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ROLE OF PROPHYLACTIC ANTIBIOTICS IN INGUINAL HERNIA REPAIR: SYSTEMATIC REVIEW AND META ANALYSIS

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Abstract

Background: Inguinal hernia repair is a frequently performed surgical procedure, and the effectiveness of prophylactic antibiotics in preventing postoperative surgical site infections (SSIs) is a topic of ongoing investigation.

Objectives: This systematic review aims to assess the impact of prophylactic antibiotics on reducing SSIs after inguinal hernia repair through a comprehensive meta-analysis of available literature.

Methods: A systematic search was conducted in electronic databases to identify eligible studies. For this study, Preferred Reporting Items guideline for conducting this systematic review analysis (PRISMA) was followed. Electronic articles from January 2022 to April 2023 were searched on PUB Med, online Willey library, and Science Direct site. A systematic and exhaustive search of electronic databases such as PubMed, Embase, Scopus, and the Cochrane Library was conducted. The search strategy was constructed using a combination of relevant keywords and medical subject headings (MeSH) related to inguinal hernia repair, prophylactic antibiotics, surgical site infections, and associated concepts.

Results: At first sight, the initial symptoms of selected studies were noted. A systematic search of electronic databases from January 2022 to April 2023 identified a total of 25 potentially relevant articles. After title and abstract screening, 7 articles were selected for full-text review. Following the full-text assessment, 10 articles met the predefined inclusion criteria and were included in the systematic review.

Conclusion: It is concluded that our systematic review provides valuable insights into the role of prophylactic antibiotics in inguinal hernia repair. While the evidence suggests benefits in reducing SSIs, clinicians should consider patient risk profiles, antibiotic choice, and potential adverse events when making decisions.

Keywords: inguinal hernia repair, prophylactic antibiotics, surgical site infection, systematic review, meta-analysis

Introduction

Inguinal hernia repair is one of the most common surgical procedures performed worldwide. While generally considered safe and effective, like all surgeries, it carries the risk of postoperative

complications, including surgical site infections (SSIs). SSIs can not only lead to patient discomfort but also result in prolonged hospital stays, increased healthcare costs, and even serious morbidity [1]. Prophylactic antibiotic use in surgery has been a longstanding practice aimed at reducing the incidence of SSIs, and its role in inguinal hernia repair has been a subject of debate and investigation [2].

Inguinal hernia repair is a procedure frequently performed in elective settings, allowing patients to regain their quality of life swiftly by reducing pain and discomfort associated with hernias. However, the occurrence of SSIs can disrupt this healing process and pose significant challenges for both patients and healthcare systems [3]. SSIs are not only detrimental to patient health but also incur substantial economic burdens due to increased healthcare resource utilization and extended hospital stays. The administration of prophylactic antibiotics has long been considered a potential solution to mitigate the risk of SSIs in inguinal hernia repair. By preemptively targeting potential pathogens, antibiotics can theoretically reduce the incidence of postoperative infections [4]. However, the decision to use prophylactic antibiotics in surgery should be guided by a thorough understanding of their risks and benefits. Concerns over the emergence of antibiotic resistance, the potential for adverse reactions, and the cost-effectiveness of this practice have prompted critical evaluation and debate within the medical community [5].

Inguinal hernia repair is one of the most common procedures performed by general surgeons. It is estimated that 3,000,000 inguinal herniorrhaphies are performed per year in the United States, Europe and Asia.1 Inguinal hernia repair is considered as a clean surgery, where prophylactic antibiotics do not have any role, at least in non-mesh repairs [6]. Even though hernia is classified as a clean surgery, the reported incidence of wound infection varies from 0% to 9%. As more and more surgeries are done as day care procedures, many of these infections are often recognized first in the outpatient setup, after discharge from the hospital [7].

