# Preventing Surgical Site Infections

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## Surgical Site Infections (SSIs) General Background

- 2.6% of 30 million operations complicated by SSIs
- SSIs second most common healthcare associated infection accounting for 17% of all hospital acquired infections
- SSIs most common healthcare associated infection in surgical patients (38%)

CDC, 2003

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## Consequences of SSI

- Increased hospital stay by up to 10 days
- Increased hospital costs
- Increased readmission rates
- Increased pain and suffering

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## Prevention of SSI: Process

- ✓MD to treat any existing infection at remote site (urine, bloodstream, etc.)
- ✓Remove hair only when necessary
  - ➢Do not shave
  - ➢When necessary, use clippers or depilatories
- ✓ Control hyperglycemia
- ✓Implement preoperative showers CHG preferred
- ✓Administer surgical prophylaxis according to guidelines
- ✓Maintain appropriate oxygenation control
- ✓Maintain normothermia/control of hypothermia

CDC SSI Guideline 1999

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## CDC Prevention of Surgical Site Infections, 1999

- http://www.cdc.gov/ncidod/dhqp/pdf/guidelines/SSI.pdf

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## Infection Prevention & Control Risk Assessment

- 30% of SSI are preventable with appropriate use of preoperative antibiotics*

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*Dellinger EP 2005

## Risk Prevention

- Patient Characteristics
  - Diabetes
  - Nicotine use
  - Steroid Use
  - Malnutrition
  - Prolonged Hospital Stay
  - Pre-operative nares colonization with *Staph aureus*
  - Peri-operative Transfusions

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## Risk Prevention

- Operative Characteristics: Preoperative Issues
  - Preoperative antiseptic showering
  - Preoperative hair removal
  - Patient skin prep in the OR
  - Preoperative hand/forearm antisepsis
  - Management of infected or colonized surgical personnel
  - Antimicrobial prophylaxis

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## Peri-Operative

- Encourage smoking sensation. At a minimum, instruct patient to abstain for a at least 30 days before elective operation from smoking cigarettes, cigars, pipes or any other form of tobacco consumption. Category IB
- Do not withhold necessary blood products surgical patients as a means to prevent SSI. CategoryIB

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## Peri-Operative

- Treat remote site infections prior to elective surgery –Category IA
- Do not remove hair preopertatively unless the hair at or around the incision will interfere with the operation. Category IA
  - If hair is removed remove immediately before the operation, preferably with electric clippers. Category IB

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## Skin Prep

- Wash site to remove gross contamination
- Use appropriate antiseptic skin agent
  - Alcohol, CHG, iodine/iodophors, combo agents
  - Concentric circles or manufacturer recommendations for use

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## Risk Prevention

- Operative characteristics: Intraoperative issues
  - Operating Room environment
    - Ventilation
    - Environmental surfaces
    - Microbial sampling – do not do routinely
    - Conventional sterilization of surgical instruments
    - Flash sterilization of surgical instruments
  - Surgical attire and drapes
    - Scrub suits
    - Masks
    - Surgical caps/hoods and shoe covers
    - Sterile gloves
    - Gowns and Drapes
  - Asepsis and surgical technique
    - Asepsis
    - Surgical technique

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## Intraoperative - OR Environment

- Ventilation
  - Positive pressure to corridors
  - A minimum of 20-25 air exchanges per hour
  - Filter air
  - Ceiling supply vents and exhaust near floor
- Humidity
  - 30-60%
- Temp 68 73°F

AIA, 2006

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## Cleaning, Disinfection & Sterilization

- Environmental cleaning
  - EPA approved hospital disinfectant
- Patient care equipment and instruments
- Sterilization
  - Sterilize all surgical instruments according to published guidelines
  - Perform flash sterilization only for patient care items that will be used immediately
    - Do not use flash sterilization for convenience or for inventory control
- Biological monitoring for sterilizers
  - Rapid readouts
  - 48 hour test
  - Steris

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## Dress Codes & Drapes

- Gloves
- Masks
- Sterile Gowns – determine the level of impermeability needed per procedure
- Shoe covers – not infection prevention for SSI but prevents blood contamination
- Drapes – impervious!

