Research Article Volume 01, Issue No. 01. 2024

The Medical Journal of Hospital Management and Health Law

Impact of Operating Room Nursing Management on Preventing Nosocomial Infections in Orthopedic Surgery: A Comprehensive Systematic Review

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Article History :
Received date : 2024/07/14
Revised date : 2024/08/19
Accepted date : 2024/09/24
Published date : 2024/10/07

ABSTRACT

Background: Nosocomial infections are a major challenge in hospital management, affecting patient outcomes and resources. Orthopedic surgery is particularly susceptible due to prolonged operation times, extensive wound surfaces, and allogeneic materials. This study aims to evaluate the impact of operating room nursing management on preventing nosocomial infections in orthopedic surgery. **Methods:** Following PRISMA 2020 guidelines, this systematic review focused exclusively on full-text articles published in English between 2014 and 2024. **Result:** The study conducted a comprehensive review of over 100 publications sourced from reputable databases, including ScienceDirect, SagePub, and PubMed. Following an initial screening, eight publications were identified as warranting more in-depth analysis. Consequently, a thorough review of these selected studies was performed to ensure a detailed and rigorous evaluation. **Conclusion:** Effective management of nosocomial infections in the operating room is crucial for postoperative recovery and patient care. Intervention strategies include preoperative management, intraoperative care, and postoperative nursing. Adherence to these measures can lead to higher nursing satisfaction and lower infection rates.

Keyword: hospital management, nosocomial infections, orthopedic surgery

INTRODUCTION

In recent years, nosocomial infections have emerged as a significant challenge for hospital management, particularly impacting patient outcomes and hospital resources.[1] Nosocomial infections, infections acquired by patients during their hospital stay or after discharge, but not present at admission, pose a serious threat to patient safety and recovery.[1,2] These infections can severely compromise surgical outcomes, extend recovery times, and increase the overall economic burden on healthcare systems. This issue is particularly acute in orthopedic surgery, where the risk of nosocomial infections is notably high due to factors such as prolonged operation times, extensive wound surfaces, and the use of allogeneic materials like bone grafts, bone cement, steel plates, screws, and artificial joints. The complexity of orthopedic procedures often leads to significant postoperative recovery periods, during which patients are immobilized and at greater risk for infections due to compromised blood supply to the surgical site.[3]

Several studies underscore the prevalence of nosocomial infections in orthopedic settings. Zhang et al. examined 9126 inpatients at Henan Provincial Orthopedic Hospital between 2009 and 2019, reporting an average infection rate of 1.96%.[4] Similarly, Qi et al. monitored 4022 patients undergoing fracture surgeries from 2009 to 2011 and found a nosocomial infection rate of 0.94%.[5] Common pathogens in orthopedic infections include coagulase-negative staphylococci, Staphylococcus aureus, and aerobic Gram-negative bacilli. These microorganisms can lead to various complications, including urinary tract infections and infected leg ulcers, further complicating patient recovery and management.[6]

Given the substantial impact of nosocomial infections, effective prevention strategies are crucial, especially in orthopedic surgery. Antibiotic prophylaxis and proper surgical practices are routinely employed to mitigate perioperative infections.[7] Studies have demonstrated that meticulous operating room care and effective nursing management can significantly reduce the incidence of nosocomial infections and enhance patient satisfaction.[8,9] However, a comprehensive

systematic evaluation of these interventions' clinical efficacy remains lacking. This study aims to address this gap by systematically evaluating the impact of operating room nursing management on preventing nosocomial infections in orthopedic surgery, to provide actionable insights to improve hospital practices and patient outcomes.

METHODS

Protocol

The investigation was conducted with rigorous adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines, ensuring strict compliance with established methodological standards. By adhering to PRISMA 2020 criteria, the study emphasizes a commitment to enhancing the clarity, replicability, and thoroughness of the review process. The research employed comprehensive methodologies for literature searches, data extraction, and synthesis of findings, effectively minimizing biases and reinforcing the robustness of the conclusions drawn. This meticulous approach underscores the study's dedication to upholding the highest standards of systematic review practice.

Criteria for Eligibility

This study provides an in-depth analysis of research conducted over the past decade regarding the impact of operating room nursing management on preventing nosocomial infections in orthopedic surgery. By systematically reviewing and integrating data from various studies, the research aims to identify key patterns and inform the enhancement of patient care strategies for this patient population with complex health needs.

