International Journal of Research in Medical Sciences
Arora T et al. Int J Res Med Sci. 2024 Feb;12(2):455-460
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20240210

Original Research Article

A comparative analysis of retrospective records of antibiotic usage in patients before and after surgery in a tertiary care government hospital in Delhi

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Received: 13 November 2023
Accepted: 17 January 2024

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ABSTRACT

Background: Antimicrobial resistance (AMR) is major problem in most of countries worldwide. Antimicrobial Stewardship program (AMSP) encourages both government and private hospitals in country to bring out guidelines regarding antimicrobial usage and hospital infection control (HIC). However, it is still in nascent stage. A retrospective study to generate lacking data about usage of antibiotics in inpatient settings in a government hospital.
Methods: Retrospective records of antibiotic usage in adult patients before and after surgery admitted in department of surgery, LHMC and Smt. Sucheta Kriplani hospital, New Delhi. The prescribed doses were converted to a number as per WHO defined daily dose (DDD) of each antibiotic and presented as per ATC/DDD methodology.
Results: The records of 121 patients admitted between June 2021 to February 2022 were retrieved. Ceftriaxone, was the leading choice of antibiotic both pre and post operatively, while co-amoxyclav was second most preferred antimicrobial. Mean ± SD for DDD pre-op and post-op was 3.345±1.602 with $p<0.001$ which was highly significant. Mean ± SD for average duration of stay pre-op and post-op was 3.041±1.179 with $p<0.01$ which was significant. Only 16 patients had complications before, during or after the procedure which prolonged their stay in hospital. There were no procedure related deaths till last follow up.
Conclusions: Guidelines for selection of proper antimicrobial usage in peri-operative period were not consistent. We advocate evidence-based pre-operative and post-operative antibiotic prophylaxis practices and rational antibiotic usage depending on prevailing antibiogram.

Keywords: AMR, Retrospective, Antibiotic usage, DDD

INTRODUCTION

Antibiotics are an important therapeutic component in prophylaxis and treatment of infections in patients admitted for surgery in a hospital.[1] In this era of ever-increasing problem of AMR, it becomes pertinent to analyze the pattern of anti-microbial usage.[2] This has been highlighted by the fact that the Indian council of medical research (ICMR) launched its AMSP, which encourages both government and private hospitals to bring out formularies and guidelines regarding antimicrobial usage and HIC.[3] AMSP aims to achieve appropriate or rational use of antibiotics through a multidisciplinary team comprising of infectious disease (ID) physicians, clinical pharmacists, specialists, nurses, and others.[3] The effective implementation of AMSP requires continuous antimicrobial audit and feedback.[3] During the COVID-19 pandemic, a large number of patients admitted for surgery were injudiciously prescribed broad spectrum antibiotics without sufficient evidence which is a direct invitation to the even more deleterious peril of superinfection.[4,5]

In the past, results from a few studies conducted in different government set ups across the country showed

that only 30% of healthcare institutes (HCI) in our country are actively calculating antimicrobial usage data while only 25% are implementing AMS strategies for antimicrobial usage.[3] Study on parenteral antibiotic restriction, a key element of AMSP, has clearly shown beneficial results when antibiotics are prescribed after culture positivity and for specific duration only.[6] Even antibiotic restrictions for peri-op prophylaxis (PABP) based on type of surgery have shown positive results in terms of decrease in antibiotic usage.[7,8] In previous study on implementation of AMSP in an emergency department on usage of 3rd generation cephalosporins and fluoroquinolones in non-trauma triage patients, results were very encouraging and showed 68% decline in usage of 3rd generation cephalosporins and rationale increase in use of aminopenicillin/beta-lactamase inhibitor formulations post implementation of AMSP.[9]

Use of WHO DDD is an effective tool to determine antibiotic usage in hospitals.[10] AMSP also recommends usage of DDD for determining trends in antimicrobial consumption.[3] A study on antibiotic usage as part of AMSP in a Qatar hospital utilizing DDD showed that there was significant decrease in the use of cephalosporins and carbapenems, while there was concerning increase in fluoroquinolone use.[11] However, such data is scarce in a country like India which houses almost a sixth of the world's population but has a healthcare set up that is underpowered and overworked.[1,2] Hence, we performed this study to generate the lacking data about usage of antibiotics in inpatient settings in a government setup which will eventually help to rationalize the antimicrobial use for patient care, thereby helping in successful implementation of AMSP.

