Cesarean Section Technique: What’s New in the Evidence Base?

Marya G. Zlatnik, MD, MMS
Maternal Fetal Medicine
UCSF

Learning Objectives

• Review new techniques & literature re: C/S
  – “Gentle” cesarean
  – Infection prevention
  – (Pain control)
  – Hemorrhage
  – Sutures
• Evidence-base (according to me)

Cesarean Rates Continue to Rise

No Disclosures
Family-Centered or “Gentle” Cesarean

UCSF Family-Centered Cesarean
- Buy in from OB, Peds, Nursing, Anesthesia
- Clear double drapes
- Staffing (extra RN)
- UCSF Protocol created by Dr. Robyn Lamar

Is “family-centered” or “gentle” cesarean a good idea?
A. Yes, we do this at my hospital
B. Yes, we’re working on it
C. We do it only because patients ask
D. No, I’m worried about infection & disruption in the OR
E. What is it?

UCSF Family-Centered Cesarean
- Mother may choose music to be played in OR
- Double drape (with clear window) used
- Anesthesia places ECG leads away from mother’s chest
- Mother’s chest warmed prior to skin-to-skin with instant hot pack
- Elevate head of bed, to facilitate viewing the birth & skin-to-skin
- After delivery of head, OB delivers body slowly
- After delivery of head, drape dropped if mother desires to see birth
- Consider delayed cord clamping for 30-60 seconds
- Pediatricians receive the baby as usual; 1 min APGAR on warmer; goal to be back to mom by 5 minutes for skin-to-skin
- After close, while drapes are removed & mother is cleaned, partner may help with weighing baby & observe other routine care
- Once mother is on recovery bed, baby placed skin-to-skin again & the dyad transported together to recovery
**Family-Centered or “Gentle” Cesarean**

**Contraindications:**
- Prematurity
- Emergency cesarean
- Anticipated resuscitation (ex: anomalies, nonreassuring FHR)

Protocol inappropriate in some situations & clinical judgment always takes precedent
- Ex: with vasa previa, slow delivery of body inadvisable
- Ex: increased BMI, elevating the head of the bed may impact surgical visualization
- Ex: insufficient nursing staff to remain with baby in OR

**What are your routine prophylactic antibiotics? (no PCN-allergy)**

A. Any agent given after cord clamp
B. Ampicillin pre-incision
C. Cephalosporin (cefazolin) pre-incision
D. Cefazolin + azithromycin
E. Other pre-incision

**Pre-incision Atbx: Decreased SSI vs After Cord Clamp**

<table>
<thead>
<tr>
<th>Year</th>
<th>Overall</th>
<th>Endometritis</th>
<th>Cellulitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-2006</td>
<td>800</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>p = 0.002</td>
<td></td>
<td>p = 0.014</td>
<td>p = 0.005</td>
</tr>
<tr>
<td>After 2006</td>
<td>516</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>p = 0.002</td>
<td></td>
<td>p = 0.006</td>
<td>p = 0.009</td>
</tr>
</tbody>
</table>

Kaimal SMFM 2008

**Prophylactic Atbx—Extended Spectrum Regimens**

- RCT adding metronidazole vag gel
  - 224 pts; vaginal gel vs placebo gel
  - Less endometritis (7 vs 17%), trend towards less fever; no difference in wound infxn, LOS

- Ureasplasma increases risk for C/S SSI
  - Cephalexin doesn’t cover
  - Post-cord-clamp cefotetan plus placebo or doxy+azithro

Pitt 2001

Andrews 2003
Extended spectrum Prophylaxis

- UAB studies over 14 years
  - In 2000, IV cefotetan or cefazolin & IV azithro at cord clamp
  - Decreased endometritis
  - Decreased wound infections

Tita ObGyn 2009
Tita AJOG 2008

Extended spectrum Prophylaxis

- Multicenter RCT: C/SOAP Trial
  - 2013 pts, C/S in labor or ROM (chorio excluded)
  - Ave BMI 35 (>60% had BMI >30)
  - Std atbx + Azithro prior to incision
  - Fewer SSIs, fevers, PP readmits

Tita NEJM 2016

Extended spectrum Prophylaxis?