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## Gloving Aspects of Hand Hygiene

- Wear gloves when contact with blood or other potentially infectious materials, mucous membranes, & nonintact skin could occur. Category IC
- Change gloves during patient care if moving from a contaminated body site to a clean body site. Category II
- Remove gloves after caring for a patient.
  - Do not wear the same pair of gloves for the care of more than one patient,
  - Do not wash gloves between uses with different patients. Category IB

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## Sterile Technique

- Adhere to principles of asepsis
- Assemble sterile equipment and solutions immediately prior to use.
- Handle tissues gently, maintain homeostasis, minimize devitalized tissues and foreign bodies and eradicate dead space at the surgical site
- Use delayed primary skin closure or an incision open to heal by secondary intention if the surgeon considers the surgical site to be heavily contaminated
- If drainage is necessary, use a closed suction drain. Place a drain through a separate incision distant from the operative incision. Remove the drain as soon as possible.

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## Surgical Hand Hygiene/Antisepsis

- Use either an antimicrobial soap or alcohol-based handrub
- Antimicrobial soap: scrub hands and forearms for length of time recommended by manufacturer
- Alcohol-based handrub: follow manufacturer's recommendations. Before applying, pre-wash hands and forearms with non-antimicrobial soap

Guideline for Hand Hygiene in Health-care Settings. *MMWR 2002*; vol. 51, no. RR-16.

LLF 2006 CDC HH slides

## Risk Reduction: Antimicrobial Pre-Operative Shower

- **Chlorhexidene Gluconate – Primary choice**
- **Iodophor**
- **Hexachlorophene**

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## Risk Prevention

- Operative Characteristics: Postoperative Issues
  - **Incision care**
    - Protect with a sterile dressing for 24 to 48 hours postoperatively an incision that has been closed primarily.
    - Wash hands before and after dressing changes any contact with surgical site
    - When an incision dressing must be changed, use sterile technique.
  - **Discharge planning**
    - Educate the patient and family regarding proper incision care, symptoms of SSI, and the need to report those symptoms

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## Surgical Site Infection: Clinical Signs and Symptoms

- **Febrile?**
- **Erythema/redness?**
- **Swelling?**
- **Warm?**
- **Tender?**
- **Drainage? (Serosanquinous/purulent)**
  - **Note: Amount, color, odor of drainage**

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## SSI Surveillance

- Concepts
- Issues
- Surveillance methods
  - Inpatient SSI surveillance
  - Post discharge SSI surveillance
  - Outpatient SSI surveillance
- Risk stratify patients according to NNIS
  - Surgical wound class, ASA class, and duration of operation
- Report numbers back to surgical team

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## SENIC Nosocomial Infection Risk Factors: Surgical Site Infections

- Reoperation
- Hematoma
- Obesity
- Diabetes
- Contaminated Surgery
- Abdominal Surgery
- Prolonged Surgery (>2 hours)

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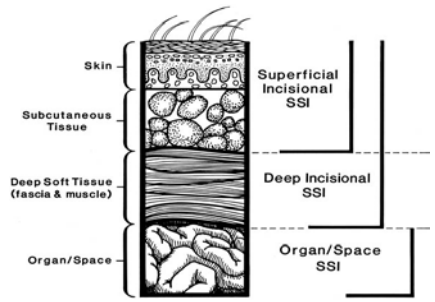
## Cross-section of abdominal wall depicting CDC classifications of surgical site infection

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## Classification of the Operative Wound by American College of Surgeons

- Class I - Clean
  - remove eye/insert implant
  - total knee
- Class II - Clean-Contaminated
  - removal of tonsils and adenoids
  - cystoscopy, stone removal
- Class III - Contaminated
  - accidental wound
- Class IV - Dirty
  - drainage of abdominal mass
- Unclassified