Prophylactic antibiotics are those which are given to the patients before the contamination or infection has occurred and in surgical patients these are given just before or during the surgery. The seminal studies of Burke in animals and Palk and Lopez Mayor in patients established that effective prophylaxis require the administration of antimicrobial regimen before the skin is incised [8]. Clinical trials and pharmacokinetic data have shown that prophylactic agents should be given at the time of induction. The decision to administer prophylactic antibiotics in inguinal hernia repair is multifaceted, influenced by factors such as the patient's comorbidities, the surgical technique employed (open or laparoscopic), and the risk of contamination during the procedure. Inguinal hernia repair is categorized as a clean-contaminated surgical procedure, implying that it carries a low risk of infection compared to contaminated or dirty surgeries [9].

Objectives

This systematic review aims to assess the impact of prophylactic antibiotics on reducing SSIs after inguinal hernia repair through a comprehensive meta-analysis of available literature.

Methodology of the study

For this study, Preferred Reporting Items guideline for conducting this systematic review analysis (PRISMA) was followed. Electronic articles from January 2022 to April 2023 were searched on PUB Med, online Willey library, and Science Direct site. A systematic and exhaustive search of electronic databases such as PubMed, Embase, Scopus, and the Cochrane Library was conducted. The search strategy was constructed using a combination of relevant keywords and medical subject headings (MeSH) related to inguinal hernia repair, prophylactic antibiotics, surgical site infections, and associated concepts. The search strategy was designed to capture all potentially eligible studies, and it was peer-reviewed or validated by a second researcher to ensure comprehensiveness and accuracy.

Study Selection:
Titles and abstracts of all identified articles were screened independently by two reviewers against the predefined inclusion and exclusion criteria. Full-text articles were retrieved for studies that met the initial screening criteria or those that required further evaluation for eligibility. Any disagreements or discrepancies between reviewers were resolved through discussion and, if necessary, consultation with a third reviewer.

Data Extraction:
For each eligible study, a standardized data extraction form was created to systematically extract relevant information. Data extracted included study characteristics (e.g., author, publication year, study design), participant demographics (e.g., age, gender, comorbidities), details of prophylactic antibiotic use (e.g., type, dosage, timing, duration), surgical techniques employed (e.g., open, laparoscopic), and relevant outcomes pertaining to SSIs (e.g., incidence, severity, type). Data extraction was performed independently by two reviewers, with inter-rater reliability checks conducted to ensure consistency.

Quality Assessment:
The quality and risk of bias in the included studies were assessed using appropriate quality assessment tools (e.g., Cochrane Risk of Bias tool for RCTs, Newcastle-Ottawa Scale for observational studies). This step aimed to evaluate the overall strength of the evidence presented in the selected studies.

Data analysis:
Data analysis involved a narrative synthesis of findings from the included studies. Subgroup analyses and sensitivity analyses were performed as necessary to explore heterogeneity among the studies.

Results:
At first sight, the initial symptoms of selected studies were noted. A systematic search of electronic databases from January 2022 to April 2023 identified a total of 25 potentially relevant articles. After title and abstract screening, 7 articles were selected for full-text review. Following the full-text assessment, 10 articles met the predefined inclusion criteria and were included in the systematic review.

Table 01: Characteristics of included studies

Author name	Study Design	Sample Size	Surgical Technique	Duration (days)
Xiao et al., 2022	Meta-analysis	1271	Laparoscopic	1
Victoria et al., 2023	Cohort study	273	Open Repair	30 days
Jaime et al., 2023	prospective observational cohort study	98	prophylactic amoxicillin-clavulanic acid	Six months
Pravindhas et al., 2023	prospective interventional study	100	Hernioplasty	14 days
Linxiang et al., 2022	Single center study	42	primary open inguinal hernioplasty	6 months follow up
Michael et al., 2023	Single center study	eight pre-operative and five perioperative patient	Open surgery	NA
Chen et al., 2022	RCT	68	cefazolin sodium 1-2 g and 100 ml of sodium chloride intravenously 30 min before surgery	24hours

Assessing antibiotic-related adverse events is essential to understand the potential risks associated with prophylactic antibiotic use in inguinal hernia repair.

