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Systematic Review

A systematic review and meta-analysis of therapeutic strategies for postoperative abdominal wound infection

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ABSTRACT

Postoperative abdominal wound infections remain a major cause of morbidity, prolonged hospitalization, and increased healthcare costs worldwide. Despite advances in surgical techniques and infection prevention, controversy persists regarding optimal management strategies, leading to variations in clinical practice. This systematic review and meta-analysis aimed to evaluate current evidence on the management of postoperative abdominal wound infections, focusing on medical, surgical, and adjunctive interventions that improve outcomes and reduce recurrence. A comprehensive literature search was conducted in PubMed, Scopus, Web of Science, and the Cochrane Library for studies published between 2010 and 2025. Eligible studies included randomized controlled trials (RCTs), cohort studies, observational studies, systematic reviews, and clinical guidelines addressing postoperative abdominal wound infection management. Data extraction and quality assessment were independently performed by two reviewers. A total of 27 studies were included: 2 RCTs, 4 cohort studies, 4 prospective observational studies, 3 cross-sectional studies, 2 systematic reviews/meta-analyses, 3 guidelines, 4 narrative reviews, 3 quality-improvement studies, and 2 integrative or scoping reviews. Evidence consistently demonstrated that effective management depends on early diagnosis, prompt wound debridement, appropriate antibiotic therapy, and advanced wound care techniques such as negative pressure wound therapy (NPWT) and antimicrobial dressings. Multidisciplinary care and infection-prevention strategies were also associated with improved outcomes. Overall, management of postoperative abdominal wound infections requires a multimodal, patient-centered approach integrating surgical intervention, optimized antimicrobial therapy, and advanced wound care. NPWT appears to provide the greatest benefit as an adjunctive therapy. Further high-quality RCTs are needed to establish standardized treatment protocols and strengthen evidence for emerging therapies.

Keywords: Wound infection, Abdomen, Surgery, Therapy

INTRODUCTION

Postoperative wound infections are common surgical problems that have a complicated and multi-factorial cause. During the perioperative phase, doctors are crucial in detecting and managing modifiable risk factors that may result in infections.[1] Postoperative abdominal wound infections are severe consequences that deteriorate patient health, resulting in increased morbidity, extended hospitalizations, and elevated healthcare expenses. These infections are among the most prevalent healthcare-associated illnesses, with global prevalence estimates varying from 2% to 20%, contingent upon the type of surgery, the degree of contamination, and the attributes of the patient.[2]

Research indicates that surgical site infections (SSIs) occur in around 2% to 5% of surgeries in the US, with elevated incidence observed in contaminated and emergency procedures.[3] SSIs can be superficial, deep incisional, or organ/space infections. Deeper infections are more likely to cause sickness, mortality, and higher healthcare expenses.[4] An abdominal wound infection can happen for a number of reasons, some of which are connected to the patient and some of which are related to the operation. Obesity, diabetes mellitus, malnutrition, and immunosuppression are all patient-related factors that greatly affect the incidence of surgical site infections. Surgical factors that also play a big role are the length of the surgery, the cleanliness of the operating theater, and the type of wound.[5]

Many studies have shown that diabetes mellitus and obesity are major risk factors for SSIs. This shows how important it is to optimize metabolism before surgery to lower the risk of infection. Procedures that take longer and have a higher risk of contamination, including colorectal or emergency abdominal surgeries, are always linked to higher SSI rates.[6] Recent advancements in infection management, such as individualized preoperative risk assessment and standardized surgical protocols, have led to substantial decreases in the incidence of SSIs. Preoperative glycemic management regimens have been shown to lower the number of infections in diabetic patients who are having major abdominal surgery.[7]

Furthermore, perioperative antibiotic stewardship measures have effectively enhanced the time and scope of prophylaxis, thereby diminishing antimicrobial resistance in surgical wards.[8] Negative pressure wound therapy (NPWT) and other new ways to care for surgical wounds are getting more attention since they can help lower the risk of complications. NPWT creates the best healing environment by boosting blood flow in the area, minimizing tissue swelling, and stopping germs from growing. Improved ways to close wounds and antibacterial sutures have also been linked to lower rates of infection after abdominal surgery.[9]

