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INVESTIGATION OF SURGICAL SITE INFECTIONS: CORRELATION WITH PERIOPERATIVE PROTOCOLS—A COMPREHENSIVE REVIEW

Usha*[1], Dr. Rajender Kumar[2], Dr. Praveen Kumar[3], Saba Saleha[3]

[1]M.Sc. Medical Laboratory Technology (Clinical Microbiology), Department of Allied & Healthcare Sciences, Guru Kashi University.

[2]Dean, Faculty of Allied and Healthcare, Guru Kashi University.

[3]Assistant Professor, Faculty of Allied & Healthcare Sciences, Guru Kashi University.

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***Corresponding Author: Usha**

M.Sc. Medical Laboratory Technology (Clinical Microbiology), Department of Allied & Healthcare Sciences, Guru Kashi University.

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ABSTRACT

Surgical Site Infections (SSIs) remain among the most common healthcare-associated infections (HAIs), contributing substantially to postoperative morbidity, mortality, prolonged hospitalization, increased healthcare expenditure, and the growing challenge of antimicrobial resistance. Despite remarkable advancements in aseptic surgical techniques, sterilization methods, perioperative antimicrobial prophylaxis, and infection prevention strategies, SSIs continue to impose a significant burden on healthcare systems worldwide, particularly in low- and middle-income countries such as India. Numerous studies have demonstrated that strict adherence to evidence-based perioperative protocols significantly decreases the incidence of SSIs. However, inconsistent implementation of these protocols, inadequate infection surveillance, shortage of trained healthcare personnel, poor antimicrobial stewardship, and limited healthcare infrastructure continue to compromise patient safety.

This review summarizes current evidence regarding the epidemiology, classification, microbiology, risk factors, and clinical consequences of surgical site infections while critically examining the effectiveness of perioperative protocols in SSI prevention. Particular emphasis is placed on the role of preoperative patient optimization, intraoperative aseptic practices, postoperative wound management, and multidisciplinary infection control strategies. Furthermore, the review discusses current implementation challenges in developing countries

and highlights emerging approaches including antimicrobial stewardship, digital surveillance systems, standardized infection bundles, and quality improvement initiatives. Strengthening compliance with perioperative protocols through continuous education, regular auditing, and evidence-based policy implementation is essential for reducing SSI incidence and improving surgical outcomes.

KEYWORDS: Surgical Site Infection, Healthcare-Associated Infection, Perioperative Protocols, Infection Prevention, Antimicrobial Prophylaxis, Patient Safety, Surgical Care, Healthcare Quality.

1. INTRODUCTION

Surgical Site Infections (SSIs) are infections occurring at or near the surgical incision within 30 days of surgery or within one year if an implant is placed. They account for approximately 20% of healthcare-associated infections worldwide and remain a major cause of postoperative complications. SSIs delay wound healing, prolong hospital stay, increase healthcare costs, and contribute to antimicrobial resistance. Although international organizations such as the WHO and CDC have developed evidence-based perioperative guidelines, inconsistent implementation continues to limit their effectiveness, particularly in low- and middle-income countries. Therefore, strict adherence to perioperative protocols is essential for improving patient safety and surgical outcomes.

2. Burden of Surgical Site Infections

SSIs continue to impose a substantial burden on healthcare systems worldwide. The WHO estimates that patients in developing countries experience significantly higher SSI rates than those in developed nations. In India, reported SSI rates vary between 5% and 25%, depending on the type of surgery, hospital infrastructure, and infection surveillance practices. Beyond increasing morbidity and mortality, SSIs result in prolonged hospitalization, additional surgical procedures, increased antibiotic use, and considerable financial burden for both patients and healthcare institutions.

3. Risk Factors

The occurrence of SSIs is influenced by multiple patient- and procedure-related factors. Patient-related factors include:

- Diabetes mellitus
- Obesity

- Advanced age
- Malnutrition
- Smoking
- Immunosuppression
- Anemia

Procedure-related factors include:

- Prolonged duration of surgery
- Emergency surgical procedures
- Inadequate antibiotic prophylaxis
- Poor aseptic technique
- Improper sterilization
- Implant surgery
- Contaminated wounds

Hospital-related factors such as inadequate hand hygiene, overcrowded operating rooms, and poor infection surveillance also contribute significantly to SSI development.

4. Common Causative Microorganisms

The microbiology of SSIs varies according to the type of surgery. Staphylococcus aureus, including methicillin-resistant S. aureus (MRSA), remains the leading pathogen. Other common organisms include Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, Acinetobacter baumannii, and Enterobacter species. In gastrointestinal surgeries, anaerobic bacteria such as Bacteroides fragilis are frequently isolated. The increasing prevalence of multidrug-resistant organisms has made infection prevention and antimicrobial stewardship more important than ever.

5. Role of Perioperative Protocols

Perioperative protocols are evidence-based interventions designed to reduce the risk of SSIs before, during, and after surgery.

Preoperative Measures

Important preventive measures include patient risk assessment, optimization of diabetes and nutritional status, smoking cessation, chlorhexidine skin preparation, appropriate hair removal using clippers, and timely administration of prophylactic antibiotics.

Intraoperative Measures

Strict aseptic techniques, surgical hand antisepsis, maintenance of sterile instruments, proper

operating room ventilation, glycemic control, maintenance of normothermia, and meticulous surgical technique help minimize bacterial contamination.

Postoperative Measures

Postoperative care focuses on sterile wound dressing, early identification of infection, appropriate wound surveillance, early patient mobilization, and avoiding unnecessary antibiotic use. Regular follow-up after discharge is equally important because many SSIs develop after patients leave the hospital.

6. Challenges in Prevention

Despite available guidelines, many hospitals face challenges in implementing effective SSI prevention programs. Resource limitations, inadequate staff training, poor compliance with infection control protocols, antimicrobial misuse, and limited surveillance systems remain major obstacles. Developing countries are particularly affected due to shortages of trained personnel and healthcare infrastructure.

7. Recent Advances

Recent advances include Enhanced Recovery After Surgery (ERAS) protocols, antimicrobial-coated sutures, negative-pressure wound therapy, electronic infection surveillance systems, and artificial intelligence-based prediction models. These innovations improve risk assessment, strengthen infection surveillance, and support evidence-based clinical decision-making.

8. CONCLUSION

Surgical Site Infections remain a significant cause of postoperative morbidity despite advances in surgical care. Most SSIs are preventable through strict adherence to standardized perioperative protocols, including appropriate antibiotic prophylaxis, aseptic surgical techniques, effective wound care, and antimicrobial stewardship. Continuous education, multidisciplinary teamwork, regular auditing, and improved infection surveillance are essential to reduce SSI incidence. Future research should focus on integrating emerging technologies with evidence-based perioperative practices to improve patient outcomes and enhance healthcare quality.

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