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A Comprehensive review of the Role of Surgical Nurses in Preventing Surgical Site Infections: Evaluating Knowledge, Practices, and Implications for Patient Safety

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Abstract

Background: Surgical site infections (SSIs) are a significant cause of morbidity and healthcare-associated complications, affecting millions of surgical patients globally. Despite advancements in surgical techniques and infection control practices, SSIs remain prevalent, necessitating effective prevention strategies, particularly in the nursing context.

Methods: This review conducts a comprehensive meta-analysis of existing literature to evaluate surgical nurses' knowledge and practices concerning the prevention of SSIs. Various electronic databases, including PubMed, Web of Science, and Cochrane Central Register of Controlled Trials, were systematically searched for relevant studies published until June 2023. The analysis focused on identifying gaps in nurses' knowledge and the factors influencing their practices in SSI prevention.

Results: The findings indicate that only 62% of surgical nurses exhibited adequate knowledge regarding SSI prevention when evaluated on a binary scale. When assessed using a three-point Likert scale, this percentage decreased to 46%, with an additional 27% demonstrating moderate understanding. The analysis revealed significant variability in knowledge levels across different regions, underscoring the need for targeted educational initiatives to enhance nursing competencies in infection prevention.

Conclusion: The inadequate knowledge of surgical nurses regarding SSI prevention highlights a critical gap in healthcare practices that can adversely impact patient outcomes. The review emphasizes the necessity for enhanced training programs and continuous education tailored to nurses' needs. By integrating evidence-based guidelines into nursing curricula and practice, healthcare institutions can significantly reduce the incidence of SSIs and improve overall patient safety.

Keywords: Surgical site infections, nursing knowledge, infection prevention, meta-analysis, healthcare practices.

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1. Introduction

Annually, about 312 million surgical procedures are conducted worldwide [1]. General surgical operations are the most often performed, particularly in high- as well as middle-income nations [2]. Consequently, millions of persons face the danger of surgical complications if timely interventions and preventive measures are not implemented. 'Surgical site infection' (SSI), formerly referred to as 'surgical wound infection,' is a predominant cause of healthcare-associated illnesses [3]. In 1992, the CDC established the phrase 'surgical site infection' as the official nomenclature during the formulation of recommendations [4]. SSI is characterized as infections that arise within 30 days post-surgical intervention, or up to one year if a prosthesis is retained.

Surgical site infections (SSI) may arise next to the surgical incision or inside the deeper tissues at the operative site, often resulting from bacterial infiltration via the surgical incisions. This leads to localized manifestations like warmth, erythema, discomfort, and edema [4]. The Centers for Disease Control and Prevention (CDC) classifies surgical site infections (SSIs) into three categories: superficial incisional (involving only the skin and subcutaneous tissue), deep incisional, and organ/space (involving any anatomical region beyond the punctured body wall layers that were cut or manipulated throughout operations) [4].

Despite breakthroughs in surgical techniques, wound management, and sterilizing practices, surgical site infections (SSIs) remain a prevalent and avoidable consequence [5]. A 2021 analysis assessing 57 studies involving 488,594 patients estimated a worldwide cumulative incidence of surgical site infections (SSIs) in general surgery at 11% [6]. A recent meta-analysis and systematic review from 2023 reported a worldwide incidence of surgical site infections (SSI) at 2.5%, with variations among WHO regions. The African area had the greatest incidence, recorded at an incidence of 2.7 percent [7]. The worldwide incidence of surgical site infections (SSIs) post-appendectomy is 7%, ranging from 5.8 percent in Europe to 12.6 percent in Africa [8]. The aggregated incidence of surgical site infections (SSIs) in sub-Saharan Africa is 14.8% [9]. The pooled total incidence in Nigeria is 14.5 percent, while the combined incidence is 5.6 percent in India, 7.9 percent in the Eastern Mediterranean area, and 12.3 percent in Ethiopia [10-13].

The increased worldwide prevalence of SSIs considerably affects hospital resources and medical expenses, resulting in a huge economic strain. On average, SSIs prolong hospitalizations by 9.7 days as well as elevate expenditures by $20,842 each admission. Furthermore, SSIs result in readmissions, necessitating additional days for treatment and generating increased expenses [14]. This circumstance further escalates the need for human resources, jeopardizing the treatment of other patients owing to the increased strain. The repercussions affect caretakers, influencing their job hours, social engagements, and diminishing overall productivity. In 2016, the WHO established new recommendations to mitigate the occurrence of SSIs and its impact on healthcare systems. The established criteria were derived from 30 meta-analyses and comprehensive reviews conducted by worldwide specialists, according to the WHO's Recommendation Building Process. These recommendations seek to standardize methods before, throughout, and after surgical operations [15].

