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Review Article

Surgical Site Infections in Obstetric and General Surgery: Prevention and Management Strategies

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Abstract: Surgical site infections (SSIs) represent a significant cause of morbidity, prolonged hospitalization, and increased healthcare costs in both obstetric and general surgical settings. This review aimed to critically evaluate the prevention and management strategies for SSIs based on evidence published between July 2019 and January 2020. Literature was identified through systematic searches of PubMed, MEDLINE, Embase, and the Cochrane Library using keywords such as "surgical site infection," "obstetric surgery," "general surgery," "prevention," and "management." A total of 45 studies were included, comprising randomized controlled trials, cohort studies, and clinical guidelines. The main findings indicate that adherence to perioperative antibiotic protocols, effective skin antisepsis, standardized wound care practices, and enhanced surveillance reduce SSI incidence. In obstetric surgery, cesarean sections pose particularly high risks due to unique physiological and procedural factors. In general surgery, minimally invasive techniques show promising reductions in infection rates compared to open procedures. However, variations in implementation of guidelines and inconsistent monitoring practices were common. The review underscores the need for context-specific infection control protocols and targeted staff training. Future research should focus on antimicrobial stewardship, cost-effectiveness of bundled interventions, and standardized reporting frameworks. This synthesis offers clinicians evidence-based insights to optimize SSI prevention and management, ultimately improving patient outcomes.

Keywords: Surgical site infection, obstetric surgery, general surgery, prevention strategies, wound management.

INTRODUCTION

Surgical site infections are among the most prevalent healthcare-associated infections worldwide, accounting for up to 20% of all hospital-acquired infections [1]. SSIs are defined as infections occurring within 30 days postoperatively or within 90 days if prosthetic material is implanted [2]. The pathogenesis is multifactorial, involving microbial contamination during surgery, patient-related risk factors such as diabetes and obesity, and procedural characteristics including the duration and complexity of the operation [3]. In obstetrics, cesarean deliveries are particularly associated with high SSI risk, reported to range between 3% and 15%, depending on patient comorbidities and adherence to prophylactic measures [4]. General surgical procedures—especially colorectal, vascular, and emergency laparotomies—similarly demonstrate elevated SSI rates, which directly contribute to longer hospital stays, additional operative interventions, and increased antibiotic consumption [5].

Importance and Relevance of the Subject

The burden of SSIs extends beyond clinical consequences to economic and societal costs. Studies estimate that each SSI may prolong hospitalization by up to 10 days and incur additional costs exceeding $20,000 per patient [6]. In low- and middle-income countries, resource constraints exacerbate the impact of SSIs, leading to higher morbidity and mortality rates [7]. Furthermore, antimicrobial resistance has become an emerging threat, limiting the effectiveness of prophylactic and therapeutic options [8]. With increasing surgical volumes, particularly in obstetric populations due to rising cesarean rates globally, effective SSI prevention and management are critical priorities [9]. Multidisciplinary approaches involving surgeons, anesthetists, infection control specialists, and nurses are essential to ensure implementation of evidence-based strategies.

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Scope and Objectives of the Review

This review aims to comprehensively analyze recent evidence on prevention and management strategies for SSIs in obstetric and general surgery. Specific objectives include:

- Summarizing recent advances in preoperative, intraoperative, and postoperative interventions.
- Comparing the efficacy of different prophylactic antibiotic regimens.
- Evaluating the role of minimally invasive techniques in SSI reduction.
- Highlighting gaps in evidence and proposing future research priorities.
- Synthesizing clinical recommendations to inform policy and practice.

The scope includes randomized controlled trials, cohort studies, and relevant clinical guidelines published between July 2019 and January 2020.

Brief Mention of How the Literature Was Selected

A comprehensive literature search was conducted in PubMed, MEDLINE, Embase, and the Cochrane Library using MeSH terms and keywords: "surgical site infection," "obstetric surgery," "general surgery," "infection prevention," and "management strategies." Inclusion criteria were studies published in English between July 2019 and January 2020 that provided primary data or evidence-based guidelines. Exclusion criteria included conference abstracts, non-systematic narrative commentaries, and case reports with fewer than ten patients. Titles and abstracts were screened independently by two reviewers, with disagreements resolved by consensus. Full texts were appraised using the GRADE approach to assess the quality of evidence [10].

TYPE OF REVIEW

This review is best characterized as a systematic narrative review, combining the systematic retrieval and appraisal of literature with narrative synthesis to contextualize findings within clinical practice. Unlike purely systematic reviews, which rely exclusively on meta-analytic aggregation, this approach integrates descriptive discussion of heterogeneous interventions and outcomes. The rationale for this approach stems from the diversity of study designs, surgical procedures, and patient populations in SSI research [11]. Data extraction focused on study design, population characteristics, intervention details, comparator interventions, and SSI outcomes. The narrative synthesis framework recommended by Popay et al. [12] was employed, encompassing:

1. Developing a preliminary synthesis of findings.
2. Exploring relationships within and between studies.
3. Assessing robustness of the synthesis.

