Addressing Surgical Site Infection in Cesarean Section Surgery

Maureen Spencer, RN, M.Ed.
Infection Control Specialist
Boston, MA

www.workingtowardzero.com
maureen@workingtowardzero.com
Background: Patient Aspects

Burden of SSIs

- Patients with SSIs have a 2-11 times higher risk of death than those without SSI
- 77% of deaths associated with SSIs are directly related to the SSI
- SSIs cost approximately $10 Billion/Yr in the U.S.
- SSI increases cost > 54% with a resulting (facility) profit margin decreased to 3.4% from 23%.


OB/Gyn Basic Facts

According to the CDC:

- C-Section is one of the most common surgeries in reproductive age women

  - Past Data: 24% of all first births (1 in 4)
  - C-section rate in 2007 reached 32% in US, a 50% increase since 1996 \(^2,3\)
  - Repeat C-section rate is estimates at 92%, as VBAC rate decreases \(^3\)

---


ObGyn Basic Facts

- Hysterectomy is the second most frequent surgery performed in reproductive age women
  - 600,000 hysterectomies/Yr in the U.S.
  - 20% for abnormal uterine bleeding
  - Rate of 5.4/1000 cases


Background on OB/Gyn Infections

- Infection is one of the most common complications of cesarean delivery \(^1,^2\)

- Endomyometritis:
  - From 4% (scheduled C/S, intact) to 75% (prolonged labor, Ruptured membranes\(^3,^5\)

- Wound infection:
  - Occur in 2.5% to 16% of cesareans\(^4\)

- Breakdown of surgical incision, caused by wound infection.\(^6\) ~2-9%

Studies/ Evidence:

C-Section Infections

• 15 to 80% of post-C-section infections, particularly those involving wounds, may actually occur after initial discharge from the hospital.

• Underestimation of the incidence of post-cesarean infection is pervasive.

Wound Infections in Gyn Surgery

- Overall wound infection rate 12%
- 6% detected during the initial hospital stay
- 35.7% required an additional surgical procedure
- 50% of the patients with infection required readmission

Surgical Wound Classification System

- Class I (Clean): Uninfected field without GI/GU entry.
- Class II (Clean-contaminated): GI/GU surgery. Vaginal Surgery. No evidence active infection
- Class III (contaminated): Major breaks in sterile technique, GI spillage. Incision with acute, nonpurulent inflammation.
- Class IV (Dirty): Perforated viscera or acute clinical infection active.

SSI In the Ob/Gyn Current Literature

- Gardella, Carolyn; Goltra, Lynne Bartholomew; Laschansky, Ellen; Drolette, Linda; Magaret, Amalia; Chadwick, H S.; Eschenbach, David. High-Concentration Supplemental Perioperative Oxygen to Reduce the Incidence of Postcesarean Surgical Site Infection: A Randomized Controlled Trial. Obstetrics & Gynecology. 112(3):545-552, September 2008
- Clara Bodelon, PhD, et al. Factors Associated With Peripartum Hysterectomy. JULY 2009 OBSTETRICS & GYNECOLOGY VOL.114, NO. 1,
SSI In ACOG Literature: Wound Focus


2. Vertical Skin Incision and wound infection in the obese partuient. Obstet Gynecol. 2003 Conclusion: vertical skin worse than low transverse for infection

3. Ramsey et al. Subcutaneous tissue closure with or without drain in the obese patient. Obstet Gynecol. 2005 Conclusion: drain addition no better than suture alone for wound reduction. Drain may increase infection

Current techniques – Surgical Site Infections

Two Categories (Cesarean Section) SSI:

• Metritis/Endometritis (Organ SSI)

• Abdominal incision:
  - Deep Wound
  - Superficial

- The Centers for Disease Control and Prevention/National Nosocomial Infections Surveillance (NNIS) program (CDC, 1996).
Current techniques – Surgical Site Infections

Cesarean SSI Rate between 5-10%\textsuperscript{1,2}

- **Independent Risk Factors for SSI:**
  - Prolonged Operating time >38 min
  - BMI > 30
  - Wound Hematoma
  - Lack of Perioperative Antibiotics/Timing
  - **Use of Skin Staples**

Staples vs. Suture at Cesarean

• 30th Annual Meeting: Society MFM
  February 1-6, 2010    Chicago, IL

• C/S Cohort
• Prospective RCT, N= 416
• Staples (197) vs 4-0 monocryl (219)

• Wound separation: staples (17%), suture (5%)
• COMPOSITE wound complication rate:
  Staple (22%), suture (9%)

Staples and SSI: Orthopedics

• BMJ March 2010
Meta-analysis to compare the clinical outcomes after ortho surgery using wound closure with staples vs sutures
• 6 publications (683 wounds)
  332 patients =sutures  351= staples.

