Reducing Cesarean Surgical Site Infections

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Objectives
- Significance of SSIs in OB
- Pathogenesis of SSI
  - Patient factors, procedural factors
- CDC recommendations for prevention
- UCSF experience
  - CDC recommendations
  - Antibiotic timing
- Other/broader strategies

Surgical Site Infections
- 3rd most frequent nosocomial infxn
  - 15% of nosocomial infxn
- Increased hospital stay & costs
  - 7-10 extra hospital days
  - Cost >$3000 each
- C/S: Most common surgery in US
  - SSIs common: endometritis, wound infxn
  - Rate of C/S SSI at UCSF as high as 12% in past


No Disclosures

UCSF
Pathogenesis of SSI

- Multi-factorial event driven by
  - Procedure variables
  - Patient risk factors

- Main pathogens = pt’s own flora
  - from skin & vagina

- Exogenous sources of SSI pathogens (less common)
  - OR environment
  - Surgical personnel
  - Instruments

Patient Factors Contributing to SSI

- Coincident infxns
- Obesity
- Diabetes
- Indwelling invasive devices
- Tobacco use
- Severity of illness
- Loss of intact skin
- Blood transfusions
- Poor Nutritional Status
- Steroid Therapy
- Extremes of Age

What can we do to prevent SSI?

- National recommendations 2014
  - Pre-op
  - In OR
  - Post-op

- These are general recommendations, not OB specific (but most apply to OB)

National Recommendations: Reducing SSIs

- SHEA/ISDA/AHA/TJC 2014

  - Atbx prophylaxis
    - Appropriate timing, drug, dosing, re-dosing
  - Don’t shave
  - Preoperative skin prep: alcohol + (CHG)
  - Control blood sugars perioperatively (<180mg/dl)
  - Normothermia
  - Adequate ventilation/oxygenation
  - Surveillance for SSI

Anderson 2014 Strategies to Prevent Surgical Site Infections in Acute Care Hospitals
Infxn Contr Hosp Epi http://www.jstor.org/stable/10.1086/676022
Preoperative: Hair Removal

- Use clippers, not razors for hair removal
  - Micro-breaks in skin barrier
- Clipping immediately before associated w/ lower SSI risk than shaving or clipping night before
- Don’t remove hair unless interferes w/ operation

Seropian, 1971, others

A hairy tale: successful patient education strategies to reduce prehospital hair removal by patients undergoing elective caesarean section

A hairy tale: education strategies to reduce prehospital hair removal by patients undergoing C/S

- Fewer pts shaved (1 wk): 83% → 53% in 2011
- SSI rate decreased: 7.6% → 3.7% after patient education interventions (P < 0.001)
- Overall reduction in SSI rate primarily d/t to reduction in superficial infections

Ng, J Hosp Infec 2013  http://dx.doi.org/10.1016/j.jhin.2012.09.013

Preoperative: Antiseptic Shower/Bath

- Decreases skin microbial colony counts
- Require pts to shower w/ antiseptic agent the night before OR (elective cases)
  - Cat IB
- Pre-clean skin using soap/CHG
  - Remove any gross contamination  Cat IB
  - Waiting on C/S data
Preoperative: Skin Preparation in OR

- Skin Prep—2 elements:
  - Physical separation of bugs
    - friction & soap
  - Chemical activity on bugs by antimicrobial soln
- Use fast-acting, broad spectrum antimicrobial
  - CHG/alcohol better than iodine
  - Allow to air dry

Amer-Alshiek 2013

Surgeon Hand/Forearm Prep

- Objectives
  - Remove dirt, debris & transient flora
  - Reduce microbial counts as much as possible
  - Leave antimicrobial residual on the skin
- Optimum duration unknown
  - 2-5 min scrub as effective as 10 min
- Chlorhexidine gluconate (CHG)
  - Persistent effect, broad spectrum

CDC/HICPAC/APIC/SHEA/IDSA hand hygiene guidelines 2002

Preoperative Hand Prep

- Artificial Nails
  - Increased bacterial & fungal colonization
  - Long nails increase tears in gloves
  - Increased nosocomial infxns
- Nail polish & hand jewelry
  - SSI risk unknown
- No artificial nails or polish, nail beds free of infxn

