



Surgical Site Infection (SSI) Prevention



Basics of Infection Prevention
2-Day Mini-Course
2013

Objectives

- Review the epidemiology of SSI
- Explore causes and mechanisms of SSI
- Describe evidence-based practices for prevention of SSI
- Review SSI surveillance definitions and methods



Epidemiology of SSI

- SSI infection generally occurs within 30 days following surgery
 - Some procedures monitored up to 90 days for SSI
- 2% -5% surgical patients acquire SSI (300-500K per year)
 - 3% die (77% of deaths directly attributable to the SSI)
 - Many result in long term disability
- SSI increases hospital length of stay 7-10 days
 - Cost estimates vary, ~\$30,000 per SSI
 - Most estimates do not account for re-hospitalization, outpatient treatment, post-discharge expenses, quality of life for the patient, or any long term disability costs



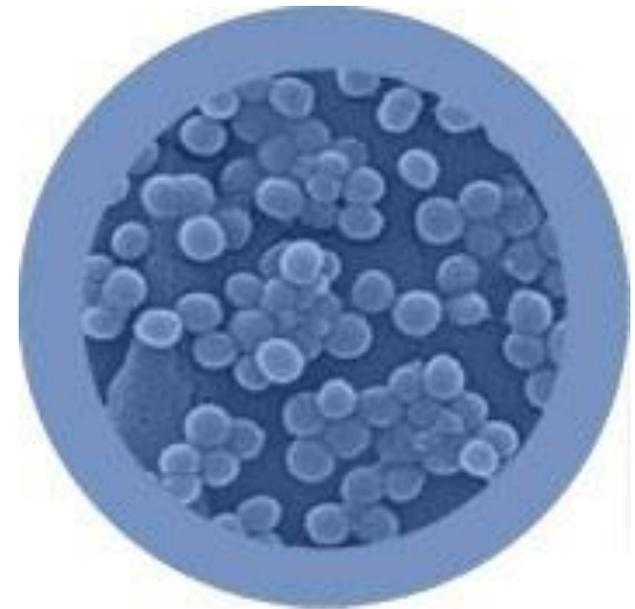
Pathogenesis of SSI

Source of infecting pathogen

- Endogenous
 - Patient Flora
 - Skin
 - GI tract
 - Mucous membranes
 - Seeding from pre-existing sites of infection
- Exogenous
 - Surgical personnel flora
 - Breaks in aseptic techniques
 - Inadequate hand hygiene
 - Contaminated garments
 - Equipment, surgical tools, materials within operative field
 - OR environment, including ventilation

SSI Pathogens

- *Staphylococcus aureus* - 30.0%
- Coagulase-negative staphylococci - 13.7%
- Enterococcus spp - 11.2%
- *Escherichia coli* - 9.6%
- *Pseudomonas aeruginosa* - 5.6%
- Enterobacter spp - 4.2%
- *Klebsiella pneumoniae* - 3.0%
- Candida spp - 2.0%
- *Klebsiella oxytoca* - 0.7%
- *Acinetobacter baumannii* - 0.6%



N=7,025

Jan 2006-Oct 2007

Hidron AI, et.al., *Infect Control Hosp Epidemiol*
2008;29:996-1011 ;ERRATUM 30:107-107

SSI Prevention Objectives

- National HAI Prevention Action Plan
 - SSI reduction of 25% from 2009 baseline
 - 95% adherence rates to Surgical Care Improvement Project (SCIP) process measure



To review

CDC Prevention Strategies

Core Strategies

High levels of scientific evidence

Demonstrated feasibility

- Should become standard practice

Supplemental Strategies

Some scientific evidence

Variable levels of feasibility

- Consider implementing in addition to Core when infections persist or rates are high



SSI Prevention Strategies: **Core**

Administer antimicrobial prophylaxis in accordance with evidence based standards and guidelines

- Administer within 1-hour prior to incision
(2hr for vancomycin and fluoroquinolones)
- Select appropriate agents on basis of:
 - Surgical procedure
 - Most common SSI pathogens for the procedure
 - Published recommendations
- Discontinue antibiotics within 24hrs after surgery
(48 hrs for cardiac)



SSI Prevention Strategies: **Core**

- Identify and treat remote infections – when possible
 - Before elective operation
 - Postpone operation until infection resolved
- Hair removal
 - Do not remove hair at the operative site unless it will interfere with the operation
 - Do not use razors
 - If necessary, remove by clipping or by use of a depilatory agent



