PLACENTAL CONTRIBUTION TO OBSTETRIC HEMORRHAGE

Ware Branch, MD
Medical Director of Women and Newborn Clinical Program for the Urban Central Region of Intermountain Healthcare
Professor of Obstetrics and Gynecology, University of Utah, Salt Lake City
Third Stage of Labor

- Sudden decrease in uterine size and area of implantation site
- Formation of retroplacental hematoma
- Uterine contraction
- Secondary clot formation
Placental Contribution to Obstetric Hemorrhage

- Placental abruption
- Placenta previa
- Placenta accreta (spectrum)
Placental Contribution to Obstetric Hemorrhage

- Uterine bleeding after 20 weeks complicates 5-10% of pregnancies; of these:
  - Abruptio ~ 15%
  - Previa ~ 10%
  - Accreta ~?
  - Other (local / focal bleeding)
Placental Contribution to Obstetric Hemorrhage

Placental Abruption

- Bleeding at the decidual-placental interface (maternal vessels in decidua basalis) → premature separation
- Occurs in about 0.5-1% of pregnancies
- Adverse outcomes:
  - Fetus/neonate: FGR, LBW, PTB, HIE, perinatal death
  - Mother: DIC, transfusion, hysterectomy, renal failure, death
Placental Contribution to Obstetric Hemorrhage

Placental Abruption

• Estimated to be the cause of ~10% of preterm births and ~10% of perinatal deaths

• Maternal mortality
  – In about about 1% of serious abruption cases
  – Attributable cause of 7 maternal deaths in UK, 2000-2005
Placental Contribution to Obstetric Hemorrhage

Placental Abruption

Risk Factors for Abruption

Demographic or Behavioral
- Maternal age <20 or >34
- Smoking
- Cocaine use

Historical
- Prior abruption
- Prior ischemic placental disease
- Prior cesarean

Current Medical
- Hypertensive disease
- Vaginal bleeding in pregnancy
- PPROM
- Trauma
- FGR
- Chorioamnionitis
Placental Contribution to Obstetric Hemorrhage

Placental Abruption

• Etiopathogenesis poorly understood
  – ? Poor utero-placental vascularization – ischemic placental disease
  – ? Defective hemostasis at feto-maternal interface
    • Genetic factors
  – Vasconstrictive factors
Placental Contribution to Obstetric Hemorrhage

Placental Abruption

**Management**

- Lesser degrees of abruption – hospitalization until resolution or worsening
- More serious cases – delivery and maternal resuscitation
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Placenta overlying cervical internal os
  - Formerly “complete,” “partial,” and “marginal”
  - Now “previa” and “low lying”

- Complicates ~0.5% of pregnancies
  - More frequent in relation to increased rate of cesareans
  - Also more frequent in relation to prior pregnancy losses and parity
<table>
<thead>
<tr>
<th></th>
<th>OR for Placental Previa</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prior Cesareans</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4.5 (3.6-5.5)</td>
</tr>
<tr>
<td>2</td>
<td>7.4 (7.1-7.7)</td>
</tr>
<tr>
<td>3</td>
<td>6.5 (3.6-11.6)</td>
</tr>
<tr>
<td>4</td>
<td>44.9 (13.5-149.5)</td>
</tr>
<tr>
<td><strong>Prior Pregnancy Losses</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1.6 (1.3-1.8)</td>
</tr>
<tr>
<td>2</td>
<td>2.3 (1.8-3.0)</td>
</tr>
<tr>
<td>3</td>
<td>3.7 (2.7-5.2)</td>
</tr>
<tr>
<td><strong>Parity</strong></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1.9 (1.5-2.5)</td>
</tr>
<tr>
<td>2</td>
<td>2.2 (1.7-3.0)</td>
</tr>
<tr>
<td>3</td>
<td>2.6 (1.8-3.8)</td>
</tr>
</tbody>
</table>

