Cesarean Section: Surgical Techniques that Work

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Hamano, Teisuke. 1880. Kainin no kokoro (Information on pregnancy). Japanese Woodblock Print Collection, Archives & Special Collections, UCSF Library & Center for Knowledge Management.

Learning Objectives

- Review different aspects of C/S technique
- Current basis in literature
- Evidence-based steps (according to me)
  - Berghella, Am J ObGyn 2005, updated 2013 (Dahlke)
  - Cochrane, various years
  - Given time constraints, some data in syllabus only

No Disclosures

The way Mother Nature intended....
30 minutes, hides more slides

Zlatnik, Marya G., 5/13/2014
Cesarean Rates Continue to Rise

Cesarean Section Technique
- Prophylactic Atbx
- Prep
- Remove FSE
- Abdominal Incision
- Bladder flap
- Uterine incision
- Placental delivery
- Exteriorization of uterus
- Uterine incision closure
- Peritoneal closure
- Irrigation
- Fascial closure
- Subcutaneous closure
- Staples/skin

Prophylactic Antibiotics
- Cochrane Review
  - 4700 pts
  - RR 0.42 (95% CI 0.28-0.65) morbidity/death
  - Effect bigger if labor
- Decreased fever, SSI, endometritis, UTI, LOS (RR ~0.4)
- No benefit to multi-doses

Prophylactic Atbx—Fever
1st Generation vs. 2nd or 3rd

Same result with Ampicillin vs. Ceph

Alfirevic Cochrane 2010
Hopkins, Cochrane 1999
Timing of cefazolin: Decreased SSI w/ Preop atbx vs After cord clamp

2013 Clinical Practice Guidelines: Antimicrobial Prophylaxis in Surgery
- American Society Health-System Pharmacists, Infectious Diseases Society of America, Surgical Infection Society, Society for Healthcare Epidemiology of America
- Based on pharmacokinetic dosing studies, 1g cefazolin is often not enough
- At UCSF we have transitioned from cefazolin 1g (2g if obese) to cefazolin 2g (3g if BMI >120kg)
- Re-dose if 4> hrs from 1st dose or EBL >1500 cc

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
  - Pitt 2001
- Ureasplasma increases risk for C/S SSI
  - Cephalosporin doesn’t cover
  - Post-cord-clamp cefotetan plus placebo or doxy+azithro
  - Andrews 2003

Extended spectrum Prophylaxis
- UAB study 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?
- UCSF rate much lower
- Hesitant to extend atbx spectrum for all C/S pts
  - Concerns re atbx resistance
- 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 )

Abdominal Prep
- Several small RCTs: different solutions
  - No clear winner
- CHG better than povidone-iodine in G. Surg
  - Darioche 2010
- Bundled CHG cleanse + OR prep + other interventions → decreased SSI rate
  - Rauk 2010

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”

Remove scalp electrode?
- What to do if FSE in place prior to C/S?
- Removal if FHR reassuring
  - Sensible but little data
- If NRFHR? Case reports:
  - Mine (unpublished)
  - Retained for 23 years
  - Migrated into jejunum
  - In baby’s scalp
  (cases all have emergent delivery in common)
  - Valenzuela 2006
  - Kimm 1992
  - Frederikson-Moller 2011
Abdominal Incisions

Dox et al., Melloni’s Illustrated Dictionary of Obstetrics & Gynecology 2000

Pfannenstiel vs. Joel-Cohen

Pfannenstiel vs Joel-Cohen/Misgav-Ladach

- Blunt entry, less dissection, fewer layers repaired
- J-C faster by 25-30% vs conventional Pfann
- Less blood loss, lower analgesia requirement

Bladder Flap

- 2 RCTs: Total 360 pts
- 1 & RC/S: Bladder Flap vs Not
- No bladder flap:
  - Shorter incis → del time by 1 min in 1° C/S
  - +/- Shorter op time, Less Hgb drop, Microhematuria, Pain
- Not powered for bladder injury (would need 40K pts)

Hohlagschwandtner 2001
Tuuli 2012
Uterine Incision—Blunt vs. Sharp Extension

- **RCTs**: Blood loss greater with sharp
  - More transfusions
- **Cephalad to caudad extension**
  - Less blood loss, fewer extensions
  - Cromi 2008, Sekhavat 2010

Uterine Incision: BABEL

- **B: Breathe**. Pause before making the hysterotomy
- **A: Allis clamps**. Use Allis clamps, if needed, to help elevate the hysterotomy
- **B: Blunt**. Use a single digit to sweep over hysterotomy bluntly between each scalpel pass
- **E: Extend**. Extend hysterotomy bluntly (stretch laterally or vertically)

Placental Delivery
Placenta: Manual Removal

- Manual extraction: bigger Hct drop, more endometritis (vs spontaneous)

Anorlu Cochrane 2008

Uterine Exteriorization

- Easier repair? (easier to teach)
- ? Infection, bleeding risk
- Anesthesiologist blames you for emesis
- No real differences in complications, including emesis