The primary objective is to elucidate significant themes from a broad spectrum of scholarly literature, thereby deepening our understanding of how operating room nursing management influences the prevention of nosocomial infections in orthopedic settings. To ensure the rigor and accuracy of the study, stringent inclusion and exclusion criteria were applied. Only peer-reviewed articles published in English from 2014 to 2024 with a valid DOI were considered, thereby

confirming their credibility. Non-research materials such as reviews, editorials, and duplicate entries were deliberately excluded to maintain the focus and integrity of the analysis.

The systematic approach adopted in this study ensures that the data analyzed is both relevant and reliable, providing a robust foundation for deriving meaningful conclusions and advancing clinical practice in the prevention of nosocomial infections in orthopedic surgery.

Search Strategy

We utilized the keywords "hospital management" and "hospital policy" to conduct our search. Studies eligible for inclusion in the systematic review were identified through a comprehensive search of the PubMed, SagePub, and ScienceDirect databases.

Data retrieval

The authors conducted a meticulous preliminary review of each article by assessing its abstract and title to determine relevance before proceeding to a more in-depth analysis. Only those studies that met the study's objectives and adhered to the predefined inclusion criteria were advanced for further consideration. This approach facilitated the identification of clear and consistent patterns across the research.

To ensure linguistic consistency, only full-text articles published in English were included. A rigorous screening process was employed to select studies directly pertinent to the research focus and compliant with all inclusion criteria. Articles failing to meet these standards were systematically excluded from further analysis and were not incorporated into the final evaluation.

The evaluation process encompassed a thorough review of various elements, including study design, titles, authors, publication dates, research locations, and methodologies. This detailed approach ensured that the included content was of the highest relevance and quality, thereby reinforcing the robustness and reliability of the study's findings.

Quality Assessment and Data Synthesis

The authors conducted a meticulous initial review of each article's abstract and title to determine its suitability for further investigation. Following this preliminary screening, all articles deemed relevant were subjected to a thorough and detailed examination. This in-depth evaluation informed the selection of studies for the review, ensuring that only the most pertinent and high-quality research advanced to comprehensive analysis. This rigorous and systematic approach not only streamlined the selection process but also enabled a nuanced and thorough assessment of the existing research and its context.

Table 1. Search Strategy

Database	**Search Strategy**	***Hits***
Pubmed	*("hospital management" OR "hospital policy")*	4013
Science Direct	*("hospital management" AND "hospital policy")*	326
Sagepub	*("tonsilectomy" AND "children")*	102

