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Original Research Article

A Retrospective Cohort to Study the Postoperative Infections and Antimicrobial Therapy in Surgical patients

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Abstract:

Background & Methods: This Retrospective Cohort aims to Evaluate Postoperative Infections and Antimicrobial Therapy. This Retrospective Cohort study Examines Post-operative Infections and Antimicrobial therapy by analysing reports of patients from 01/01/2024 to 31/08/2024. Antimicrobial susceptibility pattern of isolated bacterial pathogens was performed according to the guidelines. Inoculum was prepared by picking parts of two or three identical colonies with a sterile wire loop.

Results: Patient characteristics associated with harboring antimicrobial drug resistant pathogens. MRSA was more likely to be isolated from patients with antimicrobial exposure within one month and those with hospitalization history within six months than those with no such history. However, this difference was not statistically significant ($p>0.05$).

Conclusion: We found most of the Gram negative isolates were multiply resistant to commonly prescribed antimicrobial agents. The present study also found an increase in SSIs due to ESBLs producing Esherichia coli strains as well as MRSA. Ceftriaxone, a third generation cephalosporins commonly used for antimicrobial prophylaxis to prevent SSIs was found to be ineffective against most of gram negative organisms and MRSA isolates.

Keywords: Postoperative Infections & Antimicrobial Therapy.

Study Design: Retrospective cohort study.

Introduction

Surgical site infection (SSI) is defined as an infection occurring within 30 days after a surgical operation (or within 1 year if an implant is left in place after the procedure) and affecting either the incision or deep tissues at the operation site [1]. These infections may be superficial or deep incisional infections or involve organ or body space. SSIs are among the most common complications for surgical patients and represent the third most frequently reported nosocomial infection in hospitals [2]. The incidence of SSIs varies globally, with rates ranging from 2-5% in developed countries to 20-30% in low and middle-income settings [3]. SSIs are associated with increased morbidity, mortality, prolonged hospital stays, and higher costs of patient care.

Despite advances in infection control practices, such as improved operating room ventilation, sterilization methods, and surgical techniques, SSIs remain a significant issue due to the emergence of antimicrobial-resistant pathogens [4]. The World Health Organization (WHO) has highlighted the global threat posed by antimicrobial resistance, urging better use of antibiotics and the development of new strategies to combat resistance [5]. Antibacterial drugs play a crucial role in preventing infections, but their excessive use has accelerated resistance, complicating the treatment of SSIs [6]. In particular, resistance patterns have been observed in bacteria like *Escherichia coli*, *Staphylococcus aureus*, and *Klebsiella pneumoniae*, complicating therapeutic management of these infections [4].

Antibiotic prophylaxis is a cornerstone in preventing SSIs, aiming to achieve effective tissue concentrations during surgery [7]. However, the inappropriate use of antibiotics can lead to resistance, making it essential to balance their benefits and potential risks [8]. This study seeks to evaluate the incidence of postoperative infections and antimicrobial therapy, focusing on the prevalence of resistant bacterial strains and their implications for surgical outcomes.

Material and Methods

A retrospective cohort design was chosen due to the availability of extensive records on past surgical patients, allowing for a comprehensive analysis of infection outcomes and antimicrobial resistance patterns.

In Present study data of surgical patients presented between 01/01/2024 and 31/08/2024 at Pacific Medical College and hospital, Udaipur was reviewed and total 100 cases were selected from medical records of patients who underwent surgery during this period according to specific criteria. Antimicrobial susceptibility pattern of isolated bacterial pathogens was performed according to the guidelines. Inoculum was prepared by picking parts of two or three identical colonies with a sterile wire loop. This was suspended in sterile peptone water (broth) and incubated up to two hours to allow organisms to reach their log phase of growth.

Structured questionnaires were used to extract data from the patients case notes; the information included were; demographic data, existing chronic disease (such as diabetes mellitus), past medical history, current drug use such as steroid, smoking, length of preoperative hospital stay, duration of operation and antimicrobial prophylaxis. Physical examination was done to determine location of the wounds.

Inclusion Criteria

Inclusion criteria included patients of all age groups who underwent surgery and had complete medical records available, indicating postoperative infection status.

a. Patients of all age groups except neonates

b. Presence of post-operative SSIs

Exclusion Criteria

Patients with incomplete medical records or those lost to follow-up were excluded

a. Neonates
b. Infection occurring 30 days after operation if no implant is in place
c. Infection on episiotomy
d. Burn injuries and donor sites of split skin grafts
e. Procedures in which healthy skin was not incised such as opening abscess

Result

Table 1: Demographic and clinical characteristics of patients

S. No.	Sex	No.	Percentage
1	Male	51	51
2	Female	49	49
	Type of surgery		
1	Emergency	77	77
2	Elective	23	23
	Type of incision		
1	Clean	31	31
2	Clean contaminated	04	04
3	Contaminated	37	37
4	Dirty	28	28

Age Mean 36.7±2.1

Table 2: Frequency of pathogenic bacterial isolates from post-operative wound infections in various surgical specialties

S. No.	General Surgery	No.	Percentage	P Value
1	***Staphylococcus aureus***	02	02	0.047
2	***Escherichia coli***	16	16	
3	***Klebsiella peumoniae***	16	16	
4	***Proteus mirabilis***	14	14	
5	***P. aureginosa***	16	16	
6	***Acinetobacter spp***	11	11	
7	**GPC**	11	11	
8	**GNR**	14	14	
	Total	100	100	

The frequency of pathogenic bacterial isolates in relation to type of operation. The majority of the isolates were from surgical debridement and external fixation procedures accounting for 44/147(30%). Among these S. aureus was the most prevalent organism at 9/44(20%) isolates. Of note is the observation that Pseudomonas aeruginosa was the most common organism isolated from post caesarian section wounds at 4/17(24%). Escherichia coli and Pseudomonas aeruginosa were the most common isolates from post laparotomy wounds.

