



Diagnosis and Management of Surgical Site Infections: Narrative Review

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Infection of the wound after surgery is a regular occurrence. Wound infection is a complicated process that involves a molecular interplay between numerous biological processes. Wound infections are associated with a high rate of morbidity and mortality. Surgical site infections are a common surgical complication that affects approximately 3%-6% of all surgical procedures according to different studies. Surgical site infections (SSIs) cause negative consequences in patients, such as prolonged hospitalization and mortality. Each incision causes wound contamination, however there are established techniques to reduce the incidence of SSI. Improved adherence to evidence-based preventative strategies such as adequate antibiotic prophylaxis, in

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particular, can help to reduce the rate of SSI. The sort of procedure used determines the correct diagnosis of SSI. Early detection, on the other hand, is critical for good management of all surgical operations. Consistent antibiotic therapy, wound drainage, and, if necessary, vigorous wound debridement are all part of the treatment for SSI. Following that, wound management is determined by the location and nature of the infection.

This study aims to: Diagnosis and Management of Surgical Site Infections. In this review we will be looking at surgical site infections epidemiology, etiology, diagnosis and management.

Keywords: Surgical site infections; diagnosis; management; review.

1. INTRODUCTION

Infection of the wound after surgery is a regular occurrence. Wound infection is a complicated process that involves a molecular interplay between numerous biological processes. Wound infections are associated with a high rate of morbidity and mortality. This activity covers the aetiology, epidemiology, pathophysiology, and common manifestations of postoperative wound infections, as well as the evaluation and therapy of these patients. It also emphasises the importance of the interprofessional team in evaluating and managing these patients [1].

Surgical site infections (SSIs) cause negative consequences in patients, such as prolonged hospitalisation and mortality. Each incision causes wound contamination, however there are established techniques to reduce the incidence of SSI. Improved adherence to evidence-based preventative strategies such as adequate antibiotic prophylaxis, in particular, can help to reduce the rate of SSI. To treat SSI effectively, aggressive surgical debridement and effective antimicrobial therapy are required [2].

The sort of procedure used determines the correct diagnosis of SSI. Early detection, on the other hand, is critical for good management of all surgical operations. Consistent antibiotic therapy, wound drainage, and, if necessary, vigorous wound debridement are all part of the treatment for SSI. Following that, wound management is determined by the location and nature of the infection. If culture results are available, they can be used to guide modifications in antibiotic therapy. In the absence of adequate alternatives, avibactam and dalbavancin are novel anti-infective that should be utilized based on susceptibility testing. In patients who have a prosthesis in situ, follow-up is especially crucial [3].

Surgical site infections are a common surgical complication that affects approximately 3% of all

surgical procedures and up to 20% of patients receiving emergency intra-abdominal surgeries. Tissue degradation, failure or prolongation of appropriate wound healing, incisional hernias, and bacteremia are all possible consequences. Recurrent discomfort, as well as disfiguring and crippling scars, may be the result. Surgical site infections are associated with significant morbidity, longer hospital stays, and higher direct patient expenses. All of these issues have a significant influence on patients and hospitals, as well as a significant financial burden on different health system around the world and the US health-care system is one example. Surgeons and hospitals must prioritize reducing SSIs in order to provide the safest environment for patients having surgery [4].

2. CLASSIFICATION

The Centers for Disease Control and Prevention (CDC) classifies surgical wound infections as follows:

- Infection of the skin and subcutaneous tissues caused by a superficial incision. At least one of the following requirements must be met: purulent wound drainage, isolated organism, at least one symptom of infection, and surgeon diagnosis. More than half of all surgical infections are caused by these illnesses.
- Deeper tissues, such as muscles and fascial planes, are affected by deep incisional infections. Purulent discharge from the wound, dehiscence, or the surgeon's deliberate re-opening of a deep incision after suspecting an infection, signs of abscess growth, or other deep infection diagnoses by the surgeon must all be met.
- Organ/space infection can affect any organ other than the incision site, but it must be linked to the surgery. Purulent discharge from the drain implanted in the organ, isolated organism from the organ, abscess, or any infection involving the organ must all be present [1].

Within these categories, the following issues can be evaluated: microbe-related risk factors, with *Staphylococcus aureus* and *Streptococcus pyogenes* being particularly virulent; host-related risk factors, with morbid obesity, an index of disease severity, old age, protein-calorie malnutrition, and, most likely, diabetes, cancer, and systemic infection; and operation-related risk factors, including prolactin and prolactin-like proteins; and operation-related. Other major indicators included the performance of an intra-abdominal surgery, an operation lasting more than 2 hours, a contaminated or dirty-infected operation, and a concomitant illness of significance [5].