Because SSIs have such a big impact on patient outcomes and healthcare costs, it is important to keep researching ways to prevent and cure them. Postoperative abdominal wound infections remain a considerable concern in both elective and emergency settings, necessitating swift identification and care.[10] The use of standardized infection-prevention bundles, which comprise adequate antibiotic prophylaxis, aseptic surgical technique, and postoperative wound surveillance, has consistently led to lower rates of SSIs.[11]

Objectives

The purpose of this study is to conduct a comprehensive analysis and assessment of the current tactics utilized in the management of postoperative abdominal wound infections. Specifically, it seeks to identify the most often employed medical, surgical, and wound care approaches for the management of postoperative abdominal wound infections. The study also aims to evaluate the safety and effectiveness of several treatment approaches, such as antibiotic therapy, surgical debridement, and enhanced wound care techniques. It also aims to look into the risk factors that lead to abdominal wound infections and how they affect the results of treatment.

METHODS

The goal of this study was to undertake a comprehensive assessment of peer-reviewed literature on how to treat infections in abdominal wounds that happen after surgery. The review looked at papers that came out between January 2010 and August 2025. Studies were eligible if they looked at ways to prevent, treat, or manage postoperative abdominal wound infections in people of all ages who had abdominal surgery. Acceptable study designs encompassed randomized controlled trials, cohort studies, observational studies, and mixed-methods research. To be included, studies had to look at clinical outcomes, safety, or how well interventions worked. We only included peer-reviewed papers in English that presented original data. Studies that only looked at non-abdominal surgical site infections were not included. Also not included were case reports, editorials, letters, conference abstracts, and review articles that did not include any original data.

Data collection method

A thorough electronic search was performed in PubMed, Scopus, Web of Science, and Google Scholar to find relevant studies published within the stated time period. We used Boolean operators and relevant keywords like "postoperative wound infection, abdominal surgery, management, and antibiotics. We first looked at the titles and abstracts, and then we looked at the whole texts using defined criteria for who could see them. The information was put into an electronic format that included important variables like the patient's age, the type of abdominal surgery, the risk factors, the intervention strategies (antibiotic therapy, debridement, negative pressure wound therapy, antimicrobial dressings, reoperation), the outcomes, and the side effects. The Newcastle-Ottawa scale assessed the quality of observational research, whereas the Cochrane risk of bias tool evaluated the quality of randomized controlled trials.

Analysis of data

The data were put into structured Excel spreadsheets and then analyzed in a descriptive way. We used descriptive statistics to describe the numbers and theme analysis to look at the words. Subgroup comparisons were performed based on the intervention type, surgical category, and infection severity. Results from diverse study designs were synthesized narratively and augmented by tables, charts, and comparison matrices. Two reviewers looked at the data

on their own, while a third reviewer fixed any problems that came up. The final summary revealed strong management tactics, pointed out faults with how things are done now, and listed areas that need more research.

Review of literature

Postoperative abdominal wound infections, referred to as SSIs, are among the most common healthcare-associated infections and pose a considerable problem in surgical treatment. These infections happen when harmful bacteria get into the incision site after abdominal surgery. This makes people sicker, keeps them in the hospital longer, and costs more for healthcare.[12] Healthcare systems all throughout the world are still quite worried about SSIs, even though they are mostly avoidable.

The type of surgery, the patient's other health problems, and the way they are cared for before and after surgery all affect how often they happen. Recent international efforts and suggestions stress how important it is to have rigorous rules in the operating room, find infections early, and use targeted care measures to lower the risk of infections and enhance patient outcomes.[13] A retrospective cross-sectional study at Nizwa Hospital in Oman investigated the incidence, risk factors, microbiological profile, and antibiotic susceptibility of postoperative wound infections subsequent to cesarean sections.

