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Evaluation of Antibiotic Utilization Trends in the Surgical Department of a Tertiary Care Hospital

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ABSTRACT:

BACKGROUND: Rational use of antibiotics is essential in surgical settings to prevent post-operative infections and minimize the development of antimicrobial resistance. This study aimed to evaluate the patterns of antibiotic utilization in the surgical department of a tertiary care hospital. **METHODS:** A prospective observational study was conducted over six months (November 2023–April 2024) in the surgery department of Government Cuddalore Medical College and Hospital. **RESULTS:** A total of 105 surgical inpatients were analyzed, with males (62.9%) outnumbering females (37.1%). The most affected age group was 51–60 years (24.8%). Appendicitis (23.8%) and hernia (20%) were the leading surgical diagnoses. Cefotaxime was the most frequently prescribed antibiotic across all conditions. Monotherapy was used in 42.4% of cases, while combination and multi-drug therapies accounted for 39.5% and 18.1%, respectively. Intravenous administration was predominant (91.5%), and the average duration of antibiotic therapy was 7.23 days**. CONCLUSION:** Cephalosporins, particularly cefotaxime, were the most frequently prescribed antibiotics in surgical patients. Most antibiotics were administered intravenously. Overall, prescribing patterns were appropriate, but continuous audits and antimicrobial stewardship initiatives are recommended.

Keywords: Antibiotics, Drug utilization, Surgery, Cefotaxime.

INTRODUCTION:

Antibiotics have revolutionized modern medicine by significantly reducing morbidity and mortality associated with infectious diseases [1]. In surgical settings, their use is particularly critical—both for prophylaxis against surgical site infections (SSIs) and for the treatment of postoperative complications. However, the widespread and often inappropriate use of antibiotics has led to a growing public health concern: antimicrobial resistance (AMR). The World Health Organization (WHO) identifies AMR as one of the top ten global health threats, emphasizing the urgent need for rational antibiotic prescribing across all healthcare levels [2].

Surgical departments are especially high-risk areas for irrational antibiotic use due to empirical prescribing, pressure to prevent infections, and inadequate adherence to guidelines. Multiple studies have reported that inappropriate selection, dosing, timing, and duration of antibiotics contribute significantly to resistance patterns, prolonged hospital stays, and increased healthcare costs [3,4]. In India, the problem is compounded by factors such as over-the-counter antibiotic availability, inconsistent compliance with the *National Treatment Guidelines for Antimicrobial Use in Infectious Diseases*, and a lack of routine monitoring in tertiary care hospitals [5]. Surveillance data indicate rising resistance to commonly used antibiotics like cephalosporins and fluoroquinolones, particularly in surgical settings.

Drug Utilization Evaluation (DUE) studies are valuable tools for assessing and optimizing medication use patterns. These studies help identify inappropriate prescribing behaviors and support antimicrobial stewardship efforts aimed at improving outcomes and minimizing resistance [6]. By evaluating antibiotic utilization trends—especially in high-consumption areas like surgery—healthcare systems can develop targeted interventions to promote evidence-based prescribing and reduce AMR risks.

This study aims to assess antibiotic prescribing trends in the surgical department of a tertiary care hospital. It focuses on the types, frequency, and duration of antibiotics used, and evaluates their appropriateness based on established guidelines.

MATERIALS AND METHODS:

This prospective observational study was conducted in the Department of General Surgery at Government Cuddalore Medical College and Hospital (GCMCH), Tamil Nadu, India, over a six-month period from November 2023 to April 2024. Prior to initiation, the study received approval from the Institutional Review Board and Ethics Committee. The primary objective of this study was to assess the pattern of antibiotic use among patients undergoing surgical procedures. Participants were selected based on the following criteria.

Inclusion Criteria:

- Patients aged between 20 and 80 years.
- Patients undergoing surgical procedures.
- Patients who received at least one course of antibiotic therapy during hospitalization.

Exclusion Criteria:

- Pediatric and pregnant patients.
- Patients with known allergies or contraindications to antibiotics.
- Patients discharged before completion of the observation period.

Data were collected using a structured proforma, including details such as patient demographics, diagnosis, type of surgery, and specifics of antibiotic therapy (drug name, class, dosage, frequency, route of administration, duration, and timing—pre- or post-operative). The collected data were entered into Microsoft Excel and analyzed using descriptive statistics. The study complied with the institution's ethical guidelines. Informed consent was obtained from all participating patients, and confidentiality was maintained throughout the study.

