

Surgical Site Infection Prevention Following Cesarean Delivery

Surgical site infection complicates 3-13% of cesarean deliveries and can lead to substantial maternal morbidity, prolonged admission, re-admission and need for prolonged medical management following delivery. Surgical site infection is defined as any superficial (cellulitis), deep tissue (rectus abscess, necrotizing fasciitis) or organ infection (endometritis). Known risk factors for surgical site infection include labor prior to cesarean delivery, ruptured membranes, maternal obesity. Likely risk factors include diabetes, chronic hypertension, tobacco use and multiple prior abdominal surgeries as well as intraoperative complications including prolonged operative time, excessive blood loss, emergency cesarean section.

There are several measures to prevent SSI that have demonstrated efficacy. This is an active area of research that continues to evolve.

Peri-operative Cesarean Delivery Procedures:

Pre-operative

- Pre-delivery shower recommended
- Hair clipping

Operative

- Limiting number of persons in the OR (goal less than 9; see UCMC policy)
- Chlorhexidine skin preparation
- Vaginal prep
- Appropriate antibiotic prophylaxis prior to skin incision (see section)
- Judicious use of bovie cautery
- Pfannenstiel or other transverse skin incision, if surgically appropriate
- Spontaneous placental removal
- Subcutaneous closure if over 2 cm
- Skin closure with suture, if surgically appropriate

Dressing: There is conflicting evidence regarding the efficacy of regarding negative pressure dressing for SSI prevention in obese patients, and no cost-analysis studies to support use. A recent systematic review in *Obstetrics and Gynecology* {Smidt et al November 2017} states currently available evidence does not support the use of negative pressure dressings for prevention of wound complications in obese women. However, another recent systematic review from *Am J Obset Gynecol* suggests a reduction in SSI and overall wound infections and

complications, SSI reduction risk ratio 0.45 (95% CI 0.31, 0.66), {Yu et al Sept 2017 PMID:28951263}.

Post-operative

- Removal of surgical dressing at 24-48 hours
- Post-operative anti-microbial prophylaxis, if indicated (see section)
- Provide instructions on incisional care including:
 - Importance of keeping incision dry and well-aerated
 - Cleansing of incision with soapy warm water in a blotting fashion as opposed to scrubbing motion
 - Instruction on signs of infection including: redness around incision, focal pain in incision, drainage from incision- especially if thick, purulent, malodorous and any separation of the incision

Antibiotic Prophylaxis

Pre-operative Antibiotic prophylaxis

- **Timing of Antibiotics:** Cochrane Review on Cord versus Skin has established reduction in infectious morbidity {RR 0.57 (95%CI 0.36-0.79)} with antibiotics given prior to skin incision. Cochrane Database System Review 2014 Dec 5: (12): CD009516
 - Ancef 2 gm IV x 1 prior to skin incision
Consider 3 gm Ancef for over 160 kg
 - PCN Allergy: Clindamycin 900 mg x 1 and Gentamycin 5 mg/kg up to 500 mg. Actual body weight can be used, up to 130% of ideal body weight. Maximum dose of 400 mg for patients who weigh less than 160 kg.
 - Multiple studies have evaluated 2 gm versus 3 gm in the morbidly obese parturient. While higher doses consistently demonstrate higher tissue levels, none have evaluated/demonstrated reduction in SSI morbidity. Therefore, use of a higher dose is not uniformly recommended at this time, but could be considered in individualized care.

2015 Young	Wash U	All obese	Both at CD completion- greater median AUC plasma concentr
2011 Pevzner/Wing	Irvine	Lean to obese	Tissue concentration inversely proportional to maternal BMI
2015 Maggio/Rouse	Brown	All obese	Tissue conc, similar concentrations at skin and closure with 2 v 3
2015 Ahmadzia	Johns Hopkins/ Duke	All obese	No difference in SSI in 2 versus 3 gm 13 versus 13% Retrospective look at two time intervals where 2 v 3 gm used
2015 Swank/ Wing	Irvine	Obese	Higher adipose concentrations with 3 gm dose

UC Pharmacy Recommendations for Weight-based Dosing:

Antibiotic	≤ 80 kg (≤176 lbs)	81-119 kg (177-264 lbs)	≥ 120 kg (≥ 264 lbs)
Cefazolin	2 gram	2 grams	3 grams
Clindamycin	900 mg	900 mg	900 mg

- Skin Prep:** Prospective trials comparing chlorhexidine to iodine have mixed results with some showing benefit to chlorhexidine and others showing no difference. The most prominent study {Tuuli et al NEJM 2016; 374: 647-55} demonstrated improvement in infectious morbidity with chlorhexidine-alcohol. {RR 0.55 (95%CI 0.34-0.90)}. Therefore chlorhexidine-alcohol is recommended.

For emergency cesarean sections, iodine has a faster bactericidal action and is not dependent upon friction and duration of exposure, therefore duraprep is recommended.

- Vaginal Prep:** Systematic Reviews have demonstrated reduction in endometritis with vaginal preparation (any agent) prior to cesarean delivery {RR 0.52 (95%CI 0.37-0.72)} {Caissutti et al, Obstet Gynecol 2017 Sep; 130(3): 527-538}. A Cochrane Review has demonstrated reduction in all post-cesarean infectious morbidity {RR 0.45(95%CI 0.25-0.81)} with povidone-iodine specifically {Haas et al. Cochrane Database Systematic Review 2014 Dec 21; (12): CD007892}. Vaginal prep prior to cesarean delivery is recommended. In cases of iodine allergy, 2% chlorhexidine prep can be substituted.

Special Populations:

Laboring patients

Adjunctive azithromycin has been demonstrated to reduce surgical site infection in laboring women who undergo cesarean delivery {RR 0.51 (95%CI 0.38-0.68)} {Tita et al NEJM 2016; 375: 1231-31}.

- **Inclusion Criteria:**
 - Regular contractions with cervical dilation of 4 cm or more or documented cervical change of 1 cm or 50% effacement
 - Ruptured membranes of 4 hours duration or more
- **Exclusion Criteria:**
 - Allergy to Azithromycin
- Dose: Azithromycin IV 500 mg x 1 prior to skin incision

Obese Patients--- Post-Operative Antibiotic Prophylaxis

Broad-spectrum antibiotics continued for 48 hours have been shown to reduce the risk of SSI in obese women undergoing cesarean delivery {RR 0.41 (95%CI 0.22-0.77)} {Valent et al JAMA 2017; 318 (11): 1026-34}. The first dose is scheduled to be administered 8 hours after start of cesarean.

- **Inclusion Criteria:**
 - Pre-pregnancy BMI of 30 or greater
- **Exclusion Criteria:**
 - Allergy to cephalosporins or metronidazole
 - Do not use in the setting of overlapping broad spectrum administration for other infections
- Dose:
 - Cephalexin 500 mg po q 8 hour for 48 hours
 - Metronidazole 500 mg po q 8 hours for 48 hours

Patients with chorioamnionitis

- If patient is currently on broad spectrum antibiotics at time of cesarean section for chorioamnionitis, add metronidazole (single dose) to improve anaerobic coverage.

Flowchart to Determine Prophylactic Antibiotics Recommended