- UCSF baseline rate much lower (<1%)
- Hesitant to extend atbx spectrum for all C/S pts
  - Concerns re: atbx resistance, messing up microbiome
- Selectively extend atbx spectrum
  - eg, pt w/ DM/obesity
  - Cefazolin 2-3g IV preop + azithro 500mg IV after cord clamp (mix in 250mL/give over 1 hr)

Do you prep the vagina prior to C/S?

A. Yes, every case
B. Yes, if ruptured membranes
C. Yes, if chorio
D. No, never
E. Not sure

66% 13% 8% 1% 11%
**Vaginal Prep prior to C/S**

- Povidone-iodine prep -> decreased endometritis, esp w/ ROM
- No difference in fever or wound complications
- ? benefit if already chorio
- Possible effect on neonatal thyroid studies
- Risk of vaginal lac
- Dahlke gives a “B”


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**Vaginal Cleansing prior to C/S**

- New meta-analysis Sept 2017
- Povidone-iodine prep -> decreased endometritis, fever, esp w/ labor/ROM
- No difference in wound complications
- Only 6 of 16 specified pre-incision atbx
- ? benefit if already chorio

  – Caissutti,ObGYN 2017

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**CORONIS Trial Lancet 2016**

- International, pragmatic trial 2x2x2x2x2
- 19 sites in S. America, Africa, India, Pakistan
- 1st or 2nd C/S, follow up at 3 yrs
- 15,633 women studied:
  - Blunt vs. sharp abdominal entry
  - Repair of uterus in or out
  - 1 vs. 2 layer closure of uterus
  - Closure vs. non-closure of peritoneum
  - Chromic vs. polyglactin-910 for uterus
- Outcomes of subsequent pregnancies, pain
Uterine Exteriorization

- No differences

<table>
<thead>
<tr>
<th></th>
<th>Single closure</th>
<th>Double closure</th>
<th>Adjusted risk ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women's health</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women eligible to be assessed</td>
<td>4563</td>
<td>4671</td>
<td>-</td>
</tr>
<tr>
<td>Known deaths</td>
<td>25 (0.55% (CI))</td>
<td>32 (0.69% (CI))</td>
<td>0.78 (0.48-1.32)</td>
</tr>
<tr>
<td>Subsequent pregnancies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Births with a subsequent viable pregnancy*</td>
<td>1660</td>
<td>1646</td>
<td>-</td>
</tr>
<tr>
<td>Stillbirths</td>
<td>39 (1.63% (CI))</td>
<td>38 (1.49% (CI))</td>
<td>1.39 (0.79-2.47)</td>
</tr>
<tr>
<td>Neonatal deaths</td>
<td>307 (6.33% (CI))</td>
<td>342 (6.90% (CI))</td>
<td>0.95 (0.69-1.24)</td>
</tr>
<tr>
<td>Method of delivery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-instrumental vaginal</td>
<td>319 (16.50% (CI))</td>
<td>355 (19.11% (CI))</td>
<td>-</td>
</tr>
<tr>
<td>Instrumental vaginal</td>
<td>654 (34.85% (CI))</td>
<td>526 (29.14% (CI))</td>
<td>-</td>
</tr>
<tr>
<td>Pre-labour caesarean section</td>
<td>320 (16.50% (CI))</td>
<td>290 (15.60% (CI))</td>
<td>-</td>
</tr>
<tr>
<td>In-labour caesarean section</td>
<td>135 (7.27% (CI))</td>
<td>121 (6.61% (CI))</td>
<td>-</td>
</tr>
<tr>
<td>All caesarean sections</td>
<td>135 (7.27% (CI))</td>
<td>121 (6.61% (CI))</td>
<td>-</td>
</tr>
<tr>
<td>Women with a subsequent viable pregnancy*</td>
<td>1561</td>
<td>1614</td>
<td>-</td>
</tr>
<tr>
<td>Other pregnancy complications, composite:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other complications</td>
<td>38 (1.60% (CI))</td>
<td>33 (1.62% (CI))</td>
<td>1.00 (0.57-1.79)</td>
</tr>
<tr>
<td>Urinary incontinence</td>
<td>30 (1.60% (CI))</td>
<td>28 (1.59% (CI))</td>
<td>1.00 (0.57-1.79)</td>
</tr>
<tr>
<td>Urinary tract infections</td>
<td>40 (1.60% (CI))</td>
<td>40 (1.59% (CI))</td>
<td>1.00 (0.57-1.79)</td>
</tr>
</tbody>
</table>