CDC Hand Hygiene, Mayo

Antimicrobial Prophylaxis: Agents, Timing

- 1st & 2nd gen cephalosporins most common
  - As effective as 3rd gen for C/S (Cochrane 1999)
- Giving ≤ 2 hrs before incision reduces SSI (0.59% vs ≥ 3.3%)
- General consensus: 30-60 min before incision
  - Except C/S, after cord clamping CAT 1A

CDC “Guideline for Prevention of Surgical Site Infection, 1999” available online at www.cdc.gov/ncidod/hq
Antibiotic Prophylaxis

- Cefazolin 2g
  - 3g if > 80kg
- Repeat Dosing
  - Cochrane re: C/S prophylaxis—1 dose as good as multiple doses
  - Repeat for long (>3-4 hr) cases or excess blood loss (>1500cc)
- Maintain therapeutic levels during case & at most, few hours after closure

  *Cat 1A*

Surgical Attire: Recommendations

- Sterile gowns/gloves during case
- Masks/eye protection to protect staff
  - Theoretically filters aerosols from staff to patient - not proven
  - When sneezing or coughing w/ mask on, face sterile field directly
- Scrub clothes—Change if soiled or moist
- Hair covering in OR

  *Cat IB/OSHA*

SSI Surveillance

- Surveillance of SSI w/ feedback to surgeons reduces SSI risk
- Successful surveillance program includes:
  - Effective surveillance methods
  - Data feedback
  - Starbucks cards & emails!
- Use EHR

  *Cat IB*

Barwolff J Hosp Infect 2006

Surgical Techniques Believed to Reduce SSI Risk

- Good hemostasis
- Handle tissues gently
- Eradicate dead space
- Avoid inadvertent entry into hollow viscus
- Remove devitalized tissues
- Use drains & suture material appropriately
- Prevent hypothermia

  *Cat IB*

20/23/2014
Other C/S-related Methods

- Avoid chorioamnionitis
- Spontaneous Delivery of Placenta
  - 5.7% vs 15.2% endometritis w/ manual extraction @ C/S
    - Baksu Acta Obst Gyn Scand 2005
- ? Uterine exteriorization
  - Quicker, less febrile morbidity
    - Jakobs-Jokhan Cochrane 2004

C/S SSI Reduction—UC Irvine

- Multi-disciplinary team:
  - Atbx timing, reducing op time, double gloving, 1-layer uterine closure, tincture of iodine prep, no shaving
- C/S endometritis reduced from 4.1% to 1.6%
- Cost savings of $35,653 per year

Pre-Op Checklist

- ACOG abstract 2014—NY
- After institution: SSI 6.2% → 3%
  - Electric clipper to remove hair at surgical site
  - Cleaning skin with chlorhexidine solution
  - Broad spectrum atbx prophylaxis before incision
    - Cefazolin 1 gm IV bolus (30-60 min before surgery) plus azithromycin 500 mg IV (1 hour before surgery)
  - Removal of placenta by cord traction
  - Closure of deep subcutaneous layer >2cm
  - Skin closure with subcuticular suture

SSI after C/S: Implementing 3 changes to improve the quality of patient care

- Clippers to remove hair
- 2% CHG instead of 0.5%
- Sew skin with non-absorbable suture (instead of absorbable)
Scope & Magnitude of SSI at UCSF

- 2003: 217 C/S in 6 months at UCSF
  - 9% rate SSI (13 incisional, 6 endometritis)
  - NNIS benchmark 3%
  - Analysis of risk factors: only diabetes & BG >200 were significantly associated
- Identified as an area for improvement in our L&D
- Task force
  - MDs, RNs, Administrators, Hospital infection control

Reducing SSI in L&D at UCSF: Feb 2005

- O2 Post-op Patient warming
- Reduce nonessential personnel in OR
- New surgical prep (Duraprep)
- Improve scrub technique
- Blood Sugars

UCSF SSI before & after Protocol Changes

![Graph showing SSI (%) with p-values and sample sizes]

Reducing Surgical Site Infection 2006

![Diagram showing strategies to reduce surgical site infections]

