

## Special Article

# Challenges in Management of Surgical Site Infections — Lessons Learnt

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Surgical site infections develop due to contamination of the surgical site with microorganisms. Depending on the extent of wound and bacterial load at the time of surgery, the surgical wounds are classified into different types. Antibiotics, wound protectors, antibacterial sutures and silver containing antiseptic topical agents and wound dressing have effective roles in preventing these infections. The application of NPWT in surgical infections helps in reducing postoperative wound complications.

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**Key words :** Antibacterial sutures, NPWT, Contamination, Surgical site infection SSI, Wound protectors.

**S**urgical site infections (SSIs) develop as a result of contamination of the surgical site with microorganisms. The source is mostly patient's flora when integrity of the skin or wall of a hollow viscus is violated. Sometimes, the source may be exogenous when a break in the surgical sterile technique occurs that includes contamination from the surgical team, implants, equipment, gloves or surrounding environment. Gram positive cocci account for the half of the infections and *Staphylococcus aureus* is the most common organism. Hospital acquired MRSA is associated with nosocomial infections and affects immunocompromised patients. Gram negative bacilli account for the one-third of the SSIs and *E. coli*, *Pseudomonas aeruginosa* and *Enterobacter* spp are the most common organisms causing these infections. The risk of infection is related to the specific surgical procedure performed (Table 1).

### What are the types of surgical site wounds?<sup>3</sup>

The risk of SSIs is directly proportional to the extent of wound contamination. Depending on the extent of wound and bacterial load at the time of surgery, CDC classified the surgical wounds as clean, clean-

contaminated, contaminated and dirty or infected wounds. These different types of wounds affect outcome of the surgery and post-surgery morbidity (Table 2).

### Is there any role of prophylactic antibiotic in surgery? What should be the timing and choice of antibiotic?

Antibiotic levels should be maximum at the time of the induction of surgery. Prophylactic antibiotics are more commonly used in patients with immunocompromised conditions and rheumatic heart disease. The timing of administration should be 0-60 minutes prior to induction or at the time of incision of the surgery. Choice of antibiotics entirely depends on the spectrum of the organisms which are likely to be encountered and also on the type of surgery.

### Role of surgical intervention in SSI :

Wound protectors and antibacterial sutures seem to have effective roles to prevent SSI in intra-abdominal infections<sup>4</sup>. The application of NPWT in preventing SSI can be useful in reducing postoperative wound complications. It is important to pursue normothermia with the available resources in the intraoperative period to decrease SSI rate.

Iodine impregnated adhesive drapes probably make no difference to SSI risk compared with non-adhesive drapes<sup>5</sup>. There is probably no difference in SSI risk when antibiotics are given in the short term compared to the long term during colorectal surgery. One comparison showed that adhesive drapes increase the SSI risk compared with no drapes.

### What are the new advancements in wound care products? Any use in post surgically high-risk patients?

For early treatment management of burn wounds, there are 3000 products and 30 different methods available in the market. The most commonly used are

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**Table 1 — SSI categorization as per CDC<sup>1,2</sup>**

SSI classification	Features
Superficial incisional SSI	<ul style="list-style-type: none"> <li>• Infection occurs in &lt;30 days after surgery</li> <li>• Usually involves skin and subcutaneous tissue</li> <li>• Symptoms include pain, local edema, erythema or purulent discharge</li> </ul>
Deep incisional SSI	<ul style="list-style-type: none"> <li>• Infection occurs in &lt;30 days after surgery.</li> <li>• Soft tissue is involved</li> <li>• If surgery with implant, then deep incisional SSI occurs in &lt;1 year after surgery involving deep soft tissues.</li> <li>• Symptoms include fever, pain, tenderness, leading to wound dehiscence or purulent discharge.</li> </ul>
Organ space SSI	<ul style="list-style-type: none"> <li>• Infection occurs in &lt;30 days after surgery in patients without implant and in &lt;1 year after surgery in patients with implant.</li> <li>• It involves any part of the operation opened or manipulated.</li> <li>• It may need rehospitalisation or IV antibiotic therapy.</li> </ul>
Superficial or partly deep incisional SSIs	<ul style="list-style-type: none"> <li>• Easy to manage on oral antibiotics</li> <li>• May not require hospitalization or intervention.</li> </ul>