CORONIS Trial 2016
Management of Hemorrhage

- CMQCC hemorrhage toolkit V2.0 (revised March 2015)
  https://www.cmqcc.org/resources-tool-kits/toolkits/ob-hemorrhage-toolkit

Photo courtesy of CMQCC and David Lagrew, MD

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CMQCC OB Hemorrhage Emergency Management Plan

Every hospital will need to customize the protocol—but the point is every hospital needs one

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Uterine repair

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Goats and Soda

Overlooked Drug Could Save Thousands Of Moms After Childbirth

NPR.org
Management of Hemorrhage: TXA

TXA fibrinolytic inhibition

- Increased endothelial IPA production
- Decreased IPA inhibition mediated by protein C activation from thrombin-thrombomodulin interaction

Plasminogen activates plasmin with subsequent fibrin degradation and bleeding

Fibrin degradation

Elevated D-dimer and fibrin/fibrinogen degradation products

Pathway of early increased fibrinolysis in hemorrhage. Early after trauma and childbirth, a significant increase in fibrinolytic activity has been described. The endothelium produces more tissue plasminogen activator (tPA) and at the same time expresses the receptor thrombomodulin. The latter associates with protein C, likely elicited in the setting of trauma and childbirth from activation of the clotting cascade, resulting in activation of protein C. Protein C activation leads to inhibition of plasminogen activator inhibitor 1 with enhanced activity of tPA. The result is increased fibrinolysis with rapid degradation of established fibrin clot. Red arrow denotes inhibition. TXA, tranexamic acid; PTPA, tissue plasminogen activator; TPA, tissue plasminogen activator.

Pacheco ObGyn 2017

Management of PPH: TXA

- WOMAN trial: 20,060 women with PPH after VD or CS
- RCT: 1g IV TXA or placebo
- Outcomes: death from hemorrhage, death from all causes, or hysterectomy
- Funding: London School of Hygiene & Tropical Medicine, Pfizer, UK Dept Health, Wellcome Trust, Bill & Melinda Gates Foundation

WOMAN Trial Lancet 2017

Management of PPH: TXA

Table 2: Effect of tranexamic acid on maternal death

<table>
<thead>
<tr>
<th>Maternal Death</th>
<th>Tranexamic acid group (n=10,051)</th>
<th>Placebo group (n=9,998)</th>
<th>RR (95% CI)</th>
<th>p value (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemorrhaging</td>
<td>155 (1.5%)</td>
<td>139 (1.4%)</td>
<td>0.90 (0.66–0.94)</td>
<td>0.047</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>16 (0.1%)</td>
<td>10 (0.1%)</td>
<td>0.90 (0.56–1.37)</td>
<td>0.216</td>
</tr>
<tr>
<td>Organ failure</td>
<td>25 (0.3%)</td>
<td>18 (0.2%)</td>
<td>1.30 (0.75–2.27)</td>
<td>0.359</td>
</tr>
<tr>
<td>Septicemia</td>
<td>15 (0.2%)</td>
<td>9 (0.1%)</td>
<td>1.61 (0.78–3.37)</td>
<td>0.198</td>
</tr>
<tr>
<td>Endometritis</td>
<td>2 (0.02%)</td>
<td>0 (0.0%)</td>
<td>0.34 (0.06–1.80)</td>
<td>0.679</td>
</tr>
<tr>
<td>Other</td>
<td>26 (0.2%)</td>
<td>20 (0.2%)</td>
<td>1.30 (0.54–2.39)</td>
<td>0.561</td>
</tr>
<tr>
<td>Any cause of death</td>
<td>227 (2.3%)</td>
<td>256 (2.6%)</td>
<td>0.88 (0.74–1.05)</td>
<td>0.193</td>
</tr>
</tbody>
</table>

