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Surgical Wound Management:

A Guide to Post-Operative Wound Care

OCTOBER 2018

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Advanced Wound Care

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A Guide to Post-Operative Wound Care

Introduction and Background

Millions of patients undergo surgical procedures every year. Advances in surgical techniques afford patients increased access to minimally invasive techniques, allowing avoidance of the need for traditional "open" surgical incisions. However, many procedures performed may still require a larger incision or may involve an existing open wound of varying chronicity. Failure to heal, including wound dehiscence and surgical site infections (SSIs), is the most common major complication related to surgical wound management, and monitoring for conditions related to this failure is crucial during the immediate (three- to four-week) post-operative period.[1]

The impact of SSI is widespread, affecting the patient, caregivers, the treatment team, and the health care system as a whole. SSIs are challenging because of their multifactorial development. For patients who go on to develop SSI after a surgical procedure, length of stay can be increased by up to two weeks, and overall treatment costs average nearly $35,000 per incident. The most common wound-related consequence of SSI is dehiscence, for which wound management modalities such as debridement and advanced dressings may be used to expedite healing.

Classification of Surgical Wounds

Surgical wounds are classified by the degree of contaminants present. Classification allows for appropriate risk stratification and assists with guiding appropriate treatment:[1]

CLASS I/CLEAN:

Uninfected, uninflamed, generally closed primarily; no entry into respiratory, gastrointestinal, or genitourinary tracts (e.g., mastectomy or splenectomy).

CLASS II/CLEAN-CONTAMINATED:

Controlled entry into respiratory, gastrointestinal, or genitourinary tracts (e.g., cholecystectomy, bronchoscopy).

CLASS III/CONTAMINATED:

Open, fresh, accidental wounds; operations with a major breach in sterile technique, gross spillage from the gastrointestinal tract, and acute noninfectious inflammation (e.g., bile spillage in cholecystectomy, rectal procedures).

CLASS IV/DIRTY-INFECTED:

Old trauma or wounds with devitalized tissue, existing infection, or perforation, where organisms were present before operation (e.g., incision and drainage, chronic wound debridement).

"Surgical wounds are classified by the degree of contaminants present."

Surgical Wound Healing

Surgical wounds heal via one of three mechanisms: primary, secondary, or tertiary intention.

1 Primary Intention

Healing involves layered closure, ameliorating any dead space that could contribute to hematoma/seroma formation, followed by approximation of wound edges and closure using synthetic adhesives, sutures, or staples. Examples of healing by primary intention include closure of an uncontaminated laceration or biopsy, plastic/reconstructive procedures, or closure of other class I/clean surgical wounds. The goal of this type of closure, often referred to as primary closure, is complete functional healing. Closure inside the “golden period” of eight hours after initial incision is recommended because outside this timeframe the wound can be exposed to substantial bioburden and other contaminants and may have edema precluding complete approximation of wound edges.[2]

“Closure inside the ‘golden period’ of eight hours after initial incision is recommended...”

2 Secondary Intention

Wounds with edges that are not linear, do not approximate, or are not able to be evaluated during the “golden period” may be left to heal by secondary intention. This healing method is often utilized for wounds that are otherwise at risk for dehiscence secondary to overall poor patient condition (i.e., sepsis) or substantial wound contamination (i.e., gross fecal contamination after bowel perforation) or wounds subject to excessive tension, such as areas over articulating joints.[3]

3 Tertiary Intention

Tertiary intention involves staged closure of a wound; the wound may have been surgically created or of other etiology without previous treatment. Tertiary intention is also referred to as delayed primary closure because some surgical incisions may be left open because of excessive contamination or infection, requiring debridement of non-viable tissue followed by a period of close monitoring to ensure appropriate perfusion and tissue viability before final closure.[3] Traumatic injuries involving vascular damage and subsequent alteration in tissue perfusion such as crush injuries are often treated in this manner, as are tissue or muscle flaps used to provide coverage for soft tissue defects.