SSI Prevention Strategies: **Core**

- Skin Prep
 - Use appropriate antiseptic agent and technique for skin preparation
- Operating Room (OR) Traffic
 - Keep OR doors closed during surgery except as needed for passage of equipment, personnel, and the patient
- Colorectal surgery patients
 - Mechanically prepare the colon (Enemas, cathartic agents)
 - Administer non-absorbable oral antimicrobial agents in divided doses on the day before the operation



Prevention Strategies: **Core**

- Maintain immediate postoperative normothermia
- Surgical Wound Dressing
 - Protect primary closure incisions with sterile dressing for 24-48 hours post-op
- Control blood glucose level during the immediate post-operative period - cardiac
 - Measure blood glucose level at 6 am on post-op day 1 and 2 (procedure day = day 0)
 - Maintain post-op blood glucose level at <200mg/dL

SSI Prevention Strategies: **Supplemental**

- Nasal screen for *Staphylococcus aureus* on patients undergoing
 - elective cardiac surgery, orthopedic, neurosurgery procedures with implants
 - decolonize carriers with mupirocin prior to surgery
- Screen preoperative blood glucose levels and maintain tight glucose control post-op day 1 and 2 in patients undergoing select elective procedures
 - i.e., arthroplasties, spinal fusions, etc.

NOTE: These supplemental strategies are not part of the 1999 HICPAC Guideline for Prevention of Surgical Site Infections



Prevention Strategies: **Supplemental**

- Redose antibiotic at 3 hr intervals in procedures with duration >3 hours

*See exceptions to this recommendation in Engelmann, 2007

- Adjust antimicrobial prophylaxis dose for patients who are obese (body mass index >30)
- Use at least 50% fraction of inspired oxygen intraoperatively and immediately postoperatively in select procedure(s)
- Perform surveillance for SSI
- Feedback surgeon-specific infection rates



SSI Surveillance

Requires

- Consistent use of standard methods and definitions for identifying procedures performed and SSI that result
- Capture of sufficient risk factor data for each procedure performed
- Application of risk adjustment methods for meaningful comparisons (i.e., over time within your hospital or to national referent data)



Surgical Procedure Definition

Only considered an NHSN operative procedure when

- Takes place in an OR (meeting FGI or AIA criteria)
- Surgeon closes the incision primarily prior to patient leaving the OR
 - Primary closure defined as closure of all tissue levels regardless of the presence of devices or objects extruding through the closed incision
 - If skin edges are not fully approximated for entire length of incision, not considered primarily closed **AND**
 - Procedure should not be included in SSI surveillance denominator
 - Subsequent infection should not be reported as an SSI



Procedure Risk Factor Data

For all procedures

- Gender
- Age
- Surgical wound class -
clean, clean-contaminated, contaminated, or dirty
- ASA score - **as proxy for underlying illness**
- Duration - incision to close time
- Yes/No: Emergency, Trauma, Anesthesia type
- Endoscope (*decreases risk*)



New in 2013: **"Implant"**
no longer collected

Procedure Risk Factor Data

For specific procedures

C-section

- Height
- Weight
- Duration of labor

Spinal fusion/refusion

- Spinal level (e.g. cervical)
- Diabetes Y/N
- Approach (e.g. anterior)

Hip prosthesis

- Total or partial
- Primary or revision

Knee prosthesis

- Primary or revision

Wound Class

Clean

Operation where no inflammation encountered
Respiratory, alimentary, genital, urinary tracts **not** entered
Operation following non-penetrating (blunt) trauma
Primarily closed with no open drainage

Clean - Contaminated

Operation entering respiratory, alimentary, genital, or urinary tracts
No evidence of infection, no major break in technique, no unusual contamination encountered
Operation involving biliary tract, appendix, vagina, and oropharynx

Contaminated

Operation following open, fresh, accidental wounds
Operation with major breaks in sterile technique (e.g., open cardiac massage) or gross spillage from GI tract
Includes operation where acute, non-purulent inflammation encountered

Dirty

Operation involving old traumatic wounds with retained devitalized tissue, **or** existing clinical infection **or** perforated viscera
Definition suggests the organisms causing post-op infection were present before the operation

Identifying SSI

- Follow NHSN protocols for surveillance
- Surgical Services, surgical units, and OR staff need to assist
- Evaluate both clinical and microbiologic findings post-op
 - Can't rely on wound cultures alone to find SSI (!)
- Evaluate surgical patients during hospital stay
 - Rounds on units
 - Pharmacy reports of antimicrobial use
 - Temperature charts / logs
 - Operating room schedule of surgeries/ re-operations
- Monitor surgical patients for re-admission
- Perform post-discharge surveillance