Data are n (%), unless otherwise indicated. RR= risk ratio

WOMAN Trial Lancet 2017
Management of PPH: TXA

Laparotomy for bleeding by subgroup

<table>
<thead>
<tr>
<th>Time from delivery (h)</th>
<th>TXA</th>
<th>Placebo group</th>
<th>Risk ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20/36.2 (5.9%)</td>
<td>10/36.2 (5.9%)</td>
<td>0.48 (0.20-1.09)</td>
</tr>
<tr>
<td>1-3</td>
<td>16/30.5 (5.9%)</td>
<td>7/26.2 (3.9%)</td>
<td>0.44 (0.20-1.01)</td>
</tr>
<tr>
<td>&gt;3</td>
<td>4/73.8 (1.9%)</td>
<td>4/66.9 (3.9%)</td>
<td>0.57 (0.20-1.55)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of delivery</th>
<th>TXA</th>
<th>Placebo group</th>
<th>Risk ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laparotomy</td>
<td>3/20.8 (1.5%)</td>
<td>2/94.0 (4.6%)</td>
<td>0.34 (0.09-1.20)</td>
</tr>
<tr>
<td>Caesarean section</td>
<td>4/73.8 (1.9%)</td>
<td>4/66.9 (3.9%)</td>
<td>0.57 (0.20-1.55)</td>
</tr>
</tbody>
</table>

Management of Hemorrhage

- Topical recombinant activated Factor VII
  - Case series, 5 pts with previa, 5 controls, Denmark
  - “swab” soaked in saline containing recombinant activated Factor VII (1 mg in 246 ml) applied to placental bed, repeated x1 prn
  - Median EBL 490 ml (300-800 ml)
  - No changes in thrombin, fibrinogen, PTT, INR, pltts

Management of Hemorrhage

Skin Closure
Skin Closure: Re-approximation of subQ

- A few meta-analyses
  - Some included all pt, others included those with ≥ 2cm subQ fat
  - 3-0 plain gut, 2-0 polyglactin, 3–0 polyglycolic mostly running stitches
  - Decreased wound complications, NNT = 16

Pergialiotis BJOG 2017, Chelmow 2004, Cochrane 2006

Skin Staples, Suture, or Glue?

Staples vs. SubQ Suture

- A few RCTs, 2 meta-analyses
- Staples quicker (by ~5-9 min)
- Pts often prefer suture
- Sutures fewer wound infections/ breakdowns
  - NNT 16
- Sew if there is time

Frishman 1997, Tuuli 2011, Clay 2011
Mackeen 2014

Suture vs. Suture

- Comparison of Subcuticular Suture Type for Skin Closure After Cesarean Delivery: A Randomized Controlled Trial
- RCT: Monocryl vs Vicryl
- Composite wound measure: 8.8% vs 14.4%
- No difference when analyzed by actual suture used

SubQ Suture vs Skin Glue

- A few small studies, 1 RCT (107 pts)
- No difference:
  - OR time
  - wound disruption (?)
  - scar scores
  - NOT POWERED

Daykan AJOG 2017

Conclusions

- Yes:
  - Prophylactic Atbx (pre-incision, add azithro if risk mod-high)
  - Blunt or sharp abdominal entry
  - Repair of uterus in or out
  - 1 or 2 layer closure of uterus
  - TXA for PPH
  - Monocryl for skin

- Maybe:
  - Add azithro
  - Prep vagina
  - Family-friendly
  - ERAS

- No:
  - Not ready for aF7
  - Gluing, stapling skin

Thank You!