- Administer atbx prior to incision
- Retrain RNs in aseptic technique
- Reduce nonessential personnel in OR
- New surgical prep
- Improve scrub technique

Kaimal AJOG 2008
Methods

March 2005
- Retrain RNs in aseptic technique
- New surgical prep
- Reduce nonessential personnel
- Supplemental O2
- Patient warming
- Improve scrub technique
- Improve BG control

June 2006
- Antibiotics administered prior to incision
- Study completed

June 2007

All Cesareans

Historical Controls

Intervention Group

Multivariable Regression

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<thead>
<tr>
<th></th>
<th>aOR</th>
<th>95% CI</th>
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</thead>
<tbody>
<tr>
<td>Overall SSI</td>
<td>0.33</td>
<td>0.14-0.77</td>
</tr>
<tr>
<td>Endometritis</td>
<td>0.34</td>
<td>0.13-0.92</td>
</tr>
<tr>
<td>Cellulitis</td>
<td>0.22</td>
<td>0.49-0.96</td>
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Controlling for labor, parity, prior cesarean delivery, maternal age, BMI, DM

Results at UCSF

- Change in policy to administer prophylactic atbx prior to incision → significant decrease in C/S SSI
- Demonstrate the integration of research findings into real-life clinical practice
- Our protocol is now to ask anesthesia to routinely administer cephalosporin prior to incision (cefazolin 2-3g)
Similar Results Elsewhere: Magee-Womens

- 9,010 C/S before/after change in policy: timing of cefazolin
- Decreased SSI w/ preop atbx vs cord clamp
  - Endometritis aOR 0.6 [0.5-0.8]
  - Wound infxn aOR 0.7 [0.6-0.9]
- No difference in early onset neonatal infxn
- Lower late onset neonatal infxn
  - 1.8% vs 5.7% p<0.001
- No difference in “rule-out sepsis”
  - Owens ObGyn 2009

ACOG Committee Opinion Sept 2010

- Recommends atbx prophylaxis for all C/S
  - unless the patient is already receiving appropriate atbx (eg, for chorioamnionitis)
- Prophylaxis should be administered within 60 minutes of the start of the C/S

Extended spectrum Prophylaxis

- Ureasplasma increases risk for C/S SSI
  - Cephalosporin doesn’t cover
- RCT at UAB: 597 pts
  - Cefotetan +/- doxy 100mg IV + azithro 1g po 6hrs later vs placebo
  - 17% vs 25% endometritis p = 0.02
  - 1% vs 4% wound infxns p = 0/03

Extended spectrum Prophylaxis

- F/U in Birmingham over 14 years
  - In 2000, IV cefotetan or cefazolin & IV azithro at cord clamp
  - Decreased endometritis
  - Decreased wound infections

Andrews ObGyn 2003
Tita ObGyn 2008

Tita ObGyn 2009
Tita AJOG 2008
Extended spectrum Prophylaxis

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

Some Evidence

- Povidone-Iodine Vaginal Prep
  - Endometritis
  
  Cochrane 2010

Some Evidence

- Povidone-Iodine Vaginal Prep— +/- ROM
  
  Cochrane 2010

Mixed Evidence

- Skin Closure
  - Suture better than staples—Tuuli 2011
  - No winner—Mackeen Cochrane 2012
  - Non absorbable suture better than staples, staples better than absorbable suture—Corcoran 2013
Limited Evidence

- Supplemental O2—may help in GI surgery, no benefit in C/S (and may be harmful)
  - Gardella 2008
  - Scifres 2010
  - Duggal 2013

Review: Reducing C/S SSIs

- Treat chorio
- Atbx prophylaxis—BEFORE INCISION
  - Appropriate dosing, re-dosing
- Just don’t shave it!
- Preoperative skin prep: alcohol + CHG
- Peri-op:
  - Control blood sugars perioperatively (<180mg/dl)
  - Normothermia
- Think about a checklist
- Surveillance for SSI

Conclusions

- Multi-disciplinary approach
- Decreasing chorioamnionitis/managing labor may be as important as OR issues
- Give pre-op prophylaxis pre-op
- Consider extended spectrum atbx for high risk pts, vag prep for ROM
- Track SSIs

Thank you for your attention