The use of ultrasound on the labor and delivery suite

The menu of quick hits
1. Cervical length and threatened preterm labor
2. Premature rupture of membranes
3. Placenta previa before delivery
4. Vasa previa
5. Uterine scar
6. Trans-perineal ultrasound (TPU)

Patients who present in Preterm labor
Most patients presenting with contractions in late pregnancy prior to 36 weeks are in PTL.

Our job is to pick out the ones who are really at risk and leave the others alone.

Cervical Length
A key to preterm labor

Cervical Length

216 pts with painful preterm contractions (24-36 wks)
43 pts - cervical length <1.5 cm
16 of these (37%) delivery < 7 days
However, 132 had CL > 1.5 cm and only one delivered with 7 days
Negative predictive value of > 99%

Cervical Length in Preterm Labor

253 women with preterm labor
21 delivered preterm (8.3%)
If CL ≥ 1.5 cm, 1.8% delivered < 7 days
If CL < 1.5 cm, 47.2% delivered < 7 days
**Cervical Length**

**Proof from RCT that CL is useful**

RCT 3 studies

287 patients between 27 and 35 weeks with regular contractions
In half the providers were provided with the cervical length information, half not.
Those CL patients had a 36% drop in PTB < 37 weeks and 10% fewer interventions.


**Suggested Protocol in Threatened PTL**

If Cl < 2 cm, admit

If CL 2.0 cm - 2.9, get fFN. If positive, admit

If 3.0 cm or more, discharge
Cervical Length and pPROM

101 women with pPROM
58 delivered within 7 days
Highly correlated with:
- cervical length
- presence or absence of contractions
- gestational age


Placenta Previa

“Nobody likes surprises. Placenta previa should not be one of them”

Confucius or Tolstoy, or someone smart

Transvaginal Surprise

Incidence – 1 : 2500

Risk Factors
- Multiple pregnancies
- 2nd trimester low-lying placenta
- IVF
- Bleeding
- Bi-lobed / Succenturiate lobed placenta
- IVF 1 in 290

Types
- (1) Velamentous cord insertion
- (2) Succenturiate placenta

Mortality – 70-90%-- if not diagnosed!

Vasa Previa

Vasa previa: Knowing it is there is lifesaving

The point(s)?
- Some time before delivery, make sure there is only one placenta.
- Always look for the placental cord insertion.
- Also, if the placenta is low lying, and Cesarean section is in the offing, make sure the cord insertion is not on a collision pathway with the scalpel.
A TOLAC: To have or not to have? Depends upon the thickness of the scar.

Uterine Scar

First study: Uterine Wall Scars
Lancet 1996; 347: 281-284

Ultrasound and uterine wall scars
642 patients with previous C-sections
All had TA ultrasound evaluation of lower uterine segment (one investigator in all)
- Vaginal delivery 60.1%
- CSx (1/2 emergency) 39.9%
- Uterine rupture 2.5%
- Dehiscence 1.5%

Uterine Wall Scars
Lancet 1996; 347: 281-284

Conclusion
If thinnest uterine wall diameter is > 3.5 mm, negative predictive value was 99.3%
16% of those with 1.6 - 2.5 mm had scar defect

. Safe to do VBAC if uterine wall is of adequate thickness

Uterine wall thickness and rupture: a review

Labor in previous pregnancy increases the thickness of scar in next pregnancy. (by average of 0.6mm).
Previous studies:
1. Bujold (2009) 236 pts. 2.3 mm threshold. 9.1% vs 0% rupture
2. Gotoh (2000) 2.0 mm threshold. PPV 73.9%, NPV 100%

Studies vary but:
If > 3.5 mm chances of rupture or dehiscence close to 0%
If < 2.5 mm chances were high (up to 16%)
Between 2.5 mm and 3.5 mm, risk varied enough to make predictions difficult

Uterine Scar Thickness
Paper from Montreal

Logistic regression analysis for factors that were associated with uterine scar defect

<table>
<thead>
<tr>
<th>Factors</th>
<th>Before adjustment</th>
<th>After adjustment</th>
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<tr>
<td></td>
<td>Odds Ratio 95% CI</td>
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<tr>
<td>Full lower uterine segment thickness &gt; 2.3 mm</td>
<td>5.29 (1.24 - 20.98)</td>
<td>4.6 (1.04 - 20.91)</td>
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<tr>
<td>Single-layer closure</td>
<td>5.79 (1.48 - 22.65)</td>
<td>5.4 (1.39 - 30.82)</td>
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<td>Inter-delivery interval, mo</td>
<td></td>
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<tr>
<td>&lt; 18</td>
<td>6.79 (1.49 - 31.03)</td>
<td>9.74 (1.57 - 60.57)</td>
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<tr>
<td>18 - 24</td>
<td>1.21 (0.14 - 10.69)</td>
<td>1.32 (0.14 - 12.86)</td>
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<tr>
<td>≥ 24</td>
<td>1.00</td>
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CI, confidence interval
Techniques to do uterine scar thickness

Ways to approach the uterine wall

TAS: This works best in patients who have not had labor before prior CSx or whose section was performed preterm.

TVS: Best if term delivery with labor prior to previous CSx.

Ideal to use both

Trans-perineal Ultrasound

Fetal station and progression through labor

Work of Antonio Barbera and later authors

Indications for Cesarean Section

NRFHR 21.9%
Failure to progress 20.7%
Pelvic Landmark

Ischial Spines

Fetal Head Station

Clinical Assessment

Pelvic Axis

Pelvic Axis

Angle of ischial spines

CT scan identification

98° ± 2°

Angle of progression

Geometrical Model
Trans Perineal Ultrasound Technique

Fetal Head Caput

“Angle of Progression”

Fetal Head Caput

“Angle of Progression”

Fetal Head Caput

“Angle of Progression”

Fetal Head Caput

“Angle of Progression”

Fetal Head Caput

“Angle of Progression”
Fetal Head:
“Angle of Progression”

What we do know about the TPU angle.

1. TPU angle has excellent inter-observer variability
   Digital exam is a crap shoot with awful IOV
2. TPU can be used objectively to follow progress using the
   head as its own control.
3. It correlates with: ultimate ability to attain vaginal
   delivery (threshold >125° - 160°), length of second stage* (>125°), success of induction** (90° before induction), and
   success of vacuum delivery (>145°).

*Ghi et al AJOG 2016;215: 214
** Balbez et al UOG 2016;48: 36-91.

Some controversy regarding TPU angle and clinical station

Tutschek et al, correspondence in Ultrasound Gynecol
2017;49:279

0 station on CT equaled TPU angle of 116° (versus 98°)
+1 station was 127° (versus 105°)

Big difference between the objective CT studies. This now
makes it difficult to compare angle with our conception of
clinical station.
Prediction of time to delivery by transperineal ultrasound in second stage of labor

Sub pubic arch

339 patients at term had 3 D acquisitions by TPU
At delivery; 92% delivered from an OA position, 8% OP
Average SPA was 104° in OP, compared with average SPA in OA of 116.4°
Maternal height also correlated statistically with OR
The best SPA cut off for OP at delivery was < 90.5°.
Also much higher rate of CSx and instrument delivery

A parting thought

Even an old hand-me-down machine nearby can give all the information you need to answer some of the most important questions that arise on the labor and delivery floor.
All one needs is the creativity and motivation to use it.

But here is a dissenting voice
“This is what I think of your technology!”