METHODS

We performed a retrospective analysis of the records of antibiotic usage in adult male patients before and after surgery who were admitted in the department of surgery, Lady Hardinge medical college, and Smt. Sucheta Kriplani hospital, New Delhi between June 2021 to February 2022. The aim of the study was to find the pattern of antibiotic usage in inpatient settings in surgery departments before and after surgical intervention as per WHO DDD and also to make a comparative analysis of antibiotics as per type of infection and usage. Demographic details, type and indication of the procedure, name, dose, and route of administration of antibiotic used before and after the procedure were retrieved from medical records department of the institution after obtaining necessary ethical clearance from LHMC and Assoc. hosp. ethics committee. All the records were kept strictly confidential and used only for the purpose of this study.

Sample size

A total of 121 patients planned for surgical procedure during the period from June 2021 to February 2022 were included for final analysis of type and quantity of antibiotics consumed.

Inclusion criteria

Male patients aged 18 years and above admitted to the surgery ward and have received at least one dose of any class of antibiotics orally or intravenously and were tested negative by RT-PCR for COVID-19 were included in study.

Exclusion criteria

Patients who needed to be shifted to the ICU postoperatively with no clear reason for the same were excluded from the study. Also, patients on long-term prophylactic antibiotics, confirmed COVID positive patients (by RT-PCR) and those who were on anti-tuberculous therapy were not included in the study.

Antimicrobial consumption daily dose divided by the number of procedures and expressed by 100, as per the ATC/DDD methodology were calculated (10). The consumption was presented according to the type of the procedure and to the antimicrobials used.

The prescribed doses were converted to a number as per the WHO defined daily dose (DDD) of each antibiotic given by the formula:

Number of DDDs = (Antibiotic dose× number of daily doses × number of days)/WHO DDD for the antibiotic

The number of days of antibiotic use in terms of DDD was calculated noting the time and date of admission and discharge of the patient. Admissions after 12 noon or morning discharges before 12 noon were considered as half days.

Data management

The monitoring of antimicrobial consumption was performed by a qualified pharmacologist from the Department of Pharmacology of the same institution and presented as per the ATC/DDD methodology.[10] The consumption was presented according to the type of the procedure and to the antimicrobials used.

Statistical analysis

The obtained data was tabulated in MS excel sheet. Statistical analysis was performed using the latest free version of SPSS. Descriptive statistical methods were used. Comparison of the variables was performed using paired t test. Significance was set at $p<0.05$.

RESULTS

The records of 121 patients admitted in the department of surgery, Lady Hardinge medical college, and Smt.

Sucheta Kriplani hospital, New Delhi between June 2021 to February 2022 were retrieved, none of whom required any unexpected ICU shifting, 117 patients were males, and 4 females. Their mean age was 39.96 years. The average duration of stay in the ward was 4.73 days. The most common (MC) surgery was laparoscopic cholecystectomy (20.6%), followed by appendectomy (15.7%). Overall, abdomen (44.6%) was the MC area operated on, followed by the urogenital system (28.1%) (Table 1). Ceftriaxone, a 3rd generation cephalosporin, was the leading choice of antibiotic (28.92%) both pre and post operatively, while co-amoxyclav (augmentin), a combination of a beta-lactam antibiotic with a beta lactamase inhibitor, was the second most (15.7%) preferred antimicrobial (Table 2). All the admitted patients were administered intravenous antibiotics preoperatively. However, post operatively, 25 of them were switched over to oral antibiotic therapy as soon as they could accept orally. The mean pre-operative DDD for all the patients was 1.24, while the average post-operative DDD was 4.59 (Table 3) which was significantly higher than the pre-procedural use. The overall mean ± SD for DDD pre-op and post-op was 3.345±1.602 with $p<0.001$ which was highly significant. Only seven patients received a combination of antibiotics (restricted to 2), while rest of patients were administered a single antibiotic only. No patient received more than two antibiotics. As expected, the average duration of stay post-operatively (4.30 days vs 1.26 days) was significantly higher than it was pre operatively. Mean ± SD for average duration of stay pre-op and post-op was 3.041±1.179 with $p<0.01$ which was significant (Table 4). Only 16 patients had a complication before, during or after the procedure which prolonged their stay in hospital. However, all of them were managed successfully in ward. There were no procedure related deaths till last follow up.