A surgical wound infection occurs when the surgeon exposes the incision to clean it. If a stitch abscess is present, the wound is not considered infectious. The majority of surgical site wound infections are caused by endogenous flora found on mucous membranes, skin, and hollow viscera. In general, there is a considerable chance of an infected wound when the microbiological flora concentration is greater than 10,000 germs per gramme of tissue [1].

3. ETIOLOGY

The diverse nature of postoperative wound infections complicates the pathogenesis of these diseases. Geographical region, surgical subspecialty, and the large range of treatments performed all influence the costs.

Patient factors and procedural factors are two types of risk factors.

Advanced age, malnutrition, hypovolemia, obesity, steroid usage, diabetes, immunosuppressive drugs, smoking, and coexisting infection at a remote site are all risk factors for wound infection.

Formation of a hematoma, the use of foreign material such as drains, leaving dead space, prior infection, length of surgical scrub, preoperative shaving, poor skin preparation, long surgery, poor surgical technique, hypothermia, contamination from the operating room, and a prolonged perioperative stay in hospital are all procedure-related risk factors [1].

The type of surgery is also a significant risk factor. Surgical operations and, as a result, wounds are divided into four categories: clean, clean-contaminated, contaminated, and dirty-

infected, with highly varying rates of postoperative wound infection. According to the CADTH report 2011, classification is defined as follows:

- **Clean:** A procedure in which sterility is preserved and no inflammation occurs during the incision, approach, or main part of the operation. There is no access to the gastrointestinal, urogenital, or pulmonary tracts.
- **Clean-contaminated:** A process in which the gastrointestinal, urogenital, and pulmonary tracts are entered in a controlled manner but no contamination occurs.
- **Contaminated:** An operation performed without asepsis or an incision made across highly inflammatory tissue (non-purulent). Also, if there is a large leak from the gastrointestinal, urogenital, or pulmonary tracts, or if the incision is older than 24 hours.
- **Dirty/infected (purulent):** is A operation on perforated hollow viscera, or an incision into highly inflamed tissue, Also, severe wounds with necrotic tissue present or received through a filthy technique (older than 24 hours) (contact with faecal material). [1].

4. EPIDEMIOLOGY

Surgical site infection (SSI) is a common post-operative complication that affects at least 3-5 percent of surgical patients and up to 33% of abdominal surgery patients. Approximately 69 percent of the estimated 500,000 SSIs in the United States occur after hospital release, putting the responsibility of problem recognition on patients who are often unprepared to treat SSI. SSI is the most expensive healthcare-associated illness since more than half of all post-discharge infections result in readmission. The Center for Medicare and Medicaid Services considers operations like elective colorectal surgery, knee replacements, and hysterectomies to be avoidable conditions, hence readmissions are frequently non-reimbursable as SSI. Furthermore, current research suggests that poor post-discharge communication, care fragmentation, and infrequent, late follow-up contribute to these inferior outcomes [6-22].

SSIs are a serious and common complication of hospitalisation, occurring in 2% to 5% of patients in the United States after surgery. In the United States, up to 15 million operations are performed each year, resulting in 300,000 to 500,000 SSIs

each year. The second most common form of infection related with health care is SSI (HAI). The most prevalent cause of SSI is *Staphylococcus aureus*, which accounts for 20% of SSIs in hospitals that report to the Centers for Disease Control and Prevention (CDC) and up to 37% of SSIs in community hospitals. In fact, methicillin-resistant *S aureus* (MRSA) is the most prevalent SSI pathogen in community hospitals, as well as a common pathogen in tertiary care and academic facilities [23].

5. DIAGNOSIS

Clinical examination is required for diagnosis. Microbiological swabs, on the other hand, are required to identify the pathogenic species and sensitivities. Ultrasound or CT/MRI imaging may be useful if a deep-seated infection is suspected. Various techniques can predict the possibility of getting an infection based on risk variables for preoperative risk assessment for SSI. Traditional systems that are widely recognised include the national nosocomial infection surveillance system, the Australian Clinical Risk Index, and the European System for Cardiac Operative Risk Evaluation. However, because numerous risk factors are left out of their computations, their utility is restricted. Some people have poor discriminatory abilities or don't risk-stratify for certain procedures. More speciality and even operation-specific scoring systems are emerging as a result of the requirement for tailored therapy, such as the Infection Risk Index in cardiac surgery or the Surgical Site Infection Risk Score [1].

Including wound photographs in the diagnosis of SSI after abdominal surgery improved diagnostic accuracy and confidence. In addition, additional antibiotics are suggested for SSI patients. The most relevant symptom in identifying SSI was skin colour surrounding the wound, as reported by patients over the phone and viewed by physicians in pictures [6].