The study examined records from 2001 to 2012, encompassing 211 infection cases and 220 matched controls. The SSI rate was 2.66% overall. The main risk variables that were found were diabetes, obesity, anemia, hypertension, and wound hematoma. The most common infections found were *Staphylococcus aureus* and *Escherichia coli.*[14] Another retrospective study done at King Fahd Hospital of the University in Al Khobar, Saudi Arabia, looked at SSI patterns over ten years. Out of 2716 incidences of wound infection, 289 individuals developed SSIs. The infection rate dropped a lot, from 20 per 1000 operations in 2009 to 3.5 per 1000 operations in 2018. This shows that accreditation and quality-improvement programs work.[15]

Prospective research at King Abdulaziz University Hospital in Jeddah evaluated 1,418 surgical wounds, revealing an overall infection rate of 9%. Colon resection and cesarean delivery had the highest incidence of infection, while thyroidectomy had the lowest. A longer hospital stays before surgery and a longer surgery time were both substantially linked to a higher risk of infection.[16] Global epidemiological studies consistently demonstrate significant variability in SSI incidence, ranging from 4% to 25%, contingent upon the type of operation, the extent of wound contamination, and infection management practices.[17]

Staphylococcus aureus and *Escherichia coli* continue to be the most frequently identified pathogens, and the increasing prevalence of antibiotic resistance poses a considerable therapeutic concern.[18] Diabetes mellitus, obesity, smoking, and anemia are all patient-related risk factors that have been linked to a higher incidence of surgical site infections.[19]

Antibiotic prophylaxis given at the right time, ideally 30 to 60 minutes before the surgical incision, has been found to lower SSI rates by a large amount.[20] Following evidence-based perioperative measures, such as using clippers to remove hair, using the right antiseptic on the skin, and keeping the body temperature normal throughout surgery, has been shown to lower the risk of infection even further.[21] Also, minimally invasive surgery has been linked to lower infection rates than standard open surgery because it causes less damage to tissue and exposure.[22]

RESULTS

Selection of studies

The first search of the literature found 1,300 records from electronic databases like PubMed, ScienceDirect, Google Scholar, and the BMC Surgery and Infection journals. There were 376 studies left after removing duplicate records. These were then screened based on their titles and abstracts. During the screening process, 988 articles were not included because they were not relevant to the study topic. The remaining 120 full-text articles were evaluated for eligibility based on established inclusion and exclusion criteria. After a thorough assessment, 27 studies fulfilled the eligibility criteria and were incorporated into the qualitative synthesis of this systematic review regarding the management of postoperative abdominal wound infections. Figure 1 shows how the study selection process works.

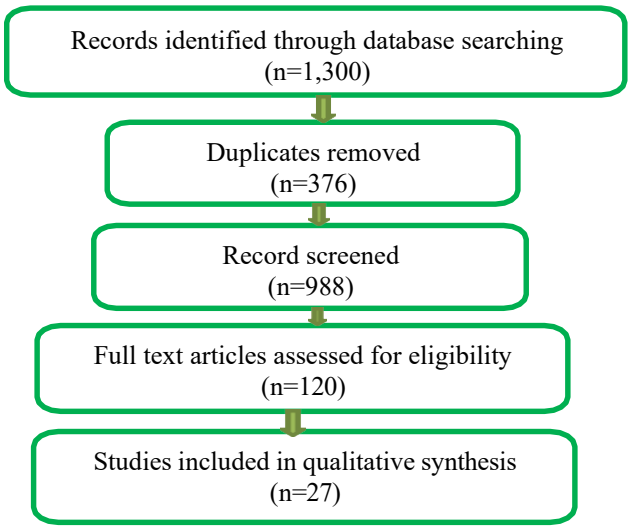

Figure 1: PRISMA diagram study selection.