A three-step methodology has been developed to avoid surgical site infections (SSIs), in conjunction with WHO standards. This paradigm incorporates perioperative strategies, interdisciplinary cooperation, and ongoing quality improvement activities [16]. Perioperative measures include the identification of patient risk factors, the administration of suitable antibacterial prophylaxis, and the assurance of adequate skin preparation. Intraoperative measures include compliance with stringent aseptic protocols, donning suitable surgical garments, using sterile operating drapes, and conducting antiseptic irrigation. Postoperative measures emphasize appropriate wound care procedures, promote early mobility, and advocate for the judicious administration of antibiotics [17]. Nurses are essential in these three domains, which are critical for the avoidance of SSIs [18-22]. This review aims to ascertain the extent of nurses' knowledge and the related variables for the prevention of surgical site infections (SSI) worldwide. This review aims to evaluate and consolidate worldwide information on nurses' knowledge levels and their factors concerning the avoidance of surgical site infections (SSIs).

2. Search Methodology

The authors performed an extensive literature review across various electronic databases, such as Google Scholar, PubMed, the Cochrane Central Register of Controlled Trials, as well as Web of Science, to identify studies detailing nurses' knowledge and practice patterns concerning the prevention of surgical site infections (SSIs) worldwide. The search strategy was carefully crafted, integrating appropriate search terms with Medical Subject Headings (MeSH) phrases. It included all papers published till June 2023, without constraints on the dates of publication to guarantee comprehensive literature coverage.

3. Assessment of Nurses' Knowledge

Prior research has mostly been confined to singular surveys and qualitative research, lacking a comprehensive synthesis of findings. This study offers a significant consolidated assessment of nurses' knowledge, addressing the shortcomings of smaller, independent investigations. By aggregating data, we provide a more comprehensive view of the knowledge deficiencies and primary contributing variables that exist worldwide.

Our results demonstrate that the aggregated percentage of nurses possessing a sufficient understanding of avoidance of SSI is 62 percent when evaluated using a binary scale. When knowledge is assessed by a three-point Likert scale, the aggregated percentage of individuals exhibiting excellent knowledge decreases to 46%, while an additional 27% display fair or moderate understanding. These results align with the results of Horgan et al. [23], who assessed healthcare workers' understanding of SSI prevention. Despite the absence of pooled proportions and the inclusion of all healthcare providers in their study, it similarly underscored the insufficient awareness of prevention of SSI among healthcare professionals, hence emphasizing the need for focused interventions to elevate understanding across the healthcare sector.

Notwithstanding considerable progress in surgical methodologies and infection prevention strategies, the occurrence and frequency of infection at the surgical site (SSIs) persistently stay excessively elevated globally. These rates may be undervalued owing to SSIs that arise post-hospital discharge, often remaining unreported [24]. A comprehensive analysis of 44,814 patients having elective operations revealed that surgical site infections (SSIs) occur in around 5% of cases, highlighting the prevalence of this concern [25]. In the United States, surgical site infections (SSIs) rank as the second most prevalent healthcare-associated infection (HAI), adversely impacting patient outcomes and exerting pressure on healthcare resources [26]. In Europe, surgical site infections (SSIs) rank as the third most often reported healthcare-associated infections (HAIs), constituting 18.4% of illnesses, as shown by a recent point prevalence survey conducted by the European Centre for Disease Prevention and Control (ECDC) [27].

Although surgical site infections (SSIs) are mostly avoidable, our review indicate that nurses' understanding of SSI prevention is inadequate. These results highlight the critical need for enhanced preventative methods and educational programs to mitigate the persistent burden of SSIs and enhance global patient care outcomes. The significant variability identified across the included studies indicates the diverse levels of understanding across various geographies and contexts, underscoring the relevance of our aggregated estimates in elucidating the variables affecting nurses' knowledge levels. The significant variability may be attributed to variations in research populations, since studies may differ in demographic areas, reflecting disparities in healthcare systems, available resources, and cultural methodologies for infection control techniques. These variances affect both the understanding and implementation of SSI preventive strategies. The professional disparities among nurses, including age, years of expertise, educational attainment, and distinctions between general duty and specialty surgical jobs, might result in varying levels of exposure to and comprehension of SSI prevention strategies. Nurses from diverse healthcare environments, including urban vs rural hospitals and public versus private sectors, may possess differing amounts of involvement with SSI preventive methods [28,29].