6. MANAGEMENT

Most SSIs respond to suture removal and, if pus is present, drainage; however, debridement and open wound care may be required in some cases. Many postoperative wound problems are caused by exudation of tissue fluid or an early failure to heal, which is more likely in patients with a high BMI (BMI). Incomplete wound edge sealing can typically be treated with a delayed primary or secondary suture or adhesive tape

closure, but healing in larger open wounds requires healthy granulation tissue with a low bioburden of colonising or contaminating organisms. More than 15% of postoperative wounds are likely to be treated with antibiotics, sometimes incorrectly, contributing to the problem of antibiotic resistance. The proper treatment of established SSIs necessitates close monitoring and communication between the multidisciplinary postoperative team (surgeons, intensivists, microbiologists, nurses), as well as the primary care team. If patients are to be discharged sooner, any SSI must be identified and treated appropriately. Returning to secondary care usually necessitates the release of pus, debridement, and, if necessary, parenteral antibiotics. To minimise the bacterial burden in the open wound, extensive wound breakdown may necessitate professional wound treatment. To stimulate secondary intention healing or facilitate secondary suture, wound bed preparation may be required [24].

Following spine surgery, a Surgical Site Infection (SSI) can be catastrophic for both the patient and the physician. Readmissions, reoperations, and subsequent poor clinical results result in high morbidity and associated health-care costs. Pseudarthrosis, neurological degeneration, sepsis, and mortality are all complications associated with SSI after spine surgery. Its management can be quite difficult. The diagnosis of SSI is based on a combination of clinical, laboratory, and sometimes radiologic findings. The majority of illnesses may be treated with medicines and, if necessary, bracing. Infections resistant to medical treatment, the necessity for open biopsy/culture, increasing spinal instability or deformity, and neurologic deficiency or degeneration are all reasons for surgery. A full understanding of the underlying risk factors is essential, and patients should be risk stratified prior to surgery. A multimodal approach to risk assessment, early diagnosis, and effective therapy is critical for successful prevention and treatment, as well as a positive outcome [25].

7. DEVELOPMENT

In a study A convenience sample of clinicians with competence in surgical infections was asked in a web-based simulation survey. Participants saw a variety of scenarios, including surgery history, physical exam, and wound description. A total of 83 people completed a median of 5 situations. The majority of the participants (70) were academic surgical specialists. The addition

of photographs raised overall diagnostic accuracy from 67 percent to 76 percent and specificity from 77 percent to 92 percent, but did not increase sensitivity considerably (55 percent to 65 percent). The average level of confidence in a diagnosis improved from 5.9 to 7.4. With the addition of photos, overtreatment recommendations reduced from 48 percent to 16 percent, but under treatment recommendations did not change (28 percent to 23 percent) [6].

In one of the systemic reviews that looked at methods of diagnosis of SSI it has found that In the 73 studies, the following approaches were used to detect post-discharge SSI, direct wound observation by a health expert in 31 study, Patient telephone interviews in 17 study, Questionnaire for patients in 13 study and also staff questionnaires in 8 studies, rest of studies approaches Examining operating logs for surgical revisions; cards for patients to use to notify health care professionals of a surgical site infection; examining hospital readmission data; reviewing pharmacy data; and employing blended approaches were among the other ways explored [26].

The utility of digital photography in assessing inpatient wound infection in laparotomy and vascular surgery wounds has been studied in the past. The results of one study we discussed [6] were consistent with these studies, with sensitivities for diagnosing SSI being lower (42-71%), and specificity being higher (65-97 percent). The accuracy of remotely assessing symptoms was lower in these trials, but it was often higher when making remote management decisions. In other words, while remote assessors may not be able to determine whether a wound is red, they can often determine what, if any, intervention is required. The scientists discovered that remote agreement was comparable to in-person agreement in both vascular wound trials, implying that SSI diagnosis can be done reliably remotely [6].

Another study found that 26.1 percent of patients who had severe intra-operative blood loss had wound infection [27,28]. There is a significant link between SSI and intra-operative blood loss of more than 500 ml. This is significant because blood loss is linked to poor tissue oxygenation, which contributes to the development of SSI. Also, as previously observed [29,30], intra-operative hypotension is closely linked to SSI, and this is due to the inadequate wound

perfusion caused by intra-operative hypotension [27].

8. CONCLUSION

Different studies, infections of the surgical site are a common complication. Surgical site infections are associated with significant morbidity, longer hospital stays, and higher direct patient expenses. All of these issues have a significant influence on patients and hospitals, as well as a significant financial burden on different health system around the world. And thus preventive methods is the most effective method to avoid such complications. Management can be also challenging if affected by high resistant micro-organism such as MRSA. Proper diagnosis is important and its accuracy can be made with right testing such as using imaging or swaps.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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