off (mm)</th>
<th>Prevalence of PTD (%)</th>
<th>Sens (%)</th>
<th>PPV (%)</th>
<th>NPV (%)</th>
</tr>
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<tbody>
<tr>
<td>Murakawa, 1993</td>
<td>&lt;20</td>
<td>34</td>
<td>27</td>
<td>100</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>≥35</td>
<td></td>
<td></td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Iams, 1994</td>
<td>&lt;30</td>
<td>40</td>
<td>100</td>
<td>55</td>
<td>100</td>
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<td>Gomes, 1994</td>
<td>≤18</td>
<td>37</td>
<td>73</td>
<td>67</td>
<td>83</td>
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<tr>
<td>Rizzo, 1996</td>
<td>≤20</td>
<td>43</td>
<td>68</td>
<td>71</td>
<td>76</td>
</tr>
<tr>
<td>Rozenberg, 1997</td>
<td>≤26</td>
<td>26</td>
<td>75</td>
<td>50</td>
<td>89</td>
</tr>
</tbody>
</table>

To et al, Lancet 2004;363:1849-53

Cervical Incompetence

- US used to follow cervical length after cerclage
- Prophylactic cerclage associated with increase in cervical length (2.7 ± 0.9 mm to 3.6 ± 0.9 mm)
- Increase in cervical length is NOT predictive of delivery at term

Funai et al, Obstet Gynecol 1999;94:117
Cervical Incompetence

- US useful in patients with "atypical history"

- Optimal interval between scans unknown

- US may be useful following cerclage