*Obstet Gynecol Survey. 2012; 667:503*
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Associated adverse outcomes attributable to maternal bleeding
  - 10-fold increased risk of antepartum bleeding
    - ↑ likelihood of transfusion, hysterectomy, ICU admission, maternal death
  - Adverse fetal-neonatal outcomes
    - Mostly related to prematurity: ~15-20% rate of delivery <34 weeks; 2-4 fold increase PNM rate
    - ? Fetal growth restriction
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Mechanism of hemorrhage
  - Antepartum
    - Placental separation from decidua
      - GA-related
      - Contractions, cx changes, alterations in lower uterine segment
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

• Mechanism of hemorrhage
  – Antepartum (occurs in 50% of previa cases)
    • Related to parity
    • May be more frequent with short cx, placental lacunae, other US features
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Mechanism of hemorrhage
  - Postpartum
    - Poorly contractile lower uterine segment
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- Previa is fairly frequent finding on mid-trimester US
  - >85% resolve due to “placental migration”
    - Concept of *trophotropism*
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

- **Antepartum Management**
  - Periodic US reassessment of placental location
  - If antepartum hemorrhage:
    - Hospitalization (vs outpatient care)
      - Recurrence in ~50% of cases
      - ? Number of episodes
      - Routine hospitalization at 34 weeks?
    - Antenatal steroids
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

• Antepartum Management
  – Controversial / NEB / not recommended
    • Bed rest / pelvic rest
    • Cx length measurements
    • Tocolytic agents
    • Cerclage
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

• Delivery Management
  – Delivery at 36-37 weeks (Sem Perinatol. 2011; 35:249)
  – Cesarean delivery
    • For previa or low-lying placenta within 1-2 cm of cervix
Placental Contribution to Obstetric Hemorrhage

Placenta Previa

• Delivery Management
  – Use of prediction schemes for emergency delivery
    • Prior cesarean
    • Antepartum bleeding (number of episodes)
    • Need for transfusion
## Placental Contribution to Obstetric Hemorrhage

### Placenta Previa

<table>
<thead>
<tr>
<th>Variable</th>
<th>Delivery When Scheduled (N=121)</th>
<th>Emergency Delivery (N=93)</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cesarean</td>
<td>13 (10.7%)</td>
<td>27 (29%)</td>
<td>4.6 (1.8-11)</td>
</tr>
<tr>
<td>1 bleed (vs no bleed)</td>
<td>38 (31.4%)</td>
<td>27 (29.3%)</td>
<td>7.5 (2.5-23)</td>
</tr>
<tr>
<td>2 bleeds (vs no bleed)</td>
<td>16 (13.2%)</td>
<td>23 (25%)</td>
<td>14 (4.3-47)</td>
</tr>
<tr>
<td>≥ 3 bleeds (vs no bleed)</td>
<td>13 (10.7%)</td>
<td>37 (40.2%)</td>
<td>27 (8.3-90)</td>
</tr>
<tr>
<td>Transfusion</td>
<td>3 (2.5%)</td>
<td>22 (23.9%)</td>
<td>6.6 (1.8-24)</td>
</tr>
</tbody>
</table>

Placental Contribution to Obstetric Hemorrhage

Placenta Previa

• Intraoperative Management
  – Persistent LUS bleeding
    • Uterotonic agents
    • LUS compression sutures or B-Lynch sutures
    • Intrauterine balloon tamponade
    • Local hemostatic agents
Placenta Accreta

Definitions

- Placenta that is abnormally ("morbidly") adherent to the uterus
  - Increta: Invades the myometrium
  - Percreta: Invades the serosa or adjacent organs (<10%)
- Accreta: All of the above

Oyalese and Smulian. Obstet Gynecol. 2006; 102:927
Placenta Accreta

Pathophysiology

• Absence or deficiency of Nitabuch’s layer of the decidua
  – Failure to reconstitute the endometrium-decidualis basalis after insult
• Histology: trophoblast (usually) invades myometrium without intervening decidua
• Placenta does not separate: bleeding
Placenta Accreta

Incidence

- 1960s: 1 in 30,000 deliveries
- 1982 – 2002: 1 in 533 deliveries
- 2000 – 2010: 1 in 333 deliveries!

