



Wound infection

Surgical site infection SSI

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Definition

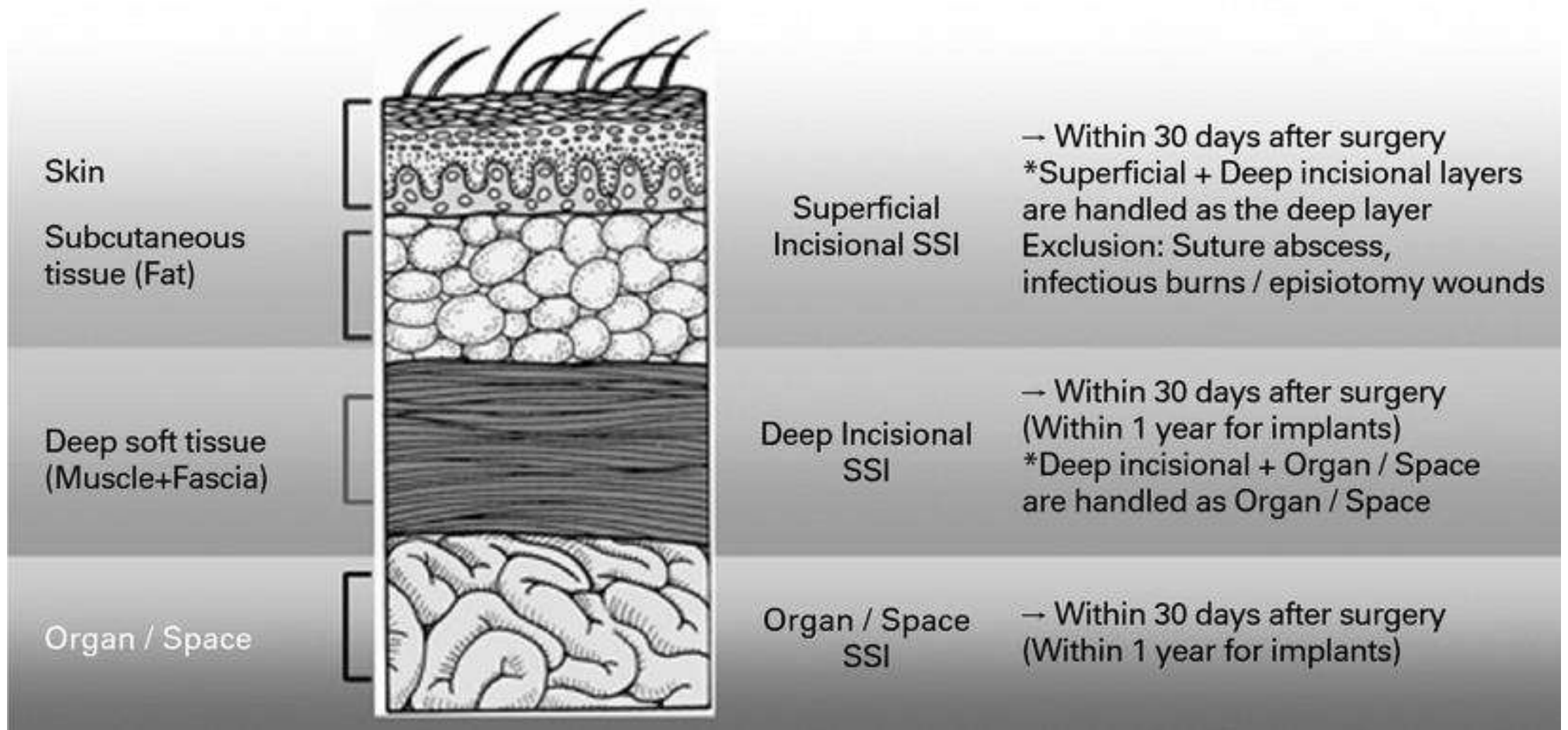
-Infection of the superficial or deep skin incision, or of an organ or space, occurring up to 30 days after surgery