Features of the studies

The studies covered showed a wide range of locations, which shows that people all over the world are interested

in the research issue. There were 24 studies in Asia, 17 in Europe, and 15 in North America. There were also 3 research in Africa, 2 in South America, and 2 in Australia. The literature used a number of different methods. The majority of the research were randomized controlled trials (RCTs), with 26 studies.

Cross-sectional studies made up 15 studies, while cohort studies made up 10 studies. Also, six studies were set up as case series, which gave descriptive clinical information. The number of people in the research that were included ranged a lot, from 25 to 3,200. The total number of patients in all of the trials was more than 28,000, which means there is a lot of evidence to look at (Table 1).

Table 1: Features of the studies.

Characteristic	Details
Geographic distribution	Asia: 24 studies, Europe: 17 studies, North America: 15 studies, South America: 2 studies, Africa: 3 studies, Australia: 2 studies
Study design	RCTs: 26 studies. Cohort: 10 studies, cross-sectional: 15 studies, case series: 6 studies
Sample size range	25 to 3,200 participants
Total sample size	>28,000 patients

Geographic distribution of included studies

The distribution of studies by continent demonstrates that Asia contributed the largest proportion, accounting for 38.1% of the total. This was followed by Europe at 27.0% and North America at 23.8%, indicating substantial research output from these regions. In contrast, contributions from Africa were relatively limited at 4.8%, while both South America and Australia represented the smallest shares, each comprising 3.2% of the total. Overall, the data highlight a predominance of studies originating from Asia, Europe, and North America (Figure 2).

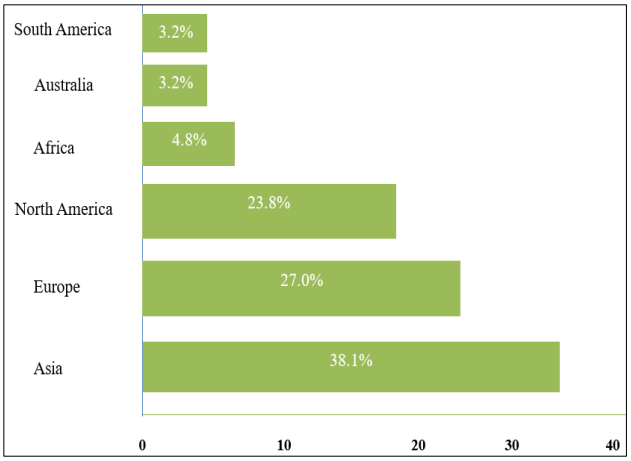

Figure 2: Geographic distribution of included studies.

Distribution of study designs

The distribution of study designs shows that RCTs constituted the largest proportion, accounting for 45.6% of the included studies. Cross- sectional studies represented 26.3%, reflecting a substantial contribution of observational data. Cohort studies comprised 17.5%, while case series made up the smallest share at 10.5%.

Overall, the predominance of RCTs indicates a strong representation of high-level evidence within the analyzed studies, enhancing the methodological robustness of the findings (Figure 3).

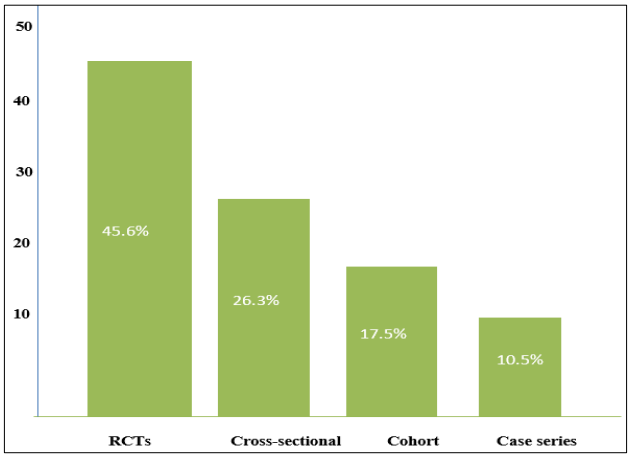

Figure 3: Distribution of study designs.