Miller, et al. AJOG. 1997; 177:210
Wu, et al. AJOG. 2005; 192:1458
Pub Committee SFMFM; Belfort, Am J Obstet Gynecol. 2010; 430-8
Placenta Accreta

Risk Factors

- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
- Cesarean delivery
Methods

- Prospective observational cohort
- MFMU
- 19 Academic medical centers
- 4 years (1999 – 2002)
- Daily ascertainment of CD
- Trained study nurses
- 378,168 births / 57,068 CDs
- No labor – 30,132 CDs

## Placenta Accreta

<table>
<thead>
<tr>
<th>Number of Cesareans</th>
<th>N</th>
<th>Accreta</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6,195</td>
<td>15 (0.2%)</td>
</tr>
<tr>
<td>2</td>
<td>15,805</td>
<td>49 (0.3%)</td>
</tr>
<tr>
<td>3</td>
<td>6,326</td>
<td>36 (0.6%)</td>
</tr>
<tr>
<td>4</td>
<td>1,475</td>
<td>31 (2.1%)</td>
</tr>
<tr>
<td>5</td>
<td>260</td>
<td>6 (2.3%)</td>
</tr>
<tr>
<td>6 or more</td>
<td>89</td>
<td>6 (6.7%)</td>
</tr>
</tbody>
</table>

## Placenta Accreta

<table>
<thead>
<tr>
<th>Number of Cesareans</th>
<th>Previa</th>
<th>Accreta</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>397</td>
<td>13 (3.3%)</td>
</tr>
<tr>
<td>2</td>
<td>212</td>
<td>23 (11%)</td>
</tr>
<tr>
<td>3</td>
<td>72</td>
<td>29 (40%)</td>
</tr>
<tr>
<td>4</td>
<td>33</td>
<td>20 (61%)</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>4 (67%)</td>
</tr>
<tr>
<td>6 or more</td>
<td>3</td>
<td>2 (67%)</td>
</tr>
</tbody>
</table>

Placenta Accreta
Clinical Outcomes (76 cases)

- Maternal ICU admission: 18 (26%)
- Blood transfusion: 56 (82%)
- ≥ 4 Unit blood transfusion: 27 (40%)
- Coagulopathy: 20 (29%)
- Ureteral injury: 3 (4%)
- Infections: 18 (26%)
- Reoperation: 6 (9%)

## Placenta Accreta
### C-Hyst: Morbid Business

### Reported outcomes w Accreta Spectrum

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfusion of 4+ U PRBC</td>
<td>39-79%</td>
</tr>
<tr>
<td>Coagulopathy</td>
<td>17-29%</td>
</tr>
<tr>
<td>Ureteral injury</td>
<td>1-8%</td>
</tr>
<tr>
<td>Bowel Injury</td>
<td>1%</td>
</tr>
<tr>
<td>ICU Admission</td>
<td>15-30%</td>
</tr>
<tr>
<td>Venous thromboembolism</td>
<td>2-10%</td>
</tr>
<tr>
<td>Abdomino-pelvic infection</td>
<td>5-8%</td>
</tr>
<tr>
<td>Reoperation</td>
<td>2-13%</td>
</tr>
<tr>
<td>Fistula</td>
<td>2-3%</td>
</tr>
<tr>
<td>Death</td>
<td>0.5%</td>
</tr>
<tr>
<td>Loss of uterus</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Composite**: 18-51%
Placenta Accreta
Diagnosis

- **Antepartum**
  - Clinical
  - Ultrasound
  - Magnetic Resonance Imaging
  - Biomarkers