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## Infection Rate by Class American College of Surgeons

| Class | Infection Rate (%) |
|---|---|
| Class I | 1.5 |
| Class II | 7.7 |
| Class III | 15.2 |
| Class IV | 40 |
| Overall | 4.7 |

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## NNIS Risk Factors: Surgical Site Infections

- ☑ASA score >3
- ☑Class III or Class IV Procedure
- ☑T= >75 percentile of t for procedure

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## Physical Status Classification, (ASA)
American Society of Anesthesiologist

1. **Normally healthy patient**
2. **Patient with mild systemic disease**
3. **Patient with severe systemic disease that is not incapacitating**
4. **Patient with an incapacitating systemic disease that is a constant threat to life**
5. **Moribund patient who is not expected to survive for 24 hours with or without operation**

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## Common SSI Pathogens

- *Staphylococcus aureus*
- *Coagulase negative staphylococci*
- *Enterococcus sp.*
- *E. coli*
- *Pseudomonas aeruginosa*
- *Enterobacter spp.*
- *Proteus mirabilis*
- *Klebsiella pneumonia*
- *Other Strep species*
- *Candida albicans*
- *Group D strep (non-enterococci)*
- *Other gram-positive aerobes*
- *Bacteroides fragilis*

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## Surgical Infection Prophylaxis (SIP) Justification

- Incidence of SSI.
  - Extra-abdominal procedures 2 – 5%.
  - Intra-abdominal procedures up to 20%
- Estimated 40 60% of SSI are preventable.
- Inappropriate use of antibiotics in 25- 50% of cases (overuse, underuse, misuse, timing).

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## SIP Measures

- SIP 1 – timing of prophylactic antibiotics.
  - Patients should receive their prophylactic antibiotics within one hour of skin incision. (Vancomycin and the fluoroquinolones should be started within two hours of incision given their longer infusion times).
- SIP 2 – selection of appropriate prophylactic antibiotics.
  - Patients should receive the appropriate prophylactic antibiotic (as dictated by the current recommendations).
- SIP 3 – cessation of prophylactic antibiotics.
  - The prophylactic antibiotics should be discontinued within 24 hours after surgery with the exception of patients undergoing CABG or other cardiac procedures in which they should be discontinued within 48 hours.

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## Targeted Surgical Procedures

- Cardiac.
- Coronary artery bypass graft (CABG).
- Colon.
- Hip and knee arthroplasty.
- Abdominal and vaginal hysterectomy.
- Vascular surgery.

* Common procedures, antibiotics clearly indicated.

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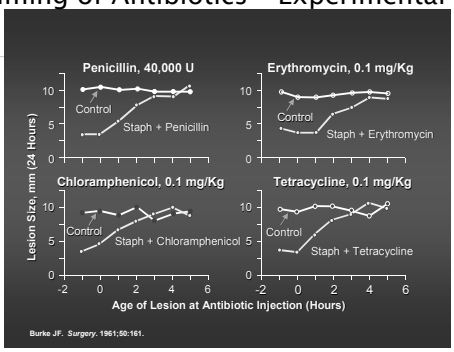
## Timing of Antibiotics – Experimental Mode

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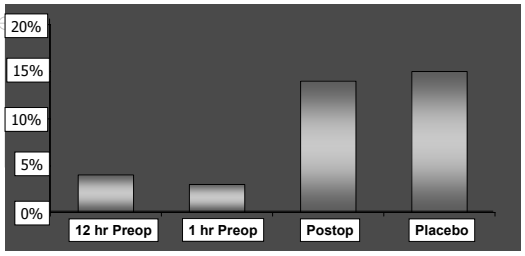
## Timing of Antibiotics – GI Surgery




Stone HH et al. *Ann Surg*. 1976;184:443-452.