-Classification of SSI

1-Superficial at the incision site

2-deep at the incision site

3-in other organs or spaces opened or manipulated during an operation



Wound classification

- **Clean:** a wound made under sterile conditions where there are no organisms present and the skin is likely to heal without complications,” or an incision in which no inflammation is encountered in a surgical procedure, without a break in sterile technique, and during which the respiratory, alimentary or genitourinary tracts are not entered (e.g. skin incision for ovarian cystectomy).
Clean contaminated: a wound made under sterile conditions but in which the respiratory, gastrointestinal, genital or urinary tract is entered under controlled conditions and without unusual contamination, or an incision through which the respiratory, alimentary or genitourinary tract is entered under controlled conditions but with no contamination encountered (e.g., skin incision at hysterectomy or caesarean section).

- **Contaminated:** typically an open, fresh or accidental wound or an incision undertaken during an operation in which there is a major break in sterile technique or gross spillage from the gastrointestinal tract, or an incision in which acute, non-purulent inflammation is encountered. Open traumatic wounds that are more than 12 to 24 hours old also fall into this category (obstetrics and gynaecology surgery in which the bowel is opened either deliberately or accidentally)
Dirty or infected: a wound with devitalised tissues with organisms pre-existing in the surgical field before surgery (e.g., laparotomy for pelvic collection).

Epidemiology

- **2-6% of surgeries in high-income countries, higher in low-income countries**
- **1.6% SSI after abdominal hysterectomy (audit of SSI in NHS 2017/2018) 8.7% in large bowel surgery, 6.8% in bile duct, liver and pancreas, small bowel surgery, 0.5% in knee replacement surgery (lowest)**
- **2.7% following hysterectomy in USA (2/3 were superficial incisional infections – vaginal cuff cellulitis; 1.1% were deep and organ-space SSIS – vaginal cuff abscess, peritonitis and pelvic abscess)**
- **SSI rate following CS vary worldwide 3-15%**

Risk factors for surgical site infection in obstetrics and gynaecology

- **Patient factors**

- Age
- Obesity
- Diabetes mellitus
- Place of residence-rural
- Smoking
- Immunosuppression ;
steroid use, alcohol.
- Poor nutritional status
- Length of preoperative stay
- Anemia

ASA (American Society of Anesthesiologists) physical status

- 1 Normal healthy patient**
- 2 Patient with mild systemic disease that is not incapacitating**
- 3 Patient with severe systemic disease that limits activity but is not incapacitating**
- 4 Patient with incapacitating systemic disease that is a constant threat to life**
- 5 Moribund patient who is not expected to survive with or without an operation**

2-Preoperative/prepregnancy factors

- Hypertension in pregnancy**
- Gestational diabetes**
- Multiple pregnancy**
- Previous caesarean section**
- Skin preparation**
- Hair removal**
- Type I and II diabetes mellitus (glycemic control)**
- Pre-hospital stay of minimum of 2 days**
- American Society of Anesthesiology (ASA) score of a minimum of 3.**