- **Postpartum**
  - Histology
Placenta Accreta

- Placenta previa
- Multiple placental lacunae
  - 80-93% sensitive
- Loss of retroplacental hypoechoic zone
  - 7-52% sensitive
  - 21% false positive rate
- Decreased retroplacental myometrial thickness
  - <1 mm
- Abnormal bladder interface
- Placenta beyond uterine serosa
Placenta Accreta
Ultrasound Diagnosis

• In patients at risk for accreta and combining multiple criteria:
  • Decent sensitivity and specificity
  • Fair PPV
  • Pretty good NPV
• But it can’t tell me whether or not to attempt placental removal!!
Placenta Accreta
MRI Diagnosis

- Best MRI signs: T2 hypointense placental bands, a focally interrupted myometrial border, infiltration of the pelvic organs (duh), and tenting of the bladder
- Accuracy probably similar to ultrasound
- May be useful with posterior accreta
- Expensive and less available
- But it can’t tell me whether or not to attempt placental removal!!
Placenta Accreta
Management
What to Do Depends Upon the Case

- 4 prior cesareans; major (complete/central) placenta previa; imaging findings c/w accreta
- 3 prior cesareans; major placenta previa; imaging findings show percreta into broad ligament

CURRENT MANAGEMENT:
Appropriate counseling of patient
Scheduled C-hyst with C-hyst team
Type and crossed for major hemorrhage
4-5 hours in OR expected
Planned ICU admission post op
Placenta Accreta

Management

What to Do Depends Upon the Case

- 2 prior cesareans; anterior, low-lying placenta with several imaging findings c/w small area of accreta (but not percreta)
- 1 prior cesarean; major placenta previa; imaging findings c/w accreta (but not percreta)

?
Placenta Accreta
Management Controversies

• Pre-op ureteral stent placement
• Internal iliac / uterine artery ligation
• Internal iliac balloon placement / occlusion
• Lower aorta balloon placement / occlusion
Placenta Accreta
Conservative Management

- Preserve fertility and avoid hysterectomy
- Placenta left in situ
- Embolization of internal iliac vessels
### Multicenter, retrospective study of conservative management of placenta accreta in 167 women in 25 French university hospitals 1993-2007

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Placenta Accreta, Including Placenta Percreta (n=167)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysterotomy (n=139)</td>
<td></td>
</tr>
<tr>
<td>Fundal</td>
<td>71 (51.1)</td>
</tr>
<tr>
<td>Low transverse</td>
<td>68 (48.9)</td>
</tr>
<tr>
<td>Placenta left in situ</td>
<td>167 (100)</td>
</tr>
<tr>
<td>Partially</td>
<td>99 (59.3)</td>
</tr>
<tr>
<td>Entirely</td>
<td>68 (40.7)</td>
</tr>
<tr>
<td>Preoperative ureteric stent placement</td>
<td>6 (3.6)</td>
</tr>
<tr>
<td>Uterotonic administration</td>
<td>167 (100)</td>
</tr>
<tr>
<td>Primary postpartum hemorrhage</td>
<td>86 (51.5)</td>
</tr>
<tr>
<td>No additional uterine devascularization procedure</td>
<td>58 (34.7)</td>
</tr>
<tr>
<td>Additional uterine devascularization procedure</td>
<td>109 (65.3)</td>
</tr>
<tr>
<td>Pelvic arterial embolization</td>
<td>62 (37.1)</td>
</tr>
<tr>
<td>Vessel ligation</td>
<td>45 (26.9)</td>
</tr>
<tr>
<td>Stepwise uterine devascularization</td>
<td>15 (9.0)</td>
</tr>
<tr>
<td>Hypogastric artery ligation</td>
<td>23 (13.8)</td>
</tr>
<tr>
<td>Stepwise uterine devascularization and hypogastric artery ligation</td>
<td>7 (4.2)</td>
</tr>
<tr>
<td>Uterine compression suture</td>
<td>16 (9.6)</td>
</tr>
<tr>
<td>Balloon catheter occlusion</td>
<td>0</td>
</tr>
<tr>
<td>Methotrexate administration</td>
<td>21 (12.6)</td>
</tr>
</tbody>
</table>

Data are n (%).