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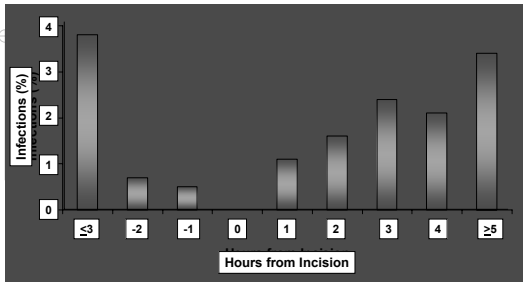
## Timing of Antibiotics – Cardiac Surgery




Classen, et al. *N Engl J Med*. 1992;328:281.

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**Table 2. Updated consensus recommendations of the Surgical Infection Prevention Guideline Writers Workgroup.**

| Surgical procedure | Antimicrobial recommendations |
|---|---|
| Abdominal or vaginal hysterectomy | Cefotetan, cefazolin, cefoxitin, or ampicillin-sulbactam[a]; metronidazole monotherapy[b]; if β-lactam allergy is present, clindamycin combined with gentamicin or parenteral fluoroquinolone[c] or aztreonam, metronidazole with gentamicin or parenteral fluoroquinolone[c], or clindamycin monotherapy are recommended |
| Hip or knee arthroplasty | Preferred therapy is cefazolin or cefuroxime; if patient is at high risk for MRSA, vancomycin[d] is recommended; if β-lactam allergy is present, vancomycin or clindamycin are recommended |
| Cardiothoracic and vascular surgery | Preferred therapy is cefazolin or cefuroxime; if patient is at high risk for MRSA, vancomycin[d] is recommended; if β-lactam allergy is present, vancomycin or clindamycin are recommended |
| Colorectal surgery[e] | Recommended oral antimicrobial prophylaxis is neomycin plus erythromycin base or neomycin plus metronidazole; recommended parenteral antimicrobial prophylaxis is cefotetan, cefoxitin, cefazolin plus metronidazole, or ampicillin-sulbactam[a]; if β-lactam allergy is present, recommendations include clindamycin combined with gentamicin or parenteral fluoroquinolone[c] or aztreonam and metronidazole with gentamicin or parenteral fluoroquinolone[c] |

**NOTE.** Consensus recommendations are based on a 17 November 2005 face-to-face meeting of representatives of most of the groups that have publishec North American guidelines for antimicrobial prophylaxis. MRSA, methicillin-resistant *Staphylococcus aureus*.

[a] Although there is little evidence that antibiotic prophylaxis prevents endocarditis, if the clinician decides to provide endocarditis prophylaxis for a patient having surgery, a drug that will inhibit growth of *Enterococcus* species should be used.

[b] Metronidazole monotherapy is included in the American College of Obstetricians and Gynecologist's Practice Bulletin as an alternative to β-lactams for patients undergoing hysterectomy, although it may be less effective as a single agent for prophylaxis [25]. For the purposes of national performance measurement; use of metronidazole monotherapy does not pass the antibiotic selection indicator for hysterectomy.

[c] Ciprofloxacin, gatifloxacin, levofloxacin, or moxifloxacin.

[d] For the purposes of national performance measurement in the Surgical Infection Prevention Project and the Surgical Care Improvement Project, use of vancomycin for surgical prophylaxis, in the absence of a documented β-lactam allergy, will require a physician-documented rationale in the medical record.

[e] For the purposes of national performance measurement, a case will pass the antibiotic selection indicator for colorectal surgery if the patient receives oral prophylaxis alone, parenteral prophylaxis alone, or oral prophylaxis combined with parenteral prophylaxis.

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| Surgical Procedure | Approved Antibiotics at Shands UF |
|---|---|
| Cardiac or Vascular | **Cefazolin**<br>β–lactam allergy or other risk factors*: **Vancomycin** |
| Hip/Knee Arthroplasty | **Cefazolin**<br>β–lactam allergy or other risk factors*: **Vancomycin** |
| Colon | ORAL: **Neomycin Sulfate + Erythromycin base**<br>PARENTERAL: **Cefoxitin *OR* Cefazolin + Metronidazole**<br>β–lactam allergy: **Levofloxacin + Metronidazole** |
| Hysterectomy | **Cefazolin *OR* Cefoxitin**<br>β–lactam allergy: **Clindamycin** |

*Risk factors for vancomycin – Hospital stay > 24 hrs, MRSA colonization, hospitalized or in LCTF in past year, chronic HD or wound care, other.