• Compared with suture closure, staple closure associated with more 3X risk of superficial wound infection after ortho surgery (RR, 3.83; 95% CI, 1.38 - 10.68; \( P = .01 \)).
• hip surgery: risk for development of a wound infection 4 times greater with staples vs sutures (RR, 4.79, 95% CI, 1.24 - 18.47; \( P = .02 \)).

Tools for SSI Reduction

– Antibiotic prophylaxis (timing) \(^1,2\)
– Scrubbing
– Gowning, Gloving
– Prevention of hypothermia
– Antimicrobial skin prep
– Aseptic technique
– *Plus* Antibacterial Sutures
– DERMABOND* Topical Skin Adhesive

Antibacterial Sutures
PLUS Antibacterial Sutures:

- Kill bacteria and inhibit colonization of the suture
- Proven *in vitro* to create a zone of inhibition around the suture against the most common surgical site pathogens
  - *Staphylococcus aureus*
  - *Staphylococcus epidermidis*
  - Methicillin-resistant *Staphylococcus aureus* (MRSA)
  - Methicillin-resistant *Staphylococcus epidermidis* (MRSE)
- *In vivo* testing shows MONOCRYL* Plus Antibacterial (poliglecaprone 25) Suture and PDS* Plus Antibacterial (Polydioxanone) Suture kill bacteria and inhibit colonization of the suture:
  - *E. coli*
  - *Klebsiella pneumoniae*

3. Data on file, ETHICON Inc.

*Trademark*
IRGACARE® MP (Triclosan) Properties

• IRGACARE MP
  – 2,4,4′-tri-chloro-2′-hydroxydiphenyl ether
  – High-purity material that meets USP specifications for triclosan, with minimal residue content

• IRGACARE MP is safe
  – Biocompatible, nontoxic
  – Consumer products
    • Mouthwash, toothpaste, soaps, cosmetics

• IRGACARE MP is effective
  – Active against methicillin-sensitive and methicillin-resistant S aureus and S epidermidis (most common for device infections)
  – Active against Escherichia coli and Klebsiella pneumoniae

• IRGACARE MP is compatible with suture processing
  – Maintains excellent suture properties

USP=United States Pharmacopeia.
“...all surgical wounds become contaminated to some degree – the primary determinant whether the contamination is established as a clinical infection is host (a competent) defense...”

Belda et al., JAMA 2005;294:2035-2042
Mean Microbial Recovery from Standard Polyglactin 910 Sutures (V) and Triclosan-Coated Polyglactin 910 Braided Sutures (VT)

Exposure Time 2 Minutes

S. aureus (MRSA)  S. epidermidis RP62A  E. coli

Mean colony forming units (cfu)/cm suture

N=10

p<0.01

Impact of 20% Bovine Serum Albumin (BSA) on Mean Microbial Recovery from Standard Polyglactin 910 Sutures and Triclosan-Coated Polyglactin 910 Braided Sutures (VT)

Mean colony forming units (cfu)/cm suture

S. aureus \((10^5)\)
MRSA

Escherichia coli \((10^5)\)

V
VT
V + 20% BSA
VT + 20% BSA

N=10

\(p<0.01\)

Potential for Contamination of Sutures at End of Case

Suture with Staphylococcus colonies

Air settling plates in the operating room at the last hour of a total joint case
A pure culture - 0.5 MacFarland Broth - of *Staph aureus* was prepared on a plate.

A coated antibacterial suture was aseptically cut and planted and incubated for 24 hrs.

Photo #1 shows zone of inhibition at day 5.

Photo # 2 shows zone of inhibition at day 10.

Plate on right is a non-coated suture. *Staph aureus* growth right over it.
PLUS Antibacterial Sutures:

- **Published Data/ Evidence Based Recommendations**


DERMABOND® Topical Skin Adhesive

• The Final Layer of Protection
Skin Closure Techniques

• **DERMABOND® Topical Skin Adhesive**
  – Works like glue to hold edges of skin together
  – Areas do not have to be kept dry during healing
  – Bandages are often not required
  – Forms a strong, flexible bond fast
  – The adhesive "sheds" from the skin naturally as the wound heals
  – No sutures to remove
Skin Closure Techniques

• FDA Approves Use of DERMABOND Adhesive to Seal Out Infection-Causing Bacteria; First Wound-Closure Technology Approved to Protect Wounds & Incisions From Common Microbes.