SSI Surveillance Period (Revised 2013)

- Post-operative monitoring period now determined by NHSN Procedure Category
- 14 NHSN procedure types require 90-day monitoring period

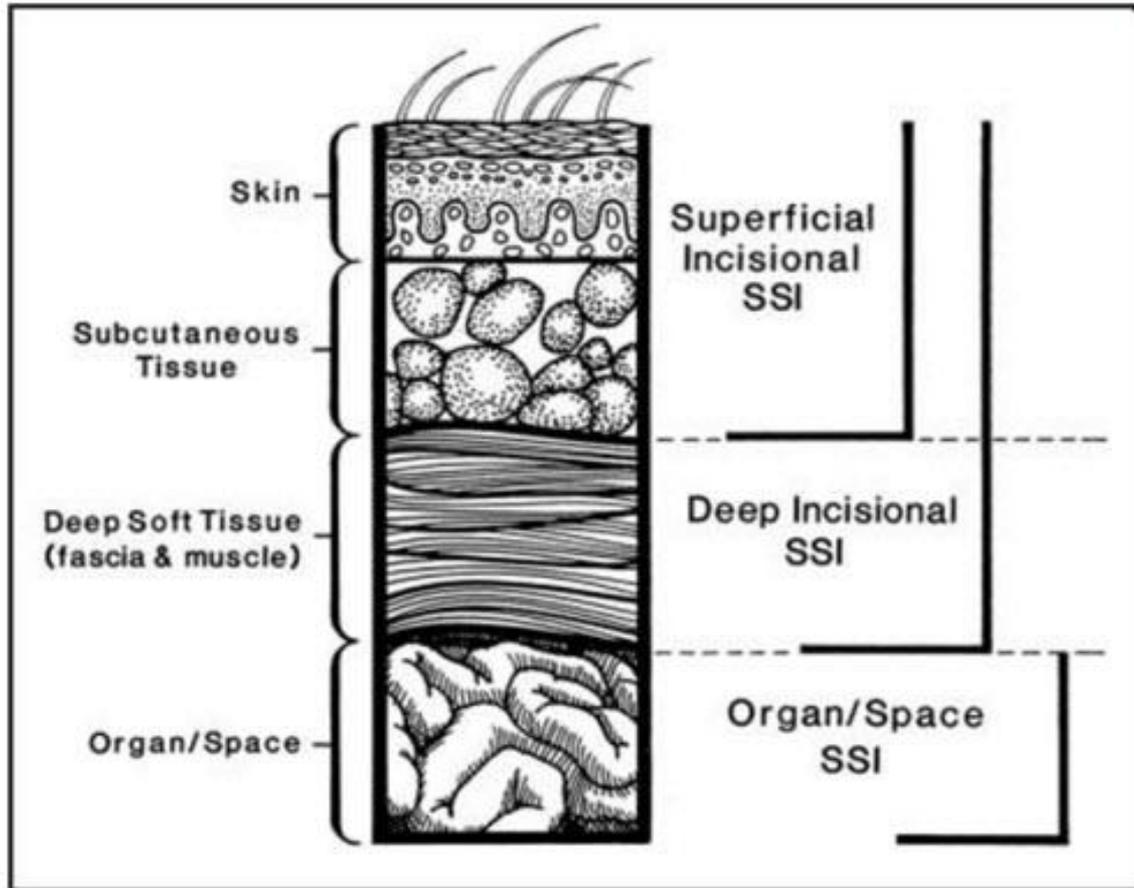
BRST*	CRAN	HPRO	RFUSN
CARD	FUSN	KPRO	VSHN*
CBGB	FX	PACE	
CBGC	HER	PVBY*	

***Not included in the 29 mandated reportable procedures in CA**

- All other procedure categories monitored for 30 days regardless of presence of an implant
- For all NHSN procedure categories, superficial SSI are monitored for 30 days only



NHSN SSI Surveillance Definition



Categorized
based on
depth infection

Superficial Incisional SSI

Surveillance Definition

- Infection occurs within 30 days after surgical procedure

AND

- Involves only skin and subcutaneous tissue of the incision

AND

Patient has at least **1** of the following:

- a. Purulent drainage from the superficial incision
- b. Organism isolated from an aseptically-obtained culture of fluid or tissue
- c. Superficial incision that is deliberately opened by a surgeon and is culture positive or not cultured

and

Patient has at least one of the following signs or symptoms:
pain or tenderness, localized swelling, redness, heat