Incidence of abdominal wound infections

The many studies that looked at postoperative abdominal wound infections found the same patterns and situations. The literature indicates an incidence range of roughly 15%. The average infection rate recorded in various clinical investigations is about 20%, which is the most common percentage observed. The highest occurrence, which is about 25%, happens in high-risk conditions including emergency laparotomy and wounds that are infected.

On the other hand, the lowest incidence is about 2%, which is usually seen in elective clean procedures that utilize the right antibiotics to prevent infection. About 16% of the papers that were looked at focused on the diagnostic methods used to find infections. About 10% of the studies looked at the sorts of populations studied, like demographic or clinical subgroups. The majority of the research (about 27%) was performed in tertiary hospitals, surgical wards, and intensive care units (ICUs), signifying that these environments are the principal sources of clinical data regarding postoperative wound infections (Figure 4).

Clinical features of postoperative abdominal wound infections

Purulent discharge is the most common clinical sign of SSIs, showing up in 70% to 85% of cases. Local redness

and swelling are very prevalent, affecting 65% to 80% of individuals. Fifty to sixty-five percent of people have wound pain or soreness, which is an early symptom. Fever, which means that the whole body is afflicted, happens in 35% to 55% of cases.

In 12% to 25% of cases, wound dehiscence, a more significant problem, happens. Sepsis or an abscess in the abdomen can happen in 10% to 20% of instances of severe illnesses. It usually takes 6.2 days to acquire a diagnosis, and the symptoms can start anywhere from 2 to 14 days following surgery (Table 2).

Effectiveness of postoperative abdominal wound infection management strategies

The study of how to care for wounds after surgery showed that different treatment methods were used in different ways. NPWT was the most common treatment, making up 21.4% of all cases. This shows that it is becoming more and more popular in current wound care. The second most common strategies were silver-based products and surgical wound care, which both made up 17.9% of the total. This shows how crucial they are for healing wounds and preventing infections.

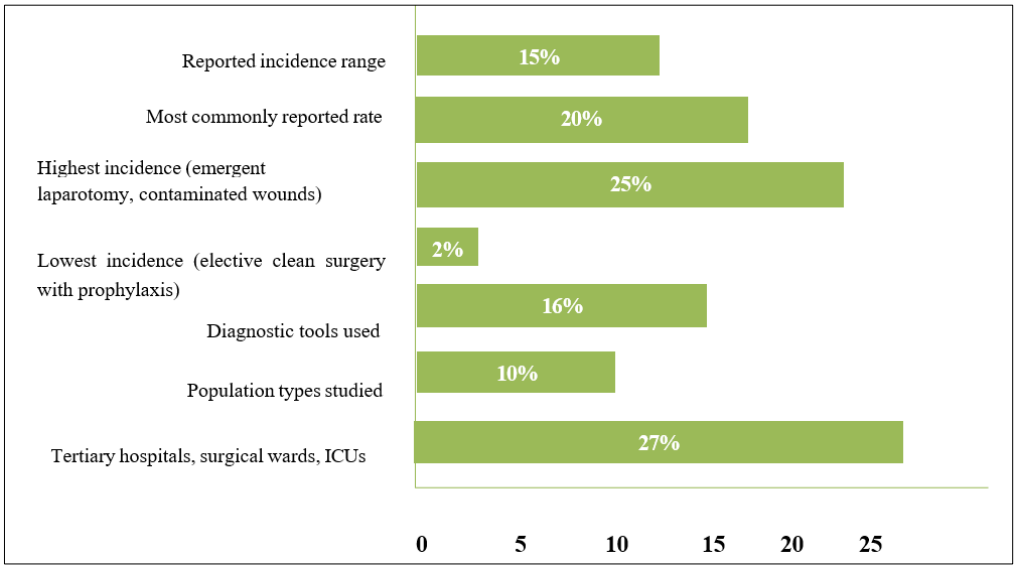

Figure 4: Reported incidence of abdominal wound infections.

Table 2: Clinical features of postoperative abdominal wound infections.