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## Duration of Antibiotic Prophylaxis

- Most studies confirmed efficacy of ≤12 hrs.
- Many confirm efficacy of a single dose.
- Shorter course results in *less antibiotic resistance*.
- Systemic review- single vs Multiple dose prophylaxis – showed no benefit

McDonald. Aust NZ J Surg 1998;68:388

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## Surgical Care Improvement Project

- Partnership of providers and national organizations (CMS, CDC, ACS, others).
- Opportunity to improve surgical care beyond surgical site infection.
- SCIP goal
  - To reduce preventable surgical morbidity and mortality 25% by 2010.

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## SCIP Justification

- Incidence of complications.
  - Noncardiac surgery – 6%.
  - High risk surgical procedures – 30%
- Sequelae of postoperative complications.
  - Increased length of stay.
  - Increased hospital costs.
  - Increased mortality.

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## SCIP Justification

- Annual estimated opportunities among Medicare beneficiaries undergoing major surgical procedures.
  - 271,055 perioperative complications.
  - 13,027 perioperative deaths.

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## SCIP – SSI Prevention 2006

- SIP measures (Initial Measures)
  - Timing of prophylactic antibiotics.
  - Appropriate prophylactic antibiotics.
  - Cessation of prophylactic antibiotics.
- Blood glucose control in cardiac surgery patients (6 AM glucose $\leq$ 200 mg/dL on POD 1, 2).
- Proper hair removal (clippers, depilatory or none).
- Normothermia in colorectal surgery patients (temp 96.8– 100.4º F first postoperative hour).

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## SCIP Modules

- Surgical site infection prevention.
- Venous thromboembolism prevention.
- Cardiac events prevention.
- Respiratory complication prevention.

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## NISQIP – 30 Day Complications

| Complication | % |
|---|---|
| Surgical site infection | 3.35 |
| Pneumonia | 2.28 |
| Failure to wean < 48 hours | 1.96 |
| Unplanned intubation | 1.74 |
| Urinary tract infection | 1.72 |
| Systemic sepsis | 1.06 |
| Wound dehiscence | 0.87 |
| Cardiac arrest | 0.78 |
| Prolonged ileus | 0.53 |
| Acute myocardial infarction | 0.52 |
| Progressive renal insufficiency | 0.45 |
| Bleeding | 0.43 |
| Renal failure | 0.37 |
| Deep vein thrombosis | 0.37 |
| Graft/prosthesis failure | 0.27 |
| Stroke | 0.27 |
| Pulmonary embolism | 0.21 |
| Coma | 0.10 |

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Best WR, et a. *J Am Coll Surg*. 2002;194:257-266.

## Glucose Control – Cardiac Surgery

TABLE 3
GLUCOSE LEVELS AMONG 72 CASES WITH SURGICAL-SITE INFECTIONS AND 902 CONTROLS WITHOUT SURGICAL-SITE INFECTIONS

| Glucose (mg/dL) | Cases (%) | Controls (%) | OR |
|---|---|---|---|
| <200 (referrent) | 35 (49) | 651 (72) | 1.00 |
| 200-249 | 21 (29) | 154 (17) | 2.54 |
| 250-299 | 11 (15) | 69 (8) | 2.97 |
| ≥300 | 5 (7) | 28 (3) | 3.32 |

Abbreviation: OR, odds ratio.
Chi square for linear trend=16.375, $P<.0001$.

Latham R, et al. *Infect Control Hosp Epidemiol*. 2001.

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## Proper Hair Removal

- Razors induce small skin lacerations.
  - Potential sites for infection.
  - Disturbs hair follicles colonized with *S. aureus.*
  - Risk greatest when done the night before.