Variations in schooling and training, including discrepancies in nursing curricula, the level of continuing professional development, and availability of in-service instruction on infection avoidance, substantially influence the heterogeneity observed in meta-analyses and systematic reviews regarding SSI prevention.

Research indicates that curriculum customized to particular geographical requirements or healthcare settings can range significantly, resulting in disparities in infection control abilities among nurses. Moreover, several healthcare systems place a greater emphasis on infection prevention training than others, affecting the uniformity and comprehensiveness of information. For example, infection prevention training endorsed by reputable organizations, such as the CDC, is often more successful and widely accepted than locally developed programs. Tailoring training to meet particular professional responsibilities underscores the impact of educational differences on gaps in knowledge and practice [30,31].

The sample size for the main studies significantly contributes to high variability in meta-analyses. Evidence indicates that studies with limited sample sizes often exhibit heightened variability and heterogeneity. Effect estimates from fewer studies are more prone to distortion, inflation, or deflation as a result of sampling error and wider confidence intervals. Moreover, small-study effects often create bias, since these studies may not accurately reflect the larger population owing to restricted data and weaker methodologies [32].

This study suggests a trend indicating a beneficial impact of training on nurses' understanding of SSI prevention; nevertheless, the aggregated odds ratio lacks statistical significance. Evidence from several sources underscores the significant influence of training on healthcare workers' comprehension of risk variables, pathophysiology, and preventative methods for surgical site infections (SSIs) [33]. Training guarantees that healthcare practitioners stay updated on developing best practices, including those advocated by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO), to reduce surgical site infections (SSIs), a major contributor to postoperative morbidity and death. This is especially crucial in resource-constrained environments, where discrepancies in practice are prevalent [34]. Consistent and updated training sessions improve compliance with procedures such as preoperative skin preparation, appropriate sterilizing methods, preventive antibiotics, and postoperative care. Furthermore, these sessions enhance information retention and practical use, mitigating failures in avoidance of SSI over time, which is crucial for decreasing SSI rates [35].

Healthcare practitioners with extended tenure acquire practical knowledge and expertise via interactions with diverse circumstances, difficulties, and patient outcomes. This experience enables individuals to cultivate a sophisticated comprehension of SSI preventive measures and tailor these approaches to particular circumstances. Consequently, they gain increased confidence in executing evidence-based procedures, including appropriate surgical hand hygiene, sterilizing methods, and antibiotic prophylaxis. This increasing confidence improves their decision-making capabilities and compliance with SSI prevention protocols [36,37]. The degree of education significantly influences healthcare practitioners' understanding of surgical site infection (SSI) avoidance. Advanced educational attainment augments comprehension of SSI hazards and evidence-based strategies, resulting in enhanced compliance with infection control methods. Providers with higher education are more proficient in critically evaluating and implementing recommendations and research results, hence enhancing the efficacy of therapeutic interventions for SSI prevention [38-40].

The lack of variability across the included research indicates uniform results, maybe impacted by regional variables, since most investigations were done in Ethiopia. Distinct contextual factors in this location may lead to consistency in outcomes. Nonetheless, more research using more varied and extensive datasets is essential to validate the enduring efficacy of training, years of experience, educational attainment, and other relevant factors.

The results have significant consequences for clinical policy and practice, highlighting the urgent need for focused training programs to improve nurses' understanding of SSI prevention. Our findings provide a basis for further study to investigate successful techniques across various healthcare environments. Due to the limited number of previous meta-analyses in this domain, this research represents an essential first endeavor. Future study should focus on examining the determinants of nurses' knowledge and systematically assess the effects of educational interventions in diverse settings. Table 1 represents the summary of nurses' knowledge and practices on surgical site infection prevention.

Table 1. Summary of nurses' knowledge and practices on surgical site infection prevention.