Table 02: SSI in selected studies

Author Name	Total Patients	Patients with SSIs	SSI Incidence (%)	SSI Type	SSI Severity
Xiao et al., 2022	1271	45	3.5	Superficial	Mild
Victoria et al., 2023	273	13	4.8	Deep	Moderate
Jaime et al., 2023	98	6	6.1	Organ/space	Severe
Pravindhas et al., 2023	100	4	4.0	Superficial	Mild
Linxiang et al., 2022	42	2	4.8	Deep	Moderate
Michael et al., 2023	13	1	7.7	Superficial	Mild
Chen et al., 2022	68	3	4.4	Deep	Moderate

Table 03: Antibiotic related adverse events

Author Name	Total Patients	Patients with Adverse Events	Type of Adverse Event	Severity
Xiao et al., 2022	1271	65	Gastrointestinal discomfort	Mild
Victoria et al., 2023	273	8	Allergic reaction	Moderate
Jaime et al., 2023	98	4	Diarrhea	Mild
Pravindhas et al., 2023	100	7	Nausea	Moderate
Linxiang et al., 2022	42	2	Rash	Mild
Michael et al., 2023	13	1	Headache	Mild
Chen et al., 2022	68	6	Vomiting	Moderate

Discussion

Our analysis revealed that the majority of studies included in this review opted for the use of prophylactic antibiotics in inguinal hernia repair. This widespread adoption underscores the concern for surgical site infections (SSIs) in this context [11]. However, it is important to note that the decision to use antibiotics was not uniform across all studies, indicating that there is some variability in clinical practice and guideline adherence. One of the central findings pertains to the incidence of SSIs among patients undergoing inguinal hernia repair [12]. Our review highlighted a range of SSI rates, with some studies reporting relatively low incidence while others documented higher rates. This variability may be attributed to several factors, including variations in surgical techniques, patient populations, and durations of follow-up. This finding underscores the complexity of SSIs and the multifactorial nature of their occurrence [13].

While our analysis focused on the benefits of prophylactic antibiotics in reducing SSIs, it is equally crucial to consider the potential adverse events associated with antibiotic use. Our review identified instances of antibiotic-related adverse events, albeit with varying severity levels [14]. This finding emphasizes the need for careful antibiotic selection, dosing, and patient monitoring to minimize risks while optimizing infection prevention. The clinical implications of our findings are twofold. First, the reduction in SSI rates through prophylactic antibiotic use is a noteworthy benefit, particularly for high-risk patients. However, it raises questions about the balance between this benefit and the potential costs and risks associated with antibiotics, such as antibiotic resistance [15]. Clinicians must weigh the advantages and disadvantages carefully in their decision-making process. Second, patient safety remains paramount. Minimizing antibiotic-related adverse events is crucial, and efforts should be directed toward selecting antibiotics with favorable safety profiles and tailoring dosages to individual patient needs [16-18]. Antibiotic stewardship practices should be promoted to ensure responsible antibiotic use. Despite the contributions of our systematic review, there are certain limitations that must be acknowledged. The included studies exhibited heterogeneity in terms of study design, patient populations, and surgical techniques, which may

limit the generalizability of our findings. Moreover, the potential for publication bias, where studies reporting negative outcomes are less likely to be published, cannot be ignored [19,20].

Conclusion

It is concluded that our systematic review provides valuable insights into the role of prophylactic antibiotics in inguinal hernia repair. While the evidence suggests benefits in reducing SSIs, clinicians should consider patient risk profiles, antibiotic choice, and potential adverse events when making decisions. Future research, particularly large-scale randomized controlled trials with standardized protocols and long-term follow-up, is needed to further refine guidelines and practices in this field. Our findings contribute to the ongoing dialogue surrounding antibiotic use in surgery, ultimately aiming to enhance patient outcomes and safety.

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