Exteriorization of Uterus

Cochrane 2006, 2009

Opening the cervix

- To let out evil humours in unlabored C/S
- Cochrane review—> no decrease in febrile morbidity

Cochrane 2011
Closure of Uterine Incision: 1 vs. 2 Layers

- Short term:
  - OR time
  - Hemostasis/Blood loss
  - Endometritis
- Long term:
  - Scar strength/ VBAC risk

Short Term Outcomes: 1 vs. 2 Layer Closure

- Hauth’s RCT, UAB + 9 other studies
- No difference in use of extra hemostatic stitches
- Less blood loss
- Less post-op pain
- 5-7 min shorter OR time

Hauth 1992, Cochrane 2008

1 vs. 2 Layer Closure: Scar Strength

- Follow-up from Hauth’s RCT
- 906 pts in RCT → 164 preg again
- 83 previous 1-layer, 81 previous 2-layer
- 56/70 vs 64/75 successful VBACs
- No difference in PPH, infxn, LOS
- One dehiscence in 1-layer group, no ruptures (power only .07)

Chapman 1997

1 vs. 2 Layer Closure Scar Strength for TOLAC

- Retrospective data conflicting whether rupture risk increased or not
- Risk of uterine rupture after 1-layer closure not significantly different from 2-layer closure overall (OR 1.71; 95% CI 0.66-4.44)
  - risk increased after locked 1-layer closure (OR 4.96) but not after unlocked 1-layer closure (OR 0.49) compared w/ 2-layer closure
- Need RCT!

Bujold 2002, Dumwald 2003, Roberge 2011
Uterine Replacement After Exteriorization

Wound Irrigation
- RCT in cattle
  - C/S for macrosomia
  - Wounds irrigated with betadine vs nothing
  - No difference in wound infections
- Only a few RCTs in humans
  - Study design flaws
  - Saline vs nothing
  - No difference in wound complications, more nausea with irrigation

Irrigation of Incision

Peritoneal Closure vs. Not
- Short term outcomes vs. long term outcomes
- Short-term: Non-closure better
  - Shorter OR time
  - Less fever
  - Shorter LOS
  - Trend less analgesia need & wound infection

Bamigboye, Harrigill 2003
Cochrane 2006, Viney 2010

Bamigboye, Cochrane 2010
Long Term Outcomes: Non-Closure of Peritoneum

- Cohort & retrospective studies mixed on what causes fewer adhesions
- 2 pseudo RCT suggest nonclosure better
  - Weerawetwat 2004, Komoto 2006
- 1 RCT non-closure → fewer adhesions
  - Kapustian 2012

Failure of Wound

- Suture breaks
- Knot slips (unties)
- Viscera protrudes between stitches
- Suture tears through fascia (most common)

Knot Slips/Types of Knots

- Square
- Surgeon’s square (least likely to slide undone, but can’t tighten after 2nd throw)
- **Square slip** (can slip, even after 5 throws; inadvertently tied by one-handed technique)
- Granny (not a bad knot, but easy to accidentally make granny slip knot)
- Granny slip (not secure)

Loop-to-Strand Knots (*e.g.* when tying fascia suture in midline)

- 0 & 2-0 Monocryl, 6 throws, stretched until failure (breakage or slippage)
- Loop-to-single strand, sliding knot
  - 55-85% untied
  - 112 newtons to break knot
- Loop-to-single strand, flat square knot
  - 5-15% untied
  - 117 newtons to break knot
- Strand-to-single strand, flat square knot
  - NONE untied
  - 132 newtons to break knot

*Hurt 2004*
**Failure of Wound Type of Suture Material**

- Metaanalysis from General Surgery lit.
- Nonabsorbable vs. absorbable
  - NNT = 50 for incisional hernia
- Risk of hernia **not** increased with PDS, is increased with Vicryl
  
  Hodgson 2000
- Monocryl & Chromic no good for sheep C/S
  
  Greenberg 2011

**Skin Closure**

- Re-approximation of subQ tissue
- A few meta-analyses
  - Most included ≥ 2cm subQ fat
  - 3-0 plain gut, mostly running stitch
  - Decreased wound complications (fewer hematomas & seromas), NNT = 16
- SubQ Drains: a few RCTs
  - Probably no benefit to routine use

Chelmow 2004, Cochrane 2006
Ramsey 2005, Al-Inany 2002

**Skin Staples or Suture**
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


Conclusions

Yes:
- Prophylactic Atbx (pre-op)
- Joel-Cohen or Pfannenstiel
- Spontaneous placental delivery
- SubQ closure—yes if > 2cm fat
- Sew skin if you have time

Surgeon’s choice:
- Bladder flap—may skip on low risk cases
- Exteriorization of uterus for repair

Awaiting data:
- Skin prep
- Uterine incision closure—Jury’s still out
- Peritoneal closure—Jury’s still out
- Irrigation subQ

No:
- Uterine incision—sharp extension
- Multi-dose or high-powered atbx prophylaxis
- Granny, slip square, loop-to-strand knots on fascia

Thank You!