3-Intraoperative/intrapartum factors

Frequent vaginal examination

Prolonged rupture of membranes

Prolonged labor

Chorioamnionitis

Emergency caesarean section

Primary postpartum hemorrhage

Intrapartum pyrexia

Premature rupture of membranes

Prolonged surgery

Poor surgical technique

Surgical drains

Non-use of antimicrobial prophylaxis

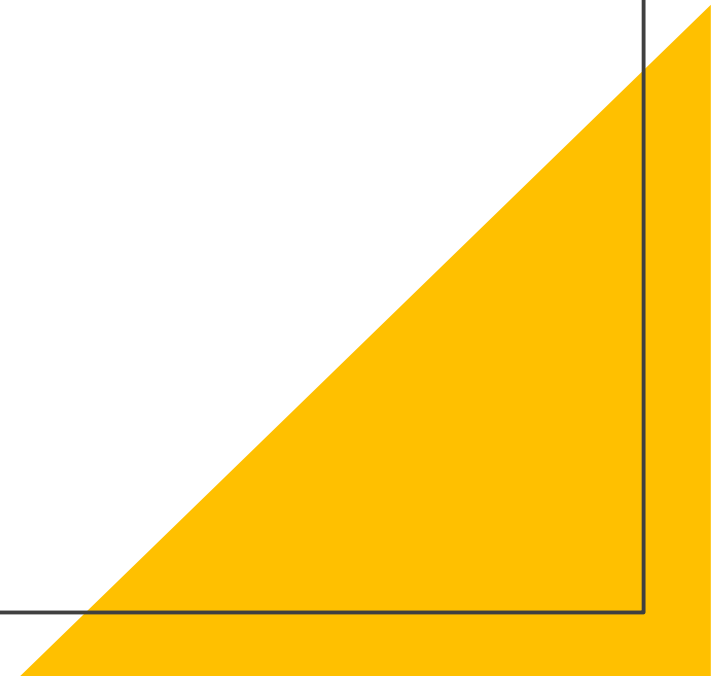


4-Postoperative factors

Hematoma

Blood transfusion

Length of hospital stay



Organisms responsible for surgical site infection

- 1-Enterobacterales (most common) – 30.2%**
- 2-Staphylococcus aureus – 22.9%**
- 3-Coliforms e.g. Escherichia coli – 19.6%**
- 4-Proteus mirabilis – 13.3%**

“In obstetrics and gynaecology”

- **Polymicrobial aerobes and anaerobes (from skin and genital tract flora)**
- **Genital infections (bacterial vaginosis/Neisseria gonorrhoea/Chlamydia trachomatis/Mycoplasma) – ascending infections**
- **Most common organism for SSI after CS
S. Aureus (40.4%), E Coli (13.3%),
Streptococcus sp. (7.4%). Enterococcus sp.,
Pseudomonas sp.**

“In obstetrics and gynaecology”

- **Gram-positive aerobes**
- **staphylococcus aureus, Enterococcus sp., Group B β hemolytic streptococcus, Streptococcus pyogenes, Staphylococcus epidermidis, Methicillin-resistant Staphylococcus aureus (MRSA).**
- **Gram-negative aerobes**
- **Klebsiella sp., Escherichia coli, Pseudomonas aeruginosa, Proteus sp.**
- **Anaerobes**
- **Clostridium (Clostridioides) sp., Gardnerella vaginalis, Fusobacterium sp., Bacteroides fragilis, Peptostreptococcus sp., Prevotella sp.**

Prevention

-Antimicrobial prophylaxis

Table 4. Suggested recommended prophylactic antibiotics for obstetrics and gynaecology surgery⁴⁶⁻⁴⁹

Indication	Antibiotics+ dose	Comments
Caesarean section	Cefazolin 2 g or cefuroxime 1.5 g+ metronidazole 500 mg	If penicillin-allergic, then clindamycin 400 mg IV + gentamycin 5 mg/kg
Abdominal hysterectomy	IV cefazolin 2 g or cefuroxime 1.5 g+ metronidazole 500 mg or co-amoxiclav 1.2 g	If penicillin-allergic, then clindamycin 400 mg IV + gentamycin 5 mg/kg
Vaginal hysterectomy	IV cefazolin 2 g or cefuroxime 1.5 g+ metronidazole 500 mg or co-amoxiclav 1.2 g	If penicillin-allergic, then clindamycin 400 mg IV + gentamycin 5 mg/kg
Perineal procedures:	IV cefuroxime 1.5 g+ metronidazole 500 mg or co-amoxiclav 1.2 g, followed by oral co-amoxiclav 625 mg 8-hourly for 5 days	If penicillin-allergic, then gentamycin 5 mg/kg + metronidazole 500 mg, followed by oral clindamycin 300–460 mg 6-hourly for 5 days
MRSA-positive patients	IV teicoplanin 400 mg IV + gentamycin 5 mg/kg	

IV = intravenous; MRSA = methicillin-resistant *Staphylococcus aureus*

Prevention

Optimal timing for preoperative

- **within 120 minutes before incision, while considering the half life of the antibiotic. WHO 2018**
Give a repeat dose of antibiotic prophylaxis when the operation is longer than the half-life of the antibiotic given.