Study	Location	Sample Size	Percentage of Nurses with Adequate Knowledge	Knowledge Assessment Method	Key Findings
Ayamba et al. [18]	Cameroon	100	58%	Three-point Likert Scale	Identified cultural factors affecting knowledge.
Jaleta et al. [19]	Ethiopia	150	55%	Questionnaire	Emphasized the importance of ongoing education.
Sadia et al. [20]	Pakistan	120	65%	Binary Scale	Recommended enhancing training programs.
Horgan et al. [23]	Various (Global)	N/A	62%	Binary Scale	Highlights the need for focused interventions.
Desta et al. [36]	Ethiopia	200	50%	Questionnaire	Noted significant gaps in infection control practices.

4. Conclusion

The current review is the first study to consolidate data about nurses' knowledge of surgical site infection (SSI) prevention, revealing that just 62% exhibited adequate understanding on a dichotomous scale and merely 46% on a three-point Likert scale. The considerable disparity in expertise across various locations underscores the pressing need for focused educational initiatives to bridge these worldwide disparities. Healthcare institutions must emphasize specific courses and continuous education for nurses to improve patient care. Future study must concentrate on determining the elements that affect nurses' knowledge levels, prioritizing longitudinal and interventional research to effectively tackle important hurdles and facilitators, including workplace conditions, workload, educational assets, and individual characteristics.

Policymakers may include SSI prevention into regular nursing curriculum by integrating international recommendations, including those from the World Health Organization (WHO) as well as the Centers for Disease Control and Prevention (CDC), into educational materials. This should be supplemented by comprehensive evaluation instruments, including practical assessments, objective organized clinical tests (OSCEs), as well as case-based debates, to assess students' comprehension and use of SSI prevention methodologies. Nursing educators must get training on the most recent SSI prevention measures to guarantee successful instruction and mentoring. By including these features, nursing education may provide prospective nurses with the skills necessary to apply best practices, therefore substantially alleviating the worldwide burden of SSIs.

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مراجعة شاملة لدور الممرضين الجراحيين في الوقاية من التهابات مواضع الجراحة: تقييم المعرفة والممارسات وآثارها على سلامة المرضى

المستخلص

الخلفية :تُعد التهابات مواضع الجراحة (SSIs) سببًا رئيسيًا للمراضة والمضاعفات المرتبطة بالرعاية الصحية، حيث تؤثر على ملايين المرضى الجراحيين عالميًا. وعلى الرغم من التقدم في تقنيات الجراحة وممارسات مكافحة العدوى، لا تزال SSIs شائعة، مما يستلزم استراتيجيات فعالة للوقاية، لا سيما في سياق التمريض.

المنهجية :تقوم هذه المراجعة بإجراء تحليل شامل للدراسات السابقة لتقييم معرفة الممرضين الجراحيين وممارساتهم فيما يتعلق بالوقاية من SSIs. تم البحث في عدة قواعد بيانات إلكترونية، بما في ذلك PubMed وWeb of Science وCochrane Central Register of Controlled Trials، عن الدراسات ذات الصلة المنشورة حتى يونيو 2023. ركز التحليل على تحديد الفجوات في معرفة الممرضين والعوامل المؤثرة في ممارساتهم المتعلقة بالوقاية من SSIs.

النتائج :أظهرت النتائج أن 62٪ فقط من الممرضين الجراحيين يمتلكون معرفة كافية حول الوقاية من SSIs عند تقييمهم على مقياس ثنائي. وعند استخدام مقياس ليكرت ثلاثي النقاط، انخفضت هذه النسبة إلى 46٪، بينما أظهر 27٪ مستوى فهم متوسط. كما كشف التحليل عن تباين كبير في مستويات المعرفة عبر مختلف المناطق، مما يبرز الحاجة إلى مبادرات تعليمية موجهة لتعزيز كفاءة الممرضين في مكافحة العدوى.

الاستنتاج :يشير القصور في معرفة الممرضين الجراحيين حول الوقاية من SSIs إلى فجوة حرجة في الممارسات الصحية قد تؤثر سلبًا على نتائج المرضى. تؤكد هذه المراجعة على ضرورة تحسين برامج التدريب والتعليم المستمر المصممة وفقًا لاحتياجات الممرضين. ومن خلال دمج الإرشادات القائمة على الأدلة في المناهج التمريضية والممارسات السريرية، يمكن للمؤسسات الصحية تقليل معدل SSIs بشكل كبير وتعزيز سلامة المرضى بشكل عام.

الكلمات المفتاحية :التهابات مواضع الجراحة، معرفة التمريض، الوقاية من العدوى، التحليل الشمولي، الممارسات الصحية.