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## Hair Removal Method Shaving *vs* Clipping

| Hair Removal Method | Clean Wound Infection Rate (%) |
|---|---|
| Shaved with razor | 2.5 |
| Clipped | 1.7 |
| Electric razor | 1.4 |
| Not shaved, not clipped | 0.9 |
| Depilatories | 0.6 |

Cruce and Forde, 1981

The increased risk with shaving prior to the operation is associated with microscopic cuts and shaving immediately before seriously reduces the SSI risk ( 20% risk if shaved > 24hrs--CDC, 1999).

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## Normothermia – Colorectal Surgery

- Experimental design (N = 200)
  - Control- routine care (mean 34.7°C)
  - Treatment- active warming (mean 36.6°C)
- Results
  - Control- 19% SSI (18/96)
  - Treatment- 6% SSI (6/104), P=0.009

Kurz A, et al. *N Engl J Med*. 1996.

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## Surgical Care Improvement Project Implementation

- Communication is KEY!
- Set up system to assure delivery of antibiotics at right dose, right time and right stop time
  - Outline steps and pathways for success
- Document no shaving
- Establish aggressive glucose control protocol
  - ICU and on units
  - Portland protocol or develop your own

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## Surgical Site Infections: Proper Skin Prep through *No Shaving & Pre-Operative Antimicrobial Showering-* The Keys to Prevention

**Infection Prevention is Our Goal**

Reduce risk of surgical site infections by

1. Educating healthcare providers to improve understanding and compliance with no shaving and pre-operative showering protocols as well as other ways to prevent Surgical Site Infections
2. Educating and providing patient with tools to understand the need not to shave and how to perform pre-op showering
3. Improving documentation of these activities
4. Monitoring surgical site infections and noting impact of these activities and report to OR and surgical staff

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## Education via Patient Safety Handout

**Points Discussed / Questions asked in Handout:**

-Will I receive and antibiotic prior to surgery?

-Should I take a shower with antibacterial soap or shave prior to surgery?

**Infection Control Tips**:

-Keep your hands clean

-Do not hesitate to ask your healthcare provider if he/she has washed their hands

-Cover your mouth and nose when you cough or sneeze. Discard the tissue and then clean your hands

-Safely care for wounds and catheters by learning proper aseptic or clean techniques

-Handle needles and other sharp items safely and discard into a sharps container to prevent injury to you and others

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## SSI Prevention Guidelines Preparation of Patient

Category 1A: Do Not Remove Hair at the incision site, unless it will interfere with surgery itself. If the hair must be removed, do it directly beforehand, preferably with electric clippers.

Category 1B: Pre-surgical patients should perform an antiseptic shower at least the night before and preferably also the morning of the scheduled surgery. Wash and clean the incision site area, scrubbing lightly to remove any gross skin contamination prior to antiseptic surgical preparation.

CDC, 1999

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## Preoperative Showering Info

•Preoperative shower or bath with CHG reduces skin microbial counts more effectively than povidone iodine or other antimicrobial soaps

• Bathing 2 times with CHG (once the evening before & then the morning of ) is recommended to increase effectiveness.

•Develop and provide bathing instructions for patients

•Develop education and visual reminders for staff to provide information to patient

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## Patient Preoperative Shower Packet

The packet given in the clinics or during preop testing should contain:

- -Instruction sheet
- -Patient Safety Handout
- -Packet or container with Hibiclens® or other CHG product

Other areas for pre-operative showering:

- -Pre-op Admissions or Pre-Op Holding Area
- -Pre-admission on a floor or ICU

Documentation of pre-operative showering:

- -Pre-op nursing notes in holding area
- -Clinic notes
- -Transplant coordinator notes
- -Unit nurse who assisted with bath

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Infection Prevention is Our Goal

## Summary

- No Shaving/Pre- operative showering is an important patient safety activity to reduce the risk of post operative infections
- Healthcare providers preparing a patient for surgery should provide education.
  - Please provide a CHG product for the patient to use at home or in the hospital for a shower the night before and the morning of the procedure
- Remember to document education and record the patient's report of not saving and pre op showering.