Table 1: MC sites and systems operated upon.

Demographic data (117 males, 4 females)		Clinical characteristics of patients	Outcome MC sites and surgery) (percentages %=type of surgery/121 ×100)
Average age* (In years)	**Sex**		
39.96	F	Acute abdominal pain, fever	15.7 (2nd MC surgery, appendectomy)
20	F	Acute abdominal pain	20.6 (Most common surgery, laparoscopic cholecystectomy)
40	M	Abdominal pain, fever	44.6 (MC site abdomen)
38	M	Burning micturition, fever, increased frequency	28.1 (2nd MC site, urogenital system)
42	M	Hip pain, fever	0.8 (Least common site, Hip arthroplasty)

*Average age=Sum of age of each patient administered an antibiotic/ Total No. of patients administered that antibiotic.

Table 2: Most common antibiotics used pre-op and post-op.

Demographic data						
Avg. age (In years)	**Sex**	**Pre-op**	**Dose**	**Post-op**	**Dose**	**Outcome (Most common (MC) antibiotics used pre-op and post-op) (%)**
37.20	3 female and 32 males	Ceftriaxone (MC)	1 G	Ceftriaxone (MC)	1 G	Ceftriaxone (28.92)
35.10	1 female and 3 males	Metrogyl	500 MG	Metrogyl	500 MG	Metrogyl (3.30)
40.5	17 males	Amikacin (3rd MC) amikacin	750 MG 750 MG	Amikacin (3rd MC) amikacin	750 MG 750 MG	Amikacin (14.04)
36.20	7 males	Levoflox (5th MC)	750 MG	Levoflox (5th MC)	750 MG	Levoflox (5.78)
35.25	17 males	Piptaz (3rd MC)	4.5 G	Piptaz (3rd MC)	4.5 G	Piptaz (14.04)
39.10	13 males	Meropenem (4th MC)	1 G	Meropenem (4th MC)	1 G	Meropenem (10.74)
39.82	19 males	Augmentin (2nd MC)	1.2 G	Augmentin (2nd MC)	1.2 G	Augmentin (15.7)
51	1 male	Azithromycin (least common)	500 MG	Azithromycin (Least common)	500 MG	Azithromycin (0.82)
42.5	2 males	Clindamycin	600 MG	Clindamycin	600 MG	Clindamycin (1.65)
39.25	4 males	Linezolid	600 MG	Linezolid	600 MG	Linezolid (3.30)
41	2 males	Gentamicin	80 MG	Gentamicin	80 MG	Gentamicin (1.65)
33	4 males			Cefixime	200 MG	Cefixime (3.30)

Table 3: Pre-op, post-op and overall DDD.

Demographic data descriptive statistics		Anti biotic pre-op	DDD pre-op DDD pre-op	Anti-biotic post-op	DDD post-op	Outcome (overall drug DD)
Avg. age (In years)	**Sex**					
37.20	3 female and 32 males	Ceftriaxone (MC) ceftriaxone	1	Ceftriaxone	3	2
35.10	1 female and 3 males	Metrogylmetrogyl	1	Metrogyl	3	1.5
40.5	17 males	Amikacin (3rd MC) ceftriaxone	1	Ceftriaxone	3	2
36.20	7 males	Levoflox (5th MC) ceftriaxone	0.5	Ceftriaxone	3	2
35.25	17 males	Piptaz (3rd MC) ceftriaxone	1	Ceftriaxone	2.5	2
39.10	13 males	Meropenem (4th MC) metrogyl	1	Metrogyl	3	1.5
39.82	19 males	Augmentin (2nd MC) ceftriaxone	0.5	Ceftriaxone	2.5	2
51	1 male	Azithromycin (least common) metrogyl	1	Metrogyl	3	1.5
42.5	2 males	Clindamycinamikacin	0.75	Amikacin	2.25	1
39.25	4 males	Linezolidceftriaxone	1	Ceftriaxone	3	2
41	2 males	Gentamicinmeropenem	1	Meropenem	10	3
3338	4 males	Levoflox	1.5	Levoflox	7.5	0.5
Mean DDD		Pre-op	1.24	Post-op	4.59	

Mean ± SD was 3.345±1.602 with p<0.001, highly significant.