RESULTS:

A total of 105 patients admitted to the surgery department were prospectively evaluated over the study period. Of these, 66 patients (62.9%) were male and 39 (37.1%) were female (Table 1). The majority of patients were in the 51–60 years age group (26 patients, 24.8%), followed by 24 patients (22.9%) in the 21–30 years range. Other age group distributions included 22 patients (21.0%) aged 41–50 years, 17 patients (16.2%) aged 31–40 years, 13 patients (12.4%) in the 61–70 years group, and 3 patients (2.9%) aged 71–80 years (Table 2).

Diagnosis-wise, the most common conditions encountered were appendicitis (25 cases, 23.8%), hernia (21 cases, 20%), diabetic foot ulcers (16 cases, 15.2%), and abscesses (11 cases, 10.5%). Other surgical indications included hemorrhoids (10 cases, 9.6%), cellulitis (9 cases, 8.6%), hydrocele (8 cases, 7.6%), and a small proportion of miscellaneous conditions comprising 5 cases (4.7%) (Table 3).

A total of 422 antibiotics were prescribed for the 105 patients during the entire surgical stay, yielding an average of approximately 4.02 antibiotics per patient. The most frequently prescribed class of antibiotics was cephalosporins, accounting for 178 prescriptions (42.2%), followed by nitroimidazoles (89, 21.1%), aminoglycosides (79, 18.7%), and penicillins (48, 11.4%). Other antibiotics included fluoroquinolones (22, 5.2%), oxazolidinones (5, 1.2%), and lincosamides (1, 0.2%) (Table 4).

Of the total 422 antibiotics prescribed, 167 (39.6%) were administered pre-operatively, while 255 (60.4%) were given post-operatively. The most extensively prescribed antibiotic was cefotaxime, which appeared in 81 pre-operative prescriptions (48.5%) and 76 post-operative prescriptions (72.4%) (Table 5). This indicates the dominance of cefotaxime in both prophylactic and therapeutic applications in surgical care.

Regarding the type of antibiotic therapy, monotherapy was the most common during the pre-operative phase, used in 63 patients (60.0%), while combination therapy was prescribed in 31 patients (29.5%), and triple therapy in 11 cases (10.5%). Post-operatively, combination therapy was the most prevalent, used in 52 patients (49.5%), followed by triple therapy in 27 patients (25.7%), and monotherapy in 26 cases (24.8%) (Table 6). The route of administration was predominantly intravenous, with 386 antibiotics

(91.5%) administered via the IV route. Only 36 antibiotics (8.5%) were given exclusively via the oral route, both pre- and post-operatively (Table 7). The average duration of antibiotic therapy across patients was 7.23 days, with a minimum duration of 3 days and a maximum of 17 days. Most therapies fell within a 5–10 days period, and the estimated standard deviation was ±3.4 days.

Table 1: Gender wise distribution

Gender	No. of patients	Percentage
Male	66	62.9%
Female	39	37.1%
Total	105	100%

Table 2: Age wise distribution

Age Group	No. of patients	Percentage
21-30	24	22.9%
31-40	17	16.2%
41-50	22	21.0%
51-60	26	24.8%
61-70	13	12.4%
71-80	3	2.9%

Table 3: Diagnosis wise distribution

Diagnosis	No. of patients	Percentage
Appendicitis	25	23.8%
Hernia	21	20.0%
Diabetic Foot Ulcer	16	15.2%
Abscess	11	10.5%
Hemorrhoids	10	9.6%
Cellulitis	9	8.6%
Hydrocele	8	7.6%
Others	5	4.7%

Table 4: Prescription pattern of antibiotics based on class

Category	No. of drugs	Percentage
Cephalosporin	178	42.2%
Nitroimidazoles	89	21.1%
Aminoglycosides	79	18.7%
Penicillin	48	11.4%
Fluoroquinolones	22	5.2%
Oxazolidinones	5	1.2%
Lincosamide	1	0.2%
Total	**422**	**100%**

Table 5: Prescribing pattern of pre- and post-operative antibiotics

Antibiotics	Pre-operative n (%)	Post-operative n (%)
Cefotaxime	81 (48.5%)	76 (72.4%)
Ceftriaxone	10 (5.9%)	8 (7.6%)
Cefoperazone+sulbactam	1 (0.6%)	1 (1.0%)
Cefpodoxime	-	1 (1.0%)
Metronidazole	28 (16.8%)	61 (58.1%)
Gentamicin	17 (10.2%)	44 (41.9%)
Amikacin	7 (4.2%)	11 (10.5%)
Piperacillin + Tazobactam	9 (5.4%)	12 (11.4%)
Ampicillin	4 (2.4%)	19 (18.1%)
Amoxicillin	1 (0.6%)	3 (2.9%)
Ciprofloxacin	9 (5.4%)	13 (12.4%)
Linezolid	-	5 (4.8%)
Clindamycin	-	1 (1.0%)
TOTAL	**167 (100%)**	**255 (100%)**