- d. Diagnosis of superficial SSI by surgeon or attending physician



Deep Incisional SSI

Surveillance Definition

- Infection occurs within 30 (or 90 days) after the operative procedure
- AND**
- Involves deep soft tissues of the incision, e.g., fascial & muscle layers
- AND**

Patient has at least **1** of the following:

- a. Purulent drainage from deep incision
- b. Deep incision spontaneously dehisces or opened by surgeon and is culture positive or not cultured

and

fever >38 C, localized pain or tenderness

(Note: a culture negative finding does not meet this criterion)

- c. Abscess or other evidence of infection found on direct exam, during invasive procedure, by histopathologic exam or imaging test
- d. Diagnosis of deep SSI by surgeon or attending physician

Organ Space SSI

Surveillance Definition

- Infection occurs within 30 or 90 days after the operative procedure

AND

- Infection involves any part of the body, excluding the skin incision, fascia, or muscle layers that is opened or manipulated during the operative procedure

AND

Patient has at least **1** of the following:

- a. Purulent drainage from drain placed into the organ/space
- b. Organism isolated from an aseptically-obtained culture of fluid or tissue in the organ/space
- c. Abscess or other evidence of infection found on direct exam, during invasive procedure, or by histopathologic or exam or imaging test
- d. Diagnosis of an organ/space infection by a surgeon or attending physician

AND

- Meets at least one criterion for a specific organ/space infection site listed on Table 4 of the NHSN Patient Safety Manual, SSI, 9-14



Organ/Space SSI Following Dirty Procedure

(clarification)

If patient

- has operation on day 1 or 2 of hospitalization and
- infection is found during operation (wound class “dirty”) and
- the surgical incision was closed primarily,

subsequent continuation of that infection type during the SSI surveillance period **is considered an organ/space SSI** if criteria are met.

Rationale: Risk of a continuing infection is considered to be minimal when a surgeon elects to close a wound primarily



Example

- On 8/1, patient presents to ED with acute abdomen and is admitted to the OR on the same day for colon resection (COLO). Peritoneal abscess noted at time of surgery. Incision is closed primarily w/ a JP drain in an adjacent stab wound.
- Even on antibiotics, patient continues to have low-grade fevers, abdominal pain, and purulent drainage via JP drain. Patient returned to OR on 8/6 for new exploration; new abscesses were found.
- This is reported as an SSI-IAB



SSI Following Multiple Procedures

If >1 operative procedure is done through a single incision and an SSI occurs

- First, attempt to determine the procedure associated w/ the infection
- If it is not clear, use the NHSN Principal Operative Procedure Selection List

Example: For abdominal surgeries

- COLO is higher priority (higher infection risk) than SB
- SB is higher than REC
- REC is higher than GAST

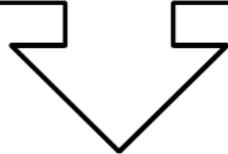




SSI – Event Details

Detected: Required.

Check the box to indicate when/how the SSI was identified.



- A** SSI was identified before the patient was discharged from the facility following the operation
- P** SSI was identified only as part of post-discharge surveillance, including ED visit without readmission. If readmitted, use RF or RO as appropriate.
- RF** SSI was identified due to patient readmission to the facility where the operation was performed.
- RO** SSI was identified due to patient admission to a facility other than where the operation was performed.

*Detected:		<input type="checkbox"/> A (During admission)	<input type="checkbox"/> P (Post-discharge surveillance)	<input type="checkbox"/> RF (Readmission to facility where procedure performed)
		<input type="checkbox"/> RO (Readmission to facility other than where procedure was performed)		
*Secondary Bloodstream Infection: Yes No		**Died: Yes No		SSI Contributed to Death: Yes No
Discharge Date:		*Pathogens Identified: Yes No		*If Yes, specify on pages 2-3.

Interpreting SSI Data

To make comparisons of SSI, use a number called the SIR (standardized infection ratio)

$$\text{SIR} = \frac{\text{Observed SSI}}{\text{Predicted SSI}}$$

1.0 indicates your hospital is the **same as** national comparison data



More coming in Epi/Surv presentation

SSI Prevention Collaboratives and Bundles

- CDC (Center for Disease Control)
www.cdc.gov/HAI/recoveryact/stateResources/toolkits
- IHI (Institute for Healthcare Improvement)
www.ihl.org/offerings/MembershipsNetworks/MentorHospitalRegistry/Pages/InfectionPreventionSSI
- SCIP (Surgical Care Improvement Project)
www.qualitynet.org/dcs/
- WHO (World Health Organization)
www.who.int/patientsafety/safesurgery/en/



References and Resources

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Questions?

For more information, please contact any Liaison Team member.

Thank you