Timing of antibiotics	Infection Rate
2-24 h before surgery	3.8%
0-2 h before surgery	0.6%
0-3 h after surgery	1.4%
3-24 h after surgery	3.3%

Prevention

- **Antimicrobial prophylaxis**
- **For CS Reduces the incidences of SSI, endometritis and serious maternal infectious complications by 60-70%**
- **Administration of first-generation cephalosporins reduces risk of postoperative wound infection by 62% and endometritis by 58%**
- **Administer within 60 minutes of a CS**
- **For hysterectomy NICE recommends a single dose of IV prophylactic antibiotics at induction of anaesthesia for surgical procedures**
- **When the wound is infected, antibiotics must be more prolonged**

- **Prolonged surgery higher SSI: 28% for surgery lasting more than 2 hours**
Significant blood loss (>1500mls) higher SSI
Redosing recommended if surgery prolonged (>3 hours) and blood loss >1500mls
Morbidly obese women, higher or indeed double the standard dose of antibiotics
(standard dose of cefazolin is 2g, for those who weigh >120kg, this should be 3g)
Not recommended in clean, non-prosthetic, uncomplicated surgeries (diagnostic laparoscopy, ovarian cystectomy or laparoscopic sterilisation)
- **Prophylactic antibiotics is an adjunct to and not a substitute for good surgical technique.**

What can we do to prevent SSI??

- **Preoperatively / Medical team**
- **Keep fingernails short, do not wear artificial nails**
- **Scrub hands and forearms as high as the elbows for at least 2-5 minutes. Then keep them away from your body**
- **put on a sterile gown and gloves**
- **Masks should be worn in the operating room if sterile instruments are exposed and throughout the surgical procedure; masks should cover the mouth and nose**
- **The hair on the head and face is to be covered with a hood or cap**

What can we do to prevent SSI??

- **Preoperatively / theater preparation**
- **Maintain positive-pressure ventilation of the operating suite relative to corridors and surrounding areas**
- **Appropriate filters should be used**
- **Keep operating room doors closed except for necessary entry**
- **All surgical instruments should be sterilized according to guidelines**

What can we do to prevent SSI??

Preoperatively / Patient preparation

- Identify and treat all infections near the surgical site
- delay operation if elective cases until infection is treated
- Patients are to shower. Hair removed at the site of incision
- Risk Assessment The NNIS risk index
 - Preoperative patient physical status assessed by the ASA as greater than 3
 - Operation status as either contaminated or dirty-infected
 - Operation lasting longer than T hours, where T is the 75th percentile of the specific operation performed

At Risk Index	Predictive Percentage of SSI
0	1.5
1	2.9
2	6.8
3	13.0

*Hospital Infection Control Practices Advisory Committee (HICPAC) recommendations (partial) for the prevention of SSIs, April 1999 (non-drug based)

What can we
do to
prevent
SSI??

Preoperatively / Patient preparation

- **Modifiable: smoking cessation 30 days before surgery , alcohol reduction, maintaining normal weight**
- **Adequate glycemic control (less than 200 mg/dl - hemoglobin A1c levels <7% before operation)**
- **Avoid immunosuppression**
- **Optimize hemoglobin status**
- **Good nutrition**
- **Prevent preoperative hospitalization**


What can
we do to
prevent
SSI??

Intraoperatively

- **Intraoperatively, adherence to good basic surgical principles of minimal and fine tissue dissection**
- **proper selection of suture materials**
- **proper asepsis**
- **surgical site preparation**
- **swab the vagina with iodinated polyvidone or chlorhexidine before caesarean delivery.**
- **extraction of the placenta must be spontaneous.**

What can we
do to
prevent
SSI??