Table 3: Antimicrobial resistance patterns of gram positive bacterial isolates

S. No.	General Surgery	S.aureus (%)	MRSA (%)
1	Gentamycin	33	75
2	Ceftriaxone	47	100
3	Ciprofloxacin	29	57
4	Ampicillin	92	-
5	Amoxy/clav	73	-
6	Cotrimoxazole	35	75
7	Chloramphenicol	20	50
8	Penicillin	83	-

All Enterobacteriaceae isolates showed high resistance to multiple antimicrobial agents tested but all were highly sensitive.

Table 4: Antimicrobial resistance pattern

S. No.	Antibiotics	ESBLs-*E.coli* %	P Value
1	Gentamycin	92	0.031
2	Ceftriaxone	100	
3	Ciprofloxacin	50	
4	Ampicillin	100	
5	Amoxy/clavul	92	
6	Cefotaxime	100	
7	Ceftazidime	100	
8	Imipenem	00	

Patient characteristics associated with harboring antimicrobial drug resistant pathogens. MRSA was more likely to be isolated from patients with antimicrobial exposure within one month and those with hospitalization history within six months than those with no such history. However, this difference was not statistically significant (p>0.05).

Discussion

Advantages and Limitations of choosing Retrospective Cohort as study design.

Advantages: It allowed the study of a larger cohort over a longer period or provided access to rare outcomes.

Limitations: Incomplete data, or the inability to control for confounding variables.

This pattern of organisms causing SSIs in the current study is in contrast with previous studies from the same study setting and elsewhere within the region, which reported *Staphylococcus aureus* as the most common SSI bacterial pathogen [9]. The possible reason for variation in these studies could be attributed to differences in the populations investigated; diversity of surgical procedures

performed on the study participants, as well as timing of specimen collections. In the present study, the majority of the isolates were obtained from patients who were already on antimicrobial treatment, and this could have led to the low recovery of antimicrobial-susceptible Gram-positive pathogens. This finding may demonstrate a relative shift in etiological agents causing SSIs, as recent studies from Western Africa and Asian countries have reported an increasing trend of *Pseudomonas aeruginosa* and other enteric Gram-negative rods as common organisms causing SSIs [10]. There are multiple factors that could have contributed to the high proportion of infections due to Gram negative pathogens in this study. A recent review has reported that hands of health care workers and patients can play a role in transfer of Gram negative bacteria during cross infection [11].

Furthermore, the study highlights the growing concern over antimicrobial resistance, which remains a critical challenge in managing SSIs. The presence of drug-resistant strains like ESBL-producing *Escherichia coli* and MRSA suggests that conventional prophylactic measures may need reconsideration. This aligns with global observations emphasizing the need for updated antibiotic stewardship programs and the judicious use of prophylactic antibiotics. Implementing more precise infection control protocols could help to mitigate the spread of these resistant organisms in clinical settings [12]. Additionally, the role of hospital hygiene practices and patient education in reducing SSIs cannot be underestimated, as the transmission of resistant pathogens often involves lapses in infection control measures.

Study attempted to describe patient's characteristics associated with harboring antimicrobial-resistant pathogens, such as previous antimicrobial exposure, previous hospitalization, and diabetes mellitus. In the present study, previous antimicrobial exposure within one month and hospitalizations within six months were not associated with harboring MRSA. These findings differ from those of a previous study, which reported an association between previous antimicrobial exposure and hospitalization with isolation of MRSA. The lack of association in the present study could partly be attributed to the small number of MRSA isolates and differences in study design [13].

Our findings from this retrospective cohort study provide insights into the prevalence of postoperative infections and the challenges of antimicrobial resistance, reinforcing the need for updated protocols based on historical trends Conclusion

We found that most of the Gram-negative isolates were multiply resistant to commonly prescribed antimicrobial agents. The present study also found an increase in SSIs due to ESBL-producing *Escherichia coli* strains as well as MRSA. Ceftriaxone, a third-generation cephalosporin commonly used for antimicrobial prophylaxis to prevent SSIs, was found to be ineffective against most Gram-negative organisms and MRSA isolates. These findings highlight the growing challenge of antimicrobial resistance in surgical settings, emphasizing the need for updated antimicrobial stewardship programs to guide prophylactic use and treatment protocols effectively [14].

Additionally, the retrospective nature of this study allowed us to analyze a wide range of patient cases, providing a clearer understanding of trends in resistance patterns over time. Our findings underscore the importance of tailoring antibiotic prophylaxis based on local resistance data to enhance patient outcomes and minimize the risk of resistant infections. This approach could lead to more targeted therapies, ultimately reducing the incidence of SSIs and improving recovery times for patients. Future research should focus on prospective studies and multi-center analysis to validate these observations and guide clinical practices further.

Conclusion

We found most of the Gram negative isolates were multiply resistant to commonly prescribed antimicrobial agents. The present study also found an increase in SSIs due to ESBLs producing Esherichia coli strains as well as MRSA. Ceftriaxone, a third generation cephalosporins commonly used for antimicrobial prophylaxis to prevent SSIs was found to be ineffective against most of gram negative organisms and MRSA isolates.

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