Risk Factors for Surgical Site Infections

Few formal studies regarding risk factors in SSI have been conducted, so data is limited. This situation is further confounded by the fact that most SSIs occur after discharge, and patients present at varying stages of SSI development. The American College of Surgeons (ACS) performed a review of nearly 50,000 surgical procedures and revealed that major contributors to SSI development included the following: dependent functional status; obesity; emergency nature, complexity, or longer duration of surgical procedure; respiratory conditions limiting perfusion; diabetes; smoking; coronary artery and peripheral vascular disease; coagulopathy; female sex, and pre-operative sepsis.[4] Another review performed by the Veterans Affairs Surgical Quality Improvement Program including approximately 350,000 surgical procedures revealed a 1.8% SSI development rate within 30 days; most prominent noted risk factors included more advanced wound classification, chemotherapy, smoking, radiation therapy, long-term corticosteroid use, and unintentional weight loss.[5]

A multitude of factors can affect wound healing in the post-operative period. Identifying impediments to healing can lead to their minimization or even elimination. The following is not an exhaustive list, but rather a review of conditions that can negatively affect wound healing in the surgical patient population.

Insufficient tissue perfusion:	Vascular disease and respiratory disorders can cause lack of oxygenated blood flow to the area of the wound.
Non-viable tissue:	Non-viable tissue will cause excessive inflammation in the wound with subsequent host response, including delayed healing.
Bioburden or infection:	The presence of pathogens can cause abscess formation, wound dehiscence, breakdown leading to evisceration of abdominal incisions, and ultimately sepsis.
Mechanical stress during healing:	Shearing forces caused by excessive patient movement, including coughing, sneezing, vomiting, or exceeding prescribed lifting or activity restrictions, can contribute to tissue breakdown, or they can perpetuate edema, prolong the inflammatory period, and delay further tissue proliferation required for complete healing.
Immunodeficiencies, including cancer and chemotherapeutic agents:	Patients taking chemotherapeutic agents or therapeutic immunosuppressive medications and patients with disease states that predispose them to an immunosuppressed state are at increased SSI risk
Diabetes mellitus:	High hemoglobin A1c values are not independent predictors of SSI risk, and there is no current evidence to demonstrate that improvement of hemoglobin A1c levels decreases SSI risk. There is, however, evidence that short-term control of glucose, particularly intraoperatively, is more significant in decreasing risk.

"...most SSIs occur after discharge, and patients present at varying stages of SSI development."

Obesity:	Morbid obesity (body mass index greater than 40) presents a 1.3 times higher risk of SSI compared with normal weight (body mass index 18.5-25), with procedures involving the abdominal wall having the highest risk. Abdominal wall thickness is an independent risk factor for SSI.
Malnutrition:	Pre-operative serum albumin levels below 3.5mg/dL put patients at higher SSI risk because of problems with collagen deposition and development of granulation tissue. Patients with planned surgical interventions should be screened on admission by a dietitian using a validated tool with application to the appropriate patient population.
Dependent functional status:	Relying on a caregiver for repositioning, nutrition, personal cleansing, etc., may contribute potential alterations in skin integrity and affect overall health.
Extrinsic factors such as tobacco use or environmental exposures:	Alcohol abuse is an independent risk factor for SSI. Smokers have the highest risk of SSI. Patients who are current tobacco users should plan smoking cessation at least one month before surgery, according to the Centers for Disease Control and Prevention (CDC).[1]

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Classification of Surgical Site Infections

Comprehensive assessment and subsequent classification of SSIs will allow for appropriate evidence-based treatment. They will also assist with understanding strategies for prevention.

Superficial incisional SSI: Skin or subcutaneous tissue is involved, and it occurs within 30 days post-operatively.

Deep incisional SSI: Involves deep soft tissues such as fascia or muscle within the incision, occurs within 30 days post-operatively without an implant, occurs within one year if an implant is in place, and infection appears to be directly related to the surgical procedure.

Organ or space SSI: Involves any part of the anatomy other than the incision, occurs within 30 days post-operatively without an implant, occurs within one year if an implant is in place, and infection appears to be directly related to the surgical procedure.

If both superficial and deep layers are involved, or if an organ or space SSI drains through an incision, the classification will be deep incisional SSI.

Prevention of Surgical Site Infections

This information published by the CDC in 2016 is not a comprehensive list of preventive measures, but it is generalizable to the majority of surgical patients.[1]

Shower or bathe patients pre-operatively with soap (antimicrobial, non-antimicrobial, or antiseptic agent) at least the night before surgery.

Administer antimicrobial prophylaxis only when indicated based on published clinical practice guidelines and timed such that the agent's bactericidal concentration is established in the serum and tissues on incision.