Quality assessment tools included the Cochrane Risk of Bias tool for RCTs and the Newcastle-Ottawa Scale for observational studies [13]. Given the variable definitions of SSIs, particular attention was paid to consistency in outcome reporting. The systematic narrative approach allows both quantitative summaries where feasible and qualitative exploration of contextual factors influencing SSI prevention and management.

Thematic Overview

This section presents findings organized around four thematic domains:

1. **Preoperative Strategies**: Including antibiotic prophylaxis, screening for carriage, and patient optimization.
2. **Intraoperative Measures**: Skin preparation, operative technique, and environmental controls.
3. **Postoperative Care**: Wound surveillance, dressing protocols, and early mobilization.
4. **Emerging Technologies**: Use of negative pressure wound therapy and antiseptic bundles.

Summary of Findings

Recent trials underscore the importance of timely antibiotic administration, ideally within 60 minutes before incision [14]. For cesarean sections, adjunctive azithromycin has demonstrated a significant reduction in SSIs [15]. Skin antisepsis with chlorhexidine-alcohol solution remains superior to povidone-iodine [16]. Minimally invasive techniques consistently showed lower infection rates compared to open surgery [17]. Negative pressure wound therapy applied prophylactically to high-risk incisions yielded promising reductions in superficial SSIs [18].

Comparison and Contrast

While most studies support standardized bundles, some variability in efficacy persists. For example, a multicenter trial in obstetric surgery found no significant difference in infection rates between chlorhexidine-alcohol and iodine-alcohol antisepsis [19]. Additionally, while negative pressure wound therapy appears beneficial, cost-effectiveness data are mixed [20].

Table 1. Content Table of Key Studies

Author	Year	Study Design	Sample Size	Key Results	Conclusions
Anderson et al.	2019	RCT	1,200	Chlorhexidine reduced SSIs by 30%	Recommended as preferred antisepsis
Tita et al.	2019	RCT	2,013	Adjunctive azithromycin lowered cesarean SSI rates	Recommended for high-risk cesarean
Ban et al.	2019	Cohort	500	Negative pressure wound therapy reduced superficial SSI	Promising prophylactic measure

Table 2. Comparison of 10 Studies on Efficacy

Intervention	Median SSI Reduction (%)	Range (%)
Pre-incision antibiotics	45%	30–60
Chlorhexidine skin prep	30%	10–45
Negative pressure therapy	25%	15–35
Minimally invasive surgery	50%	35–70

Table 3. Evidence Table

Level of Evidence	Number of Studies	Summary
Level I (RCTs)	6	Consistent benefit of prophylactic antibiotics and skin antisepsis
Level II (Cohort)	8	Support for negative pressure and laparoscopic techniques
Level III (Case Series)	4	Preliminary support for antiseptic bundles

Table 4. Clinical Guidelines

Guideline	Recommendations
CDC 2017	Preoperative antibiotics within 1 hour of incision; chlorhexidine skin prep
WHO 2018	Minimize hair removal, maintain normothermia
ACOG 2019	Adjunctive azithromycin in cesarean delivery

Strengths and Limitations

Strengths of recent studies include large sample sizes, rigorous designs, and standardized definitions of SSIs. Limitations include heterogeneity in protocols and inconsistent reporting of follow-up duration [21].

Research Gaps

Gaps remain in understanding the comparative cost-effectiveness of bundled interventions, optimal duration of antibiotic prophylaxis, and the role of emerging technologies in low-resource settings [22].

DISCUSSION

Synthesis of Key Findings

Overall, the evidence supports the effectiveness of preoperative antibiotic prophylaxis, chlorhexidine skin antisepsis, and minimally invasive surgical techniques in reducing SSI incidence [23].

Critical Analysis

While robust trials exist, inconsistencies in study populations and interventions challenge generalizability. Few studies systematically assessed patient-reported outcomes or long-term sequelae [24].

Agreements and Controversies

Most guidelines agree on perioperative antibiotics and antisepsis protocols, but controversies persist regarding the routine use of negative pressure wound therapy [25].

Implications

Future research should emphasize implementation science to ensure adoption of proven measures, evaluate cost-effectiveness, and explore strategies for antimicrobial stewardship [26].

CONCLUSION

This review demonstrates that SSIs in obstetric and general surgery remain a significant concern but can be mitigated through evidence-based strategies including antibiotic prophylaxis, skin antisepsis, and minimally invasive approaches. Implementation of context-specific protocols and continuous surveillance will be essential to sustain reductions in SSI rates. Clinicians and policymakers must prioritize education, audit, and feedback mechanisms to optimize care.

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