Table 6: Distribution of patients based on types of therapy

Types Of Therapy	Pre-operative n (%)	Post-operative n (%)
Monotherapy	63 (60.0%)	26 (24.8%)
Combination Therapy	31 (29.5%)	52 (49.5%)
Triple Therapy	11 (10.5%)	27 (25.7%)

Table 7: Distribution of drugs based on route of administrations

Route of administrations	No. of drugs (Pre + Post)	Percentage
Iv	386 (157+229)	91.5%
Oral	36 (10+26)	8.5%

DISCUSSION:

This study provides valuable insight into the antibiotic prescribing practices in a surgical department of a tertiary care hospital. The analysis reveals significant trends and patterns that could impact patient outcomes and antimicrobial resistance (AMR).

The present study found that males (62.9%) were more frequently admitted than females for surgical interventions, with the 51–60 years age group being most represented. This demographic trend mirrors findings from other studies such as Raut A et al. (2017), where male dominance in surgical admissions was attributed to lifestyle-related conditions like hernia and appendicitis, and occupational exposure [7].

The leading diagnoses included appendicitis (23.8%), hernia (20%), and diabetic foot ulcers (15.2%). Similar patterns were observed in a study by Soman et al. (2020), where these conditions represented more than 50% of surgical admissions [8]. This consistency across studies suggests common surgical burdens in Indian tertiary care hospitals, particularly related to gastrointestinal and diabetic complications.

A major finding was the predominant use of cefotaxime across nearly all diagnoses, accounting for most prescriptions both pre- and post-operatively. This preference for third-generation cephalosporins is corroborated by Sajan K et al. (2018), who reported that cephalosporins, especially ceftriaxone and cefotaxime, are preferred due to their broad-spectrum activity, low toxicity, and effectiveness in prophylaxis and treatment of post-surgical infections [9].

However, excessive reliance on a single class of antibiotics, particularly broad-spectrum agents, can contribute to antibiotic resistance. A study by Mehta et al. (2020) emphasized the alarming rise in cephalosporin resistance in Indian hospitals, urging institutions to review their empirical prescribing habits periodically [10].

In our study, monotherapy was used in 42.4% of cases, while combination therapy and multi-drug regimens accounted for 39.5% and 18.1% respectively. This is in line with the findings of Patel et al. (2020), who noted that combination therapy is often adopted post-operatively due to infection risks or culture results, but often without adequate justification [11].

Intravenous (IV) administration dominated (91.5%), consistent with standard surgical practice. A comparable study by Tiwari et al. (2018) reported 88% IV usages in surgical wards, especially during the initial post-operative period to ensure rapid therapeutic levels [12].

The average duration of therapy in this study was 7.23 days, aligning with the World Health Organization (WHO) recommendation for short-course perioperative antibiotic use (typically 3–7 days). According to the WHO AWaRe (Access, Watch, Reserve) classification, the majority of antibiotics prescribed in this study—such as cefotaxime, ceftriaxone, and ciprofloxacin—fall under the 'Watch' category, which is associated with higher potential for resistance. Ideally, antibiotics from the 'Access' group should be prioritized for common infections. The high use of Watch antibiotics may reflect a lack of guideline-based prescribing and underscores the need for stewardship efforts. Furthermore, the Indian National Treatment Guidelines also recommend narrower-spectrum agents wherever possible, and empirical broad-spectrum use should be reserved for confirmed or highly suspected severe infections [13].

LIMITATIONS:

This study has several limitations. It was conducted in a single tertiary care hospital, which may limit the generalizability of the results to other institutions. Additionally, the lack of microbiological culture and sensitivity data prevents a full assessment of the appropriateness of empirical antibiotic prescriptions. Finally, since the study design was observational, it could not evaluate causality or the direct clinical outcomes of specific antibiotic regimens.

CONCLUSION:

This study highlights the prevalent use of broad-spectrum antibiotics, particularly cefotaxime, in the surgical department of a tertiary care hospital. While these antibiotics are effective for preventing infections, their overuse raises concerns about antimicrobial resistance (AMR). The findings suggest the need for regular review of antibiotic prescribing practices to ensure adherence to evidence-based guidelines and reduce unnecessary antibiotic exposure.

To mitigate AMR, healthcare institutions should implement robust antibiotic stewardship programs, promote narrow-spectrum antibiotics where appropriate, and strengthen surveillance of resistance patterns. Optimizing antibiotic use in surgical settings is essential for improving patient outcomes and preserving the effectiveness of antibiotics.

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