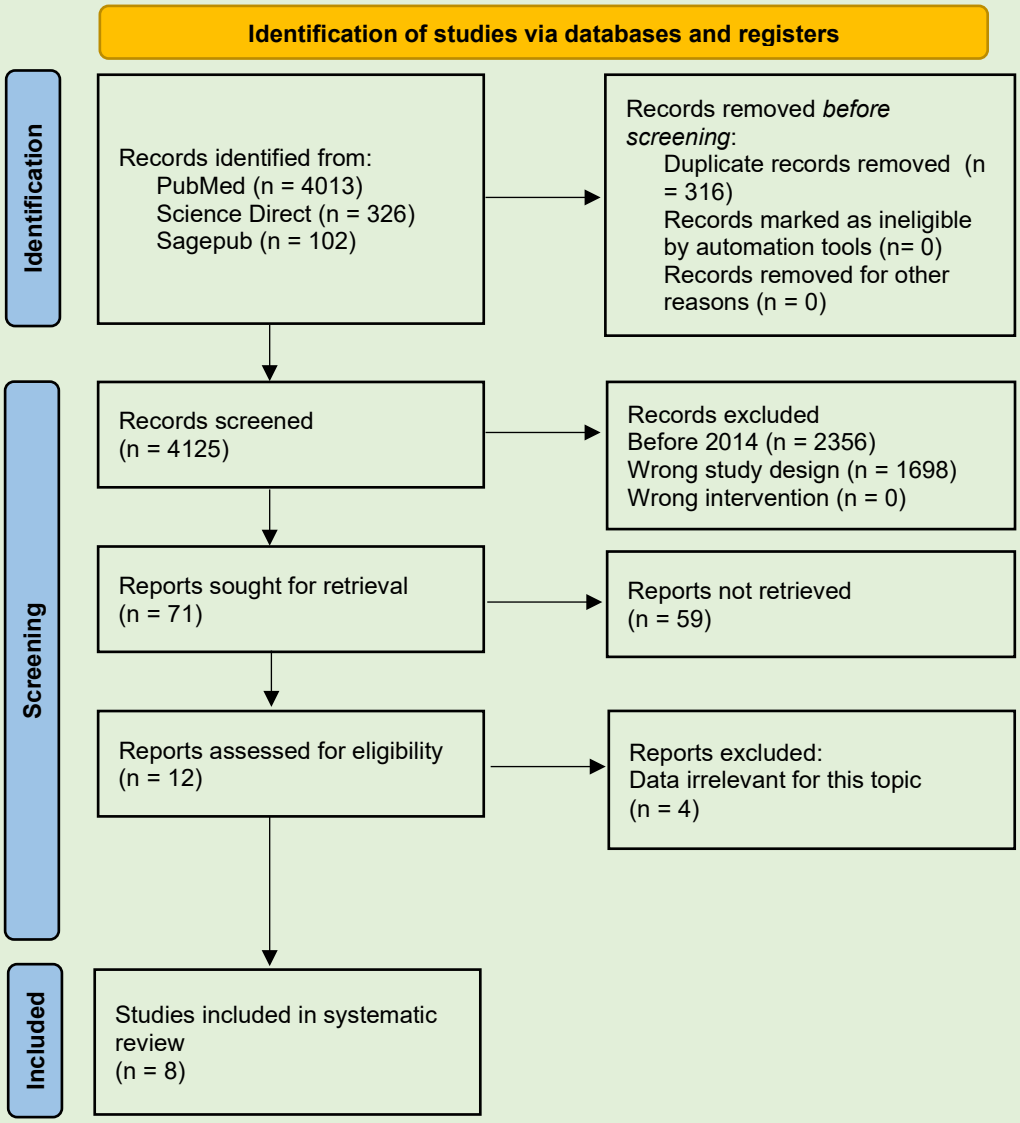

Figure 1. Article search flow chart

Table 2. Critical appraisal of Study

Parameters	(Yanling et al., 2016)	(Tianxiao et al., 2017)	(wen et al., 2017)	(Ruiling et al., 2018)	(Ta et al., 2018)	(Jing et al., 2019)	(Lei et al., 2019)	(Chao et al., 2020)
1. Bias related to temporal precedence								
Is it clear in the study what is the "cause" and what is the "effect" (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation								

Was there a control group?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Bias related to confounding factors								
Were participants included in any comparisons similar?	No	No	No	No	No	No	No	No
4. Bias related to administration of intervention/exposure								
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.	Yes.
5. Bias related to assessment, detection, and measurement of the outcome								
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were the outcomes of participants included in any comparisons measured in the same way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Were outcomes measured in a reliable way?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6. Bias related to participant retention								
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
7. Statistical conclusion validity								
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

RESULT

We commenced our investigation by systematically collecting a substantial number of papers from reputable databases, including ScienceDirect, PubMed, and SagePub. Following a rigorous three-stage screening process, we identified eight studies that were highly relevant to our systematic review. Each selected paper was then thoroughly examined, with specific topics chosen for in-depth analysis. To facilitate our study and provide clarity, we have summarized the key findings of the evaluated reports in Table 3.

Table 3. The literature included in this study

Author	Origin	Method	Sample	Result
Yanlin et al.[10] (2016)	China	RCT	310 participants	The experimental group received operating room nursing management, while the control group received routine nursing management. The experimental group experienced increased nursing satisfaction and reduced infection incidence, with statistically significant differences. The results suggest a potential intervention for improved patient care.
Tianxiao et al.[11] (2016)	China	RCT	126 participants	Routine nursing management went to the control group; operating room nursing management went to the experimental group. With statistically significant variations, the experimental group felt more satisfied with nurses and had lower infection incidence. The findings imply a possible intervention to guarantee better patient care.
Wen et al.[12] (2017)	China	RCT	100 participants	The review demonstrates the limited evidence base of studies that investigate delayed care and patient outcomes, which is primarily derived from self-reported data from nurses and patients. In order to substantiate the claim that adverse outcomes are linked to nurse staffing levels and skill mix as a consequence of delayed care, additional research that employs objective staffing and outcome measures is necessary.

Ruiling et al.[13] (2018)	Taiwan	RCT	85 participants	Operating Room (OR) nurse leaders should use the current findings as a benchmark for quality improvement initiatives within their hospitals, taking into account the unique characteristics of their local environments. While the study participants perceive the setting as safe and the quality of care as high, there remain opportunities to enhance workflows and processes. Specifically, improvements should focus on optimizing OR workflows and addressing potential patient safety concerns to further elevate the standard of care.
Ta et al.[14] (2018)	USA	RCT	144 participants	Experienced OTNs enhance patient safety in the operating theatre (OT) by managing risks, respecting patient vulnerability, navigating the perioperative process safely, and contributing to a safety culture. This involves attentiveness, careful preparation, use of protocols, and preventive measures. Both nontechnical and technical competencies are essential for enhancing patient safety in the OT.
Jing et al.[15] (2019)	China	RCT	86 participants	To ensure optimal patient outcomes, it is crucial to provide comprehensive preoperative and discharge