Antimicrobial prophylaxis should be administered before skin incision in cesarean section procedures.

Operating room skin preparation should be performed using an alcohol-based agent unless contraindicated.

For clean and clean-contaminated procedures, additional prophylactic antimicrobial agent doses should not be administered after the surgical incision is closed in the operating room, even in the presence of a drain.

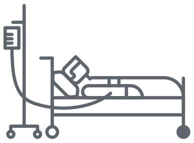
Topical antimicrobial agents should not be applied to the surgical incision.

Glycemic control should be implemented using blood glucose target levels less than 200mg/dL during surgical procedures.

Maintain normothermia in all patients undergoing surgical procedures.

Increased fraction of inspired oxygen should be administered during surgery and after extubation in the immediate post-operative period for patients with normal pulmonary function who are undergoing general anesthesia with endotracheal intubation.

Blood transfusion products should not be withheld from surgical patients as a means of preventing SSIs.



"...most organizations agree interventions should be aimed at prevention..."

Multiple organizations have published documents containing recommendations or guidelines for prevention of SSI that are broadly similar, but without complete consensus among them. Although most organizations agree interventions should be aimed at prevention, there is a lack of research and therefore evidence regarding surgical wound management in the post-hospital setting. Additionally, no formal wound care protocol exists that has consistently proven to decrease SSI risk.

Assessment of Surgical Wounds

Surgical wound assessment should be performed utilizing a validated, comprehensive, reproducible tool allowing for identification of any changes in assessment parameters. The tools or scales utilized will vary by facility and geographic location and may be influenced by regulatory agencies that oversee the facility. Prompt identification of changes will assist with timely intervention, as well as guide the treatment trajectory and ongoing dynamic care tailored to the changing environment of the surgical wound as it progresses through the healing phases. Assessment should begin in the immediate post-operative period. Subjective patient assessment is integral during this phase because the wound is typically covered by a dressing after surgery. Duration of dressing wear varies widely, with some dressings remaining intact up to a full week, such as with incisional negative pressure therapy.

Management of Surgical Wounds: Treatment Modalities

Surgical wound management for open, chronic, subacute wounds may follow the modern principles of wound care, including cleansing, debridement, periwound skin care, moisture or exudate management, and so forth. A study of surgical wounds healing by secondary intention in *The Journal of Tissue Viability* identified advanced dressings as the most common single treatment for surgical wound complications or SSIs.[6] Advanced dressing technology has broadened the spectrum of available options for managing surgical wounds. Negative pressure wound therapy is one such technology that can provide incision management with closed incisional negative pressure therapy, closure by secondary intention such as abdominal wound dehiscence, or tertiary closure in vascular flap procedures.[7] Cellular and/or tissue-based products can also offer some indications for use in the management of surgical wound complications; the availability and clinician access to these products may vary greatly and be limited more by reimbursement potential than with other modalities.

"Surgical wound management for open, chronic, subacute wounds may follow the modern principles of wound care..."

Conclusion

The financial and psychological burdens of surgical wound complications are increasing, along with the number of medically challenging patients undergoing complex operations. Aggregate data from the Institute for Healthcare Improvement suggest that although class I/clean cases carry a two to three percent SSI rate, approximately 40% to 60% of those infections are preventable.[8] This means approximately half of these SSIs can be prevented with appropriate implementation of guidelines inclusive of patient-centered, evidence-based care. Clinician adoption of such guidelines at a given facility is paramount to successful implementation of interventions and subsequent improvement in surgical wound complication rate and prevention of SSI. Individual facility and health care system needs may vary greatly depending on patient population, staffing models, and administrative structure. Adapting preventive measures and treatment guidelines can be crucial to fostering best outcomes. Recent comprehensive national initiatives, evidence-based guidelines, and quality reporting measures provide risk reduction strategies and further awareness for reducing incidence of surgical wound complications, namely SSI. Although health care infection control practices have improved substantially, surgical wound complications such as SSI continue to be major contributors to morbidity, protracted length of stay, readmissions, and mortality.[1] For this reason, it is essential to recognize risk factors for SSI and post-operative surgical wound complications and to understand how to manage such complications.

"The financial and psychological burdens of surgical wound complications are increasing..."

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- Anti-microbial Protection[2-4†] ✓
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- Slim Profile Design ✓

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*Indicated for wounds healing by primary intent. Refer to product Instructions for Use for more information.

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