PR Newswire | January 16, 2002 | Copyright

“ETHICON Products announced today that DERMABOND* Topical Skin Adhesive (2-octyl cyanoacrylate) can act as a barrier against bacterial microbes. The microbial barrier provided by DERMABOND Adhesive seals out the most common infection-causing bacteria, including certain staph, pseudomonas and E. coli. “.....
DERMABOND® Topical Skin Adhesive

- **8-carbon** side-chain
- **Plasticizers** for flexible bond and high wound-closure strength
- High viscosity = greater application control
- May be used without dressings*
- Patient may **shower immediately**
- Clinically proven to **close long incisions**
- Gentler on the skin

1. DERMABOND® Adhesive Instructions For Use. Somerville, NJ: ETHICON, INC; 2003
Topical Skin Adhesive: Octyl versus Butyl


OB/Gyn Surgeries

• DERMABOND® Topical Skin Adhesive can be used for topical skin closure in:
  - Cesarean section
  - Total abdominal hysterectomy
  - Tuboplasty
  - Minimally invasive procedures
DERMABOND® Topical Skin Adhesive

• DERMABOND® Adhesive is clinically proven to close skin effectively in long incisions up to 69 cm$^{1,2}$ making it appropriate for C-sections and abdominal hysterectomies

Incisional Adhesive Skin Closure

(With Subcuticular Stitch)
Abdomino-plasty

(Without Subcuticular stitch)
(Neck) Thyroidectomy

Courtesy: Plastic Surgery, ENT
Methodist Medical Center Dallas
Benefits for surgeons, nurses, patients, and hospitals

**Physician, Hospital -centered Benefits**
- Proven microbial barrier for lasting protection
- 7 days of wound healing strength in 3 minutes for strong closure and peace of mind
- No time spent removing staples or sutures
- Reduces needle stick exposure
- Increases patient satisfaction
- Reduced Hospitalization Costs

**Nurse, Patient -centered Benefits**
- Reduces number of suture set ups
- Ease of Post Op wound checks
- Reduces number of wound dressings
- Shower immediately
- Excellent Cosmesis
Incisional Adhesive on Total Knee Incision
Adhesive and Antimicrobial Dressing

Total hip incision with dermabond and AMD

Healed Dermabond incision
Rotator Cuffs and Total Shoulders

- Rotator cuff and total shoulders
  - incisional adhesive (Dermabond)
  - AMD gauze (not really necessary)
  - Transparent Dressing until discharge

- No staples
- Since implementation, no infections in > 300 total shoulders

Steri-strips over Dermabond
DB: Evidence Based Recommendations


- **Octyl-Cyanoacrylate tissue adhesive vs suture wound repair in a contaiminated wound model.** *Surgery, Volume 122, Issue 1, July 1997, Pages 69-72* Jim Quinn, Jennifer Maw, Karam Ramotar, Georg Wenckebach, George Wells


- **Tissue Adhesive vs suture wound repair at 1 yr: RCT correlating early, 3 month and 1 yr cosmetic outcomes,** *Annals of Emergency Medicine, Volume 32, Issue 6, December 1998, Pages 645-649* James Quinn, George Wells, Terri Sutcliffe, Mario Jarmuske, Jennifer Maw, Ian Stiell, Peter Johns

CONTRAINDICATIONS

• Do not use on any wound with evidence of active infection, gangrene, or wounds of decubitus etiology.
• Do not use on mucosal surfaces or across mucocutaneous junctions (e.g., oral cavity, lips), or on skin which may be regularly exposed to body fluids or with dense natural hair, (e.g., scalp).
• Do not use on patients with a known hypersensitivity to cyanoacrylate or formaldehyde.
Needlestick Safety and Prevention Act

- Signed by Congress of the United States of America on Nov. 6, 2000
- Sec. 3. Bloodborne pathogens standard
  - (4) In addition to the existing requirements concerning exposure control plans, the review and update of such plans shall be required to also:
    - (A) Reflect changes in technology that eliminate or reduce exposure to bloodborne pathogens
    - (B) Document annually consideration and implementation of appropriate commercially available and effective safer medical devices designed to eliminate or minimize occupational exposure.