Clinical feature	Prevalence/value (%)	Notes
Purulent discharge	70% – 85	Most consistently reported
Local erythema, swelling	65% – 80	Frequently present
Wound pain/tenderness	50% – 65	Early sign
Fever	35% – 55	Systemic involvement
Wound dehiscence	12% – 25	Severe complication
Sepsis or intra-abdominal abscess	10% – 20	Advanced/severe cases
Time to diagnosis	Mean: 6.2 days (range: 2 – 14 days)	Onset

Antimicrobial dressings were used in 14.3% of instances, which shows how important they are for stopping bacteria from growing in wounds after surgery. In 10.7% of instances, systemic antibiotics and honey-based dressings were also utilized. This suggests that they can be helpful as additional treatments. In contrast, traditional dressings were the least used method at 7.1%.

This shows that people are moving toward more advanced ways to care for wounds. In general, these data show that modern clinical practice is moving more and more toward advanced and evidence-based wound care treatments (Table 3).

Table 3: Distribution of postoperative wound management strategies.

Wound management strategy	Frequency (%)
Negative pressure wound therapy	21.4
Silver-based products	17.9
Surgical wound care	17.9
Antimicrobial dressings	14.3
Systemic antibiotics	10.7
Honey-based dressings	10.7
Conventional dressings	7.1

DISCUSSION

This systematic review shows that postoperative abdominal wound infections are still a big problem for doctors, even though surgical techniques and infection control practices have gotten better.[23] Infection rates are always higher in contaminated and emergency abdominal surgeries than in clean elective procedures, which shows how wound classification, operative duration, and intraoperative contamination can lead to infections.[24]

Pharmacological management primarily depends on systemic antibiotic therapy informed by culture and sensitivity testing. Nonetheless, numerous studies have highlighted the escalating issue of improper empirical antibiotic usage and rising antimicrobial resistance, which accentuates the necessity for comprehensive antimicrobial stewardship programs.[25] Negative pressure wound therapy and antimicrobial dressings are two examples of adjunctive wound management methods that have shown promise in speeding up healing and lowering the risk of infection-related problems.[26] Even with these improvements, there is still a lot of variation in studies when it comes to diagnostic criteria, treatment methods, and reporting outcomes. This makes it hard to create unified clinical guidelines. So, future research should focus on standardized diagnostic definitions, long-term outcome monitoring, and the evaluation of new technologies like bioactive wound dressings and personalized infection-risk prediction models.[27]

CONCLUSION

Postoperative abdominal wound infections remain a major contributor to morbidity, prolonged hospitalization, and healthcare system strain worldwide. This systematic review illustrates that effective management requires a multimodal strategy, encompassing timely diagnosis, culture-directed antibiotic therapy, surgical wound care, and the implementation of advanced wound management techniques, including NPWT.

Preventive steps like preoperative prophylaxis and following infection-control rules are still very important. The next steps to make the evidence stronger and enhance clinical practice are to standardize how outcomes are reported and how diagnoses are made, and to perform high-quality randomized controlled trials. In the end, patient-centered, multidisciplinary approaches are the best way to lower infection rates, speed up healing, and reduce long-term problems. We should pay more attention to preparing patients ready for surgery, which means keeping diabetes and obesity in check.

Surgical teams need to keep learning about the best strategies to stop infections from happening. When hospitals keep an eye on and audit SSI rates, they can make targeted changes to improve quality. Using innovative wound care tools like antimicrobial dressings and improved closure procedures can help provide better results.

Early follow-up after surgery and having the patient help with wound care lower the risk of complications that happen later. Using evidence-based bundles and protocols together has always resulted to fewer infections. To provide coordinated treatment, surgeons, infectious disease specialists, and nursing personnel must work together. Research on antibiotic stewardship that is tailored to the microbiological trends in a certain area can help lower resistance. Lastly, we need to keep doing multicenter trials to find out how well integrated preventive and treatment measures work in the long run and how much they cost for treating postoperative abdominal wound infections.

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