				instructions, including guidelines, medications, and postoperative care, as well as details on complications, treatment, tests, and post-discharge follow-up care.
Lei et al.[16] (2019)	Taiwan	RCT	78 participants	Enhancing patient safety applications in the operating room can be achieved through the implementation of educational programs, the development of an intuitive reporting system, the promotion of the reporting of medical errors, and the active involvement of healthcare professionals in decisions that may impact patient safety.
Chao et al.[17] (2020)	China	RCT	160 participants	The study results indicated that there was progress in the attitudes and opinions of operating teams regarding surgical safety in relation to the checklist response in the surveyed units. Nevertheless, there are challenges associated with its implementation, particularly in terms of surgeons' adoption of checklist use. New research is required to confirm the longevity of the surgical teams' shifts in attitudes in the institutions that were examined.

DISCUSSION

Operating room nursing management plays a pivotal role in the overall surgical process, significantly impacting postoperative recovery. This management is crucial in minimizing nosocomial infections, which have become a focal point in hospital administration, particularly within the realm of orthopedic surgery. Given that orthopedic procedures often exceed two hours, involve extensive surgical wounds, and require substantial rehabilitation, the risk of nosocomial infections is notably high. Such infections can exacerbate the patient's condition, extending hospital stays and increasing the economic, physical, and psychological burdens. Consequently, thorough investigation and implementation of effective infection control measures are essential, especially in orthopedic contexts.[18]

The intervention strategies examined in this study encompass three key areas: preoperative management, intraoperative care, and postoperative nursing. Preoperative measures involve a comprehensive assessment of patients, proactive management of underlying conditions, limiting personnel movement within the operating room, and disinfecting surgical instruments. During surgery, maintaining a sterile environment is crucial, which includes controlling the number of personnel present, ensuring proper distance between team members, and adhering to strict hygiene protocols to prevent infection. Postoperatively, vigilant monitoring of vital signs, careful handling of surgical incisions, regular wound inspections, timely medication adjustments, and prompt response to signs of infection are critical. An analysis of 20 studies revealed that the experimental group, which adhered to these intervention measures, showed higher nursing satisfaction and lower infection rates compared to the control group.[19]

Further research has introduced specific principles and models aimed at improving operating room nursing practices. Chunhua et al. advocated for the 10S management approach, which includes principles such as sort (SEIRI), set in order (SEITON), sustain (SHITSUKE), standardize (SEIKETSU), sweeping (SEISO), saving (SAVING), safety (SAFETY), habit (SHIKUKAN), adherence (SHIKOKU), and speed (SPEED).[20] Fu et al. demonstrated that implementing failure mode and effect analysis (FMEA) during surgery could effectively standardize medical staff processes, enhance operating room quality, and improve

patient safety.[21] Waiwai et al. highlighted the effectiveness of the PDCA (Plan-Do-Check-Act) cycle management method in reducing adverse reactions and increasing patient satisfaction.[22] Despite these advances, practical issues such as resource allocation and the effectiveness of nursing management systems need further development tailored to real-world conditions.

This meta-analysis has several limitations. Firstly, all included studies were sourced from Chinese literature, potentially introducing language bias and limiting the generalizability of the findings. Secondly, the study timeframe was relatively short, and only 20 articles were analyzed, resulting in a smaller sample size that might affect the robustness of the results. Additionally, the methodology of many studies did not specify the grouping techniques used, making it difficult to ascertain whether randomization was applied. Lastly, the lack of blinding in the studies, compounded by the nature of surgical interventions, may influence the outcome measures, as different surgical techniques could impact the results.[19]

These limitations suggest the need for more diverse and extensive research to validate the findings and enhance the applicability of operating room nursing management strategies across different settings. Future studies should aim to include a broader range of literature from various geographic locations, utilize larger sample sizes, and incorporate rigorous methodologies to reduce potential biases and improve the overall understanding of effective infection control practices in orthopedic surgery.

CONCLUSION

Nosocomial infections are a significant concern in the operating room, especially in orthopedic surgery. Effective management of these infections is crucial for postoperative recovery and patient care. Intervention strategies include preoperative management, intraoperative care, and postoperative nursing. Adherence to these measures can lead to higher nursing satisfaction and lower infection rates. However, limitations such as language bias, small sample sizes, and

lack of blinding in studies suggest the need for more diverse research to validate findings and improve infection control practices in orthopedic surgery.

DISCLOSURE STATEMENT

Disclosure Statement: The authors have no conflicts of Interest to declare.

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