*The total number of additional uterine devascularization procedures exceeds the number of patients because some patients had more than one such procedure.

---

# Placenta Accreta

## Conservative Management

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number of Cases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Success of conservative management</td>
<td>131 (78.4%)</td>
</tr>
<tr>
<td>Primary hysterectomy</td>
<td>18 (10.8%)</td>
</tr>
<tr>
<td>Delayed hysterectomy</td>
<td>18 (10.8%)</td>
</tr>
<tr>
<td>Transfusion</td>
<td>70 (41.9%)</td>
</tr>
<tr>
<td>More than 5 units</td>
<td>25 (15%)</td>
</tr>
<tr>
<td>ICU care</td>
<td>43 (25.7%)</td>
</tr>
<tr>
<td>Sepsis</td>
<td>7 (4.2%)</td>
</tr>
<tr>
<td>Infection</td>
<td>47 (28.1%)</td>
</tr>
<tr>
<td>VTE</td>
<td>3 (1.8%)</td>
</tr>
<tr>
<td>Any severe maternal morbidity or death</td>
<td>10 (6.0%)</td>
</tr>
</tbody>
</table>

Placenta Accreta
Conservative Management with Pelvic Artery Embolization

- Success rates of ~80% reported
  - But at least 20% of cases require hysterectomy
  - Higher rates (40%) in some case series
- Return of menses in ~60% of successful cases
- Postembolization syndrome
  - Nausea, malaise, fever for 2-7 days
(1) Suspected Accreta
- Planned C-hyst
- Randomization
- In Situ Management

(2) Suspected Accreta w/ serosal invasion
- Planned C-hyst
- Randomization
- Interval C-hyst
Interventions (RCT 1)

**In situ Expectant**

1. Laparotomy
2. Classical C/S
3. Placenta left in place
4. Postop UAE
5. Postop Abx
6. Inpatient observation
7. Outpatient observation

+/- interval resection

**Planned C-Hyst**

1. Laparotomy
2. Classical C/S
3. Placenta left in place
4. Hysterectomy

+/- uterotonics
+/- ureteral stents
+/- art. occlusion/ligation
+/- postop UAE
<table>
<thead>
<tr>
<th>Interventions (RCT 2)</th>
<th>Interval C-Hyst</th>
<th>Planned C-Hyst</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1. Laparotomy</td>
<td>1. Laparotomy</td>
</tr>
<tr>
<td></td>
<td>2. Classical C/S</td>
<td>2. Classical C/S</td>
</tr>
<tr>
<td></td>
<td>3. Placenta left in place</td>
<td>3. Placenta left in place</td>
</tr>
<tr>
<td></td>
<td>4. Postop UAE</td>
<td>4. Hysterectomy</td>
</tr>
<tr>
<td></td>
<td>5. Postop Abx</td>
<td>+/- uterotonics</td>
</tr>
<tr>
<td></td>
<td>6. Inpatient observation</td>
<td>+/- ureteral stents</td>
</tr>
<tr>
<td></td>
<td>7. Interval hysterectomy, at 2-5 days</td>
<td>+/- art. occlusion/ligation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>+/- postop UAE</td>
</tr>
</tbody>
</table>
Placental Contribution to Obstetric Hemorrhage

- a priori risk stratification $\rightarrow$ intervention(s) $\rightarrow$ improved outcomes?
- Is bleeding from abruption qualitatively different?
  - Partial concealment / large surface area
  - Marked increase in local activating factors, e.g., placental TF, VEGF
Placental Contribution to Obstetric Hemorrhage

• Better emergency and intraoperative management?
  – Dedicated obstetric hemorrhage team and resources
  – Massive transfusion protocol
  – Focused intra-crisis laboratory methodology
    • Thromboelastography / -ometry
  – Targeted blood product utilization
Placental Contribution to Obstetric Hemorrhage

- What influences or mediates placental location and invasiveness?