Safety and Health Information Bulletin\(^1\) (03-23-2007)

- **Developed by:**
  - OSHA (Occupational Safety and Health Administration), Department of Labor
  - NIOSH (National Institute for Occupational Safety and Health)
  - CDC (Centers for Disease Control and Prevention), Department of Health and Human Services.

- **Background:**
  - ACS and AORN both endorsed the statement—“all published studies to date have demonstrated that the use of blunt suture needles can substantially reduce or eliminate needle stick injuries from surgical needles”

- **Conclusion:**
  - Employer **must use safer devices** to replace corresponding conventional sharp-tip suture needles in their workplaces when clinically appropriate
  - Where an employer has determined that the use of available safer devices is not feasible, the clinical justification for this determination must be documented in the facility’s Exposure Control Plan

Safety and Health Information Bulletin¹ (03-23-2007)

• Blunt-tip suture needles are identified by OSHA as an example to reduce percutaneous injuries.

Evidence of Effectiveness of Blunt-Tip Suture Needles

Figure 1. Rate of injury associated with the use of curved suture needles during gynecologic surgical procedures and percentage of suture needles used that were blunt, by quarter—three hospitals, New York City hospitals, April 1993–June 1994

In 1997, Mendelson and colleagues reported that, after the introduction of blunt tip needles in 3 hospitals, the use of blunt-tip suture needles rose to nearly 50% and the rate of percutaneous injuries was reduced by over 75%.

Suture Needle Injuries

Potentially Preventable Suture Needle Injuries

6 hospitals, 15 months, 197 suture needle injuries

Many are preventable by substituting alternative methods of skin closure

- Used to suture skin or other tissue: 41%
- Used to suture muscle or fascia: 59%

Preventable with the use of blunt suture needles

Information from Jane Perry, Janine Jagger. A Surgeon, a Suture Needle—and Hepatitis C. Vol.5, no. 6, 2001
Suture Needle Injuries

Increase in Sharps Injuries in Surgical Settings Versus Nonsurgical Settings after Passage of National Needlestick Legislation

Janine Jagger, MPH, PhD, Ramon Berguer, MD, FACS, Elayi Ginger Parker, MBA, Ahmed E Gomaa, MD, ScD, MSPH

Surveillance data from 87 US Hospitals

- Injuries increased 6.5% in surgical settings

Injuries were due to:

- Suture needles (43.4%)
- Scalpels (17%)
- Syringes (12%)
Recent Literature on blunt needles

• Preventing Needlestick Injuries in Obstetrics and Gynecology: How Can We Improve the Use of Blunt Tip Needles in Practice?

CATANZARITE Val; BYRD Kevin; MCNAMARA Mike; BOMBARD Allan

• Surgical needlestick injuries are common in obstetrics and gynecology and can cause transmission of viral diseases including hepatitis and acquired immunodeficiency syndrome (AIDS). Strategies to reduce the rate of needlestick injuries include using instruments rather than fingers to retract tissue and grasp needles, double gloving, using surgical staplers for skin closure, and substituting blunt tip surgical needles for sharp tip needles where applicable. Studies have shown the use of blunt tip surgical needles to be remarkably effective in reducing needlestick injuries. Despite recommendations by the American College of Surgeons that blunt tip surgical needles be used routinely, at least for fascial closure, and by the Occupational Safety and Health Administration and the National Institute for Occupational Health and Safety that these devices be used whenever medically appropriate, use in obstetrics and gynecology appears to be limited. Potential barriers to use include availability, the "feel" of the needle as it penetrates tissue, and habit. We suggest that blunt tip surgical needles have the potential to replace traditional needles for many obstetric and gynecologic applications. If their use is to become more widespread, we must focus on availability, evaluation for specific applications, and physician education.

Obstetrics and gynecology 2007, vol. 110, no6, pp. 1399-1403
Recent Literature on Blunt Needles


• Catanzarite, Val; Byrd, Kevin; McNamara, Mike; Bombard, Allan. **Preventing Needlestick Injuries in Obstetrics and Gynecology: How Can We Improve the Use of Blunt Tip Needles in Practice?** Obstetrics & Gynecology. 110(6):1399-1403, December 2007.


Summary

• Ob/Gyns are responsible for the two most common surgeries in reproductive age women.

• Plus Antibacterial Suture kill bacteria and inhibit colonization of the suture

• Blunt Needles aid in prevention of needle-stick injuries and protect the patient and clinical staff

• Closure with topical liquid adhesive may decrease risks of dermal infection, and improve patient satisfaction