Postoperatively

- **Wound and episiotomy site infections require broad-spectrum antibiotics because of the polymicrobial nature of the local flora.**
 - **proper wound closure is important**
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Clinical presentation

- **Purulent or exudate from the wound or the episiotomy site.
redness, localized swelling or heat**
- **tenderness out of proportion to expected postpartum pain
Wound dehiscence with fever, pain or tenderness
Evidence of abscess or infection involving deep wound**

Management / History taking

- ask if the delivery was vaginal or cesarean
- if premature rupture of the membranes occurred
- if the patient had any prenatal care
- if the patient was diagnosed or treated for any infections during pregnancy / antepartum period.
- SI develops within 4-7days postoperatively

Management / Physical Examination

- **Assess the patient's surgical site wound.**
 - Identify the location**
 - Determine the cause of the wound infection**
 - Any fever $>38^{\circ}\text{C}$ on 2 occasions, at least 4 hours apart >24 hours after surgery should be evaluated for infection**
 - Evaluate and measure of the wound (depth, length, and width)**
 - **Evaluate wound tissue status (Granulation tissue, Fibrinous Eschar)**
 - check wound margins (tunneling, rolled edges, undermining fibrotic changes)**
 - **Observe pain**

Management/ Workup

- **Take microbiological swabs from wound and vagina for determining the infective organisms , blood cultures, complete blood count and CRP assay**
- **Imaging to exclude intra-abdominal collection of fluid or pus with transabdominal or transvaginal ultrasound scan (CT scan when USG is inconclusive)**
- **For the wound: Drainage, debridement, and irrigation may be required.**
- **Use broad-spectrum antibiotics**

Management

- **First line antibiotics regimen: co-amoxiclav (amoxicillin /clavulanic acid), or cephalosporin and metronidazole (cover S. Aureus and anaerobes)**
- **MRSA (which may be isolated from pus) is usually sensitive to vancomycin or teicoplanin, but not flucloxacillin.**
- **Clindamycin or vancomycin if there is severe allergy to penicillin**
- **Combinations of broad-spectrum antibiotics can be used when the organism is not known or when it is suspected that's several bacteria, acting in synergy, may be responsible for the infection. For example, during and following emergency surgery requiring the opening of perforated or ischaemic bowel, any of the gut organisms may be responsible for subsequent peritoneal or bacteraemic infection. In this case, a triple-therapy combination of broad-spectrum penicillin (such as ampicillin or mezlocillin) with an aminoglycoside (such as gentamicin) and metronidazole, may be used pre and postoperatively to support the patient's own body defense.**

Management

- If patient remain febrile after 24-48 hours of antibiotics, gentamicin can be added
- Superficial incisional SSI presents as cellulitis - flucloxacillin
- Deep-seated SI (pelvic cellulitis and abscesses) - may need surgical exploration and drainage with peritoneal saline wash with insertion of drain

Necrotizing fasciitis

- Necrotizing fasciitis is a rare but serious infection causing significant morbidity after cesarean delivery**
- characterized by rapid and progressive necrosis of subcutaneous tissue and fascia**
- suspected with severe pain, crepitus, wooden-hard induration of the subcutaneous tissues, bullous lesions, skin necrosis or ecchymosis, and elevated serum creatine kinase level**
- The hallmark of necrotizing fasciitis is rapid progression of clinical manifestations**
- Imaging studies such as CT or MRI may show edema extending along the fascial plane.**

Necrotizing fasciitis

- **Features suggestive include fascia that is swollen and dull gray in appearance with areas of necrosis, skin necrosis with easy dissection along the fascia, or presence of gas in the soft tissues.**
- **Type I necrotizing fasciitis results from a polymicrobial infection involving both aerobic and anaerobic bacteria; type II necrotizing fasciitis is generally caused by a single organism, group A streptococcus**
- **Type 2 most common in Obstetrics and gynecology**
- **Risk factors include patients with immunosuppression, diabetes, vascular insufficiency or chronic alcoholism, undergone transplant or on steroids**

Management of necrotizing fasciitis

- **It includes early and aggressive surgical exploration and debridement of necrotic tissue until healthy viable tissue is reached in addition to broad-spectrum antibiotic therapy**
- **Antibiotics include penicillin G and aminoglycoside with clindamycin to cover streptococci and staphylococci, gram negative bacilli and anaerobes**

- **Thank you**