Table 4: Mean duration of stay pre-op and post-op.

Descriptive statistics		Avg. pre-op duration of stay (Days)	Avg. post-op duration of stay (Days)	Outcome (Follow-up till complete recovery)
Avg. age (In years)	**Sex**			
39.96	4 females and 101 males	1.26	3	Recovered completely
39.96	16 males	1.26	4.30	Surgical site infection recovered completely
Mean duration of stay		Pre-op: 1.26 days	Post-op: 4.30 days	

Mean ± SD, 3.041±1.179 with p<0.01.

DISCUSSION

Being a developing tropical nation, IDs are very common in the Indian healthcare topography. Hence, unsurprisingly, it is one of the largest consumers of antibiotics, though their use might be irrational at times. This injudicious practice has led to the emergence of widespread superbugs, which render even the most recent high-end antibiotics like carbapenems ineffective due to the production of inactivating enzymes by micro-organisms.[12,13] Our study showed that the use of carbapenems, mostly meropenem, as a prophylactic antibiotic in pre-operative setting was not in line with the guidelines.[14] However, despite this fact, meropenem was prescribed in 13 of 121 patients. Such over coverage is a direct invitation to cost escalation and adverse effects in a resource poor setting like ours, while indirectly paving the way to decreased susceptibility of target organisms to antimicrobials.[15,16]

Administration of intravenous perioperative antibiotics has been shown to decrease the incidence of surgical site infections (SSIs). However, broader, or longer duration coverage than recommended coverage has not been shown to reduce the incidence of SSIs, the most common organisms responsible being fram-positive cocci such as *Staphylococcus* which are site specific.[14,17] The present IDSA (write full form) guidelines advocate narrow-spectrum antibiotic therapy limited to one dose or continued for less than 24 hours post-surgery chosen according to the type of procedure performed.[14] We found that the patients in our study had an overall mean DDD of 3.26, which meant that the consumption was more than expected. This may be explained by the fact that most of the government hospitals in India have a high incidence of post-operative infections.[18] Also, many of the procedures might not be clean surgical procedures. However, the timing of starting dose of the antibiotic was appropriate in all of the patients as documented.

Though there are inconsistencies with regards to the guidelines for perioperative antimicrobial prophylaxis, most of the patients (114 of 121) in our study were administered only a single antimicrobial agent, which agrees with the accepted national guidelines.[18,19] Also, quite a few of the patients (25) were switched over to oral antibiotics as soon as they were able to tolerate. This is also considered as a healthy practice as it encourages early mobilization and discontinuation of intravenous line which can be a potential source of infection.[19]

Our study, like every other, might have few limitations. Being a single centre study, the results may not be reflective of the entire population. However, from the experience, the sample is likely to represent the practices in the region when taken together with the reports of emergence of multidrug-resistant pathogens. Though caution was taken to exclude patients who were on long term antibiotics or anti-tubercular therapy, details of medical ailments that might have altered the final cocktail of antimicrobials were unavailable for the study. Finally, covering intricate surgical details that might have influenced the surgeon's choice of postoperative antibiotic was beyond the scope of this discussion.

CONCLUSION

This study highlighted the dearth of active antibiotic stewardship in government set ups in India, which, alarmingly, may be just the tip of the iceberg. We advocate evidence-based pre- and post-operative antibiotic prophylaxis practices and more rational antibiotic usage. An inter-disciplinary collaboration of the treating surgeons, hospital management, and infection control departments along with active surveillance and feedback holds the key to mitigate this menace. Larger multi-centre studies are required to establish the true magnitude of this problem.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Arora T, Bhowmick S, Singh J. A comparative analysis of retrospective records of antibiotic usage in patients before and after surgery in a tertiary care government hospital in Delhi. Int J Res Med Sci 2024;12:455-60.