**Table 2 — Types of surgical site wounds**

Wound type	Characteristics
Clean wounds	<ul style="list-style-type: none"> <li>• Uninfected operative, primarily closed wound without inflammation</li> <li>• Respiratory, alimentary, genital or uninfected urinary tracts are not entered.</li> <li>• The infection rate is around 1-3%.</li> </ul>
Clean-contaminated wounds	<ul style="list-style-type: none"> <li>• Operative wounds in which the respiratory, alimentary, genital or urinary tracts are entered.</li> <li>• Involves operations of the biliary tract, appendix, vagina and oropharynx.</li> <li>• Infection rate is around 5-8%.</li> </ul>
Contaminated wounds	<ul style="list-style-type: none"> <li>• Open, fresh, accidental wounds.</li> <li>• Operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract</li> <li>• Infection rate is around 20-25%.</li> </ul>
Dirty or infected wounds	<ul style="list-style-type: none"> <li>• Old traumatic wounds with retained devitalized tissue, existing clinical infection or perforated viscera with pus in operative wound.</li> <li>• Open supportive wound and severe inflammation.</li> <li>• Infection rate is around 30-40%.</li> </ul>

Silver Sulphadiazine such as Silver nitrate, Povidone Iodine and Nano Crystal Silver. Melonin sheet is a newer low adherent, absorbent dressing used for management of burns. Outer hydrophobic non-woven material is designed to resist fluid strike through, reduce bacterial access, provide structural integrity and resist external fluid.

Nanocrystalline silver releases sufficient and sustained levels of silver that are proven to be antimicrobial at 70-100 ppm. It remains effective for three days, increasing comfort and convenience for patient, especially for pediatric patients. The topical application of ionic silver kills pathogens and helps protect the wound from becoming contaminated or infected. Since the ionic silver destroys bacteria, viruses and mold, the wound does not get infected thus reducing the need for phagocytosis, which reduces the immune cascade. There are different forms

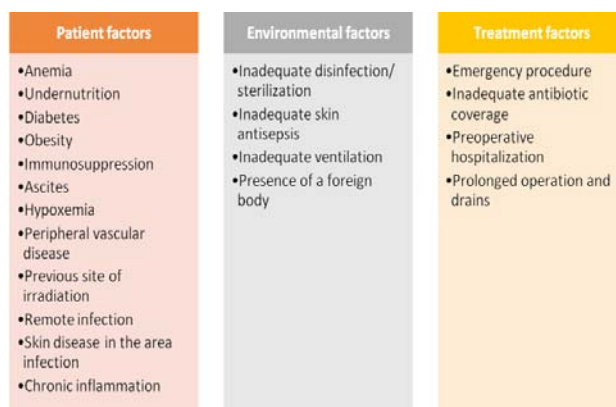


Fig 1 — Risk factors for surgical site wound infection

of Nanocrystal silver dressing materials available in the market. These include paper-based, net-based, foam-based and pet type. Among these, Silver Sulphate

absorbent foam dressing is the best form used for management of a wide range of acute and chronic wounds.

Presenter emphasized on the use of other newer techniques such as meek micro grafting and flexi seal-perineal burn care. Till today, flexi seal-perineal burn care is not used in India and he pinpointed the need of adopting this technology in India.

#### Role of NPWT for SSI?

In NPWT, the combined effect of macrostrain and microstrain promotes wound healing.

NPWT contraindications include:

- Foam dressings of the VAC therapy system directly in contact with exposed blood vessels, anastomotic sites, organs, or nerves.
- Malignancy in the wound
- Non-enteric and unexplored fistulas
- Necrotic tissue with eschar present
- Sensitivity to silver
- Untreated osteomyelitis

#### Case studies of surgical site infection:

##### Which is the best postoperative dressing?

It depends on the surgeon's preference. According to the presenters, the silicon-based impregnated Nanocrystalline Silver dressings are the best one.

##### Summary :

The risk of SSIs is directly proportional to the extent of wound contamination. Different types of wounds affect outcome of the surgery and postsurgery morbidity. Wound protectors and antibacterial sutures can prevent SSIs in intra-abdominal infections. Silver nitrate, Povidone Iodine, and Nano crystal silver are commonly used for early treatment of burn wounds. Silver Sulphate absorbent foam dressing is the best dressing for management of a wide range of acute and chronic wounds.

SSI after left modified radical mastectomy



Surgical site infection after incisional hernia repair with mesh



Sinus after right inguinal hernioplasty



Sinus over abdomen after emergency laparotomy



**Chronic sinus wound post cardiac surgery: NPWT was applied after debridement and complete healing of the wound occurred in two sittings of 5-day therapy.**



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