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## Summary/Conclusions

- There are significant opportunities for improvement in surgical care.
- SIP and SCIP represent broad national commitment to improve quality.
- Hospitals and health care providers are encouraged to participate in these efforts.

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## References


- CDC Prevention of Surgical Site Infections, 1999
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2007 Teleclass Schedule

**January**
9 - *The UK Infection Prevalence Survey*, Chris Perry, UK
18 - *Personal Hygiene Measures to Prevent Influenza Transmission*, Dr. Elaine Larson, USA
25 - *Twenty First Century Plagues*, Prof. Robert Pratt, UK

**February**
8 - *Influenza – Of Poultry, Pets and People*, Dr. Corrie Brown, USA
15 - *Fresh Produce and Human Pathogenicity*, Prof. Keith Warriner, Canada
21 - *Infection Control in the Endoscopy Clinic*, Dr. Richard Everts, New Zealand
22 - *Best Practice for Hospital Construction Management*, Andrew Streifel, USA

**March**
6 - *Tuberculosis in the Modern Age*, Evonne Curran, UK
8 - *Voices of CHICA*, CHICA Canada Board & Guests
22 - *A Year of Cleaner, Safer Care - A Worldwide Experience*, Dr. Didier Pittet, Switzerland
29 - *Environmental Control Strategies for C. diff*, Dr. Lynne Sehulster, USA

**April**
12 - *Who's Afraid of the CIC Exam?*, Sheila MacDonald & Sharon Krystofiak
19 - *Bacterial Resistance to Biocides in the Healthcare Environment*, Dr. Jean Yves Maillard, UK
25 - *Making IC Really Work - Managing the Human Factor*, Prof. Seto Wing Hong, China
26 - *Environmental Surveillance for Infection Control*, Andrew Streifel, USA

**May**
8 - *Panton-Valentine Leucocidin Producing Staph. aureus*, Brenda Dale & Adam Brown, UK
10 - *Infection Control in the Dialysis Clinic*, Dr. Charmaine Lok, Canada
17 - *Ethics of Care During a Pandemic Crisis*, Dr. Eric Wasylenko, Canada
24 - *Importance of Vaccination Among Dialysis Patients*, Dr. Matthew Arduino, USA
31 - *Evaluation and Management of Outbreaks in Nursing Homes*, Dr. Chesley Richards, USA

**June**
7 - *Infection Control in the Living and the Dead: The Angola Marburg Outbreak*, Dr. Adriano Duse, South Africa
20 - *Central Venous Lines and Prevention of Infection*, Dr. Steve Chambers, New Zealand

**July**
3 - *Implementing Innovations in Health Services*, Clare Allen, UK
26 - *CDC Guideline Review - Disinfection & Sterilization*, Dr. Bill Rutala, USA

**August**
9 - *Outcome Surveillance and Process Surveillance to Minimize Nosocomial Infection*, Dr. Victor Rosenthal, Argentina
22 - *ESBLs - Where Are We Now?*, Dr. Fong Chiew, New Zealand

**September**
20 - *Extreme Makeover: Exploring New Challenges to Our Identity in Infection Control*, Gwyneth Meyers, Canada
27 - *Ethical Issues in Infection Control*, Dr. Loreen Herwaldt, USA

**October**
4 - *Green Cleaning Strategies for Healthcare*, Dr. Lynne Sehulster, USA
10 - *Infection Prevention Among Refugees*, Dr. Mark Birch, Australia
18 - *Hot Issues in Hand Hygiene Improvement - The First Global Challenge*, Julie Storr, Switzerland

**November**
6 - *Commissioning Infection Control Strategy*, Yvonne Sawbridge, UK
8 - *Hazard Vulnerability Analysis for Infection Control*, Andrew Streifel, USA
15 - *An Approach to Outbreak Management- Using Biostats to Clobber Bugs*, Dr. Dick Zoutman, Canada
29 - *Effective Infection Control Promotion in 3-to-5 Steps*, Allen Soden, USA

**December**
13 - *Water Quality Issues Pertaining to Medical Device Reprocessing*, Dr. Michelle Alfa, Canada