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Original Research Article

Audit of Antibiotic Prescription with Emphasising Adherence to Antibiotic Policy: A Prospective Observational Study from South India

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Abstract:

Introduction: Antimicrobial resistance being a public health challenge, Ministry of Health and Family Welfare Department of Government of India recognized this as a high priority area. In collaboration with ICMR, lots of efforts are taken to implement antimicrobial stewardship program. Our objective was to peruse the antibiotics prescribed for inpatients and day care surgical cases with emphasizing the importance of adherence to antibiotics. Appraise and to find out the deviation of antibiotic prescriptions from the department policy before and after training with antibiotic policy and highlighting the areas for improvement in the prescription.

Materials and Methods: It is a Prospective, observational and Cross-sectional study for the patients who are admitted to General Surgical wards and day care surgical patients in the two months period between august and September 2022. Consecutive cases receiving the antibiotic prescription were screened using a structured proforma in order to elicit various data for analysis.

Results: Males predominated and male to female ratio was 2:1 among the cases included in Phase 1 (50 cases) and Phase 2 (54 cases). Nearly, 90% of the patients had one or other evidence of overt infections. In this category (Phase 1) the surgeon did not deescalate the antibiotics prescribed. After training, among the 54 cases, (90.74%) received empirical antibiotic therapy and escalation and de- escalation were noticed in 17 (31.4%) and 15 (27.77%) cases respectively. The pattern of antibiotic prescription invariably reflected a combination of antibiotics, and these were administered parenterally in 74% of cases.

Conclusion: The audit of antibiotic prescription revealed that many surgeons prescribed high end antibiotics invariably. The indications stated by the surgeons were co morbid conditions and a fear of cross infection. Deviation of antibiotic prescription was noticed even after training in 66.6% of cases. Though training has helped to alter the approach of surgeons towards antibiotic prescription.

Keywords: Empirical Antibiotic, Escalation, Training, Adherence.

Introduction

Emergence of multidrug resistant pathogens continues to burden global healthcare system [1]. This has caused a fear among practitioners, physicians and surgeons who tend to prescribe high end/ combination of antibiotics. This has led to persistence or further development of multidrug resistant infections.

Multidrug resistant (MDR) bacteria are virtually not treatable, thereby causing a threat to health care. In addition, underuse/ misuse/ overuse/ abuse of antibiotics contributes to the growing problem of antibiotic resistance, posing a serious threat to public health [2]. Hence, there is a need to audit the existing practice of antibiotic prescription. Moreover, the study of prescribing pattern by and large seeks to monitor, evaluate and suggest modification in the prescribing habits so as to make medical care rational and cost effective [3]. Information on audit of antibiotic prescription pattern is necessary for a constructive approach to problems that arise from the antibiotic prescriptions [4].

Inappropriate use of antibiotics is a global public health challenge [5]. In India, the prevalence of use of antibiotics varies from 24 to 67%. According to

a recent study, 75% of the antimicrobial prescription are irrational and lead to increased health care utilization, morbidity, mortality, adverse drug events and drug resistance [6].

WHO reports state that rational antibiotic use in developing countries is poor. With the growing number of infections with antibiotic resistant bacteria, rational use of antibiotics becomes imperative. The reasons for non-adherence were studied by previous workers6 which has resulted in the introduction of audit of antibiotic prescriptions [7]. More studies are required in order to improve the antibiotic prescription practices as well as to recognize the areas for revision of antibiotic policy [8,9,10].

Hence, an attempt has been made to look into antibiotic prescriptions made during surgical practice, as antibiotics are prescribed either regularly or preoperatively, intra- operatively and post-operatively. Therefore, it is proposed to focus on the audit of antibiotic prescriptions of Department of General Surgery in a tertiary care hospital. Special emphasizing work done, to find out the deviation of antibiotic prescriptions from the department policy before and after training and to highlight the areas for improvement.

Materials and Methods

Study Design

This is a prospective, observational, cross-sectional study done for the patients who are admitted to General Surgical wards and day care surgical patients at Trichy SRM Medical College Hospital and Research Centre, Trichy, Tamil Nadu. For the study settings we involved three major departments from our institute for the entire duration of study period. Department of pharmacology, Central lab attached to the department of microbiology and general surgery are the major departments involved. The study period designed for 2 months in the year of 2022 at august and September month.

Samples

Consecutive cases receiving the antibiotic prescription were screened using a structured proforma in order to elicit:

- Baseline data (sociodemographic) and clinical aspects of patients,
- Underlying disease(s)
- Nature of infection(s)
- Confirmation of infection- Microbiological studies including isolation, identification of organisms and their antibiotic sensitivity patterns (CLSI guidelines 2018), adhering to good laboratory practices.
- Antibiotics prescribed including dose, frequency, duration and route of administration.
- Indication for antibiotic prescription were elicited by interacting with Surgeons in charge of the case.
- Deviation from antibiotic policy and reason(s) for deviation.

Data on Antibiotic Prescription

Antibiotic prescription related data were collected in two phases as given below:

Phase 1: (Pre training)

As per the format given in Table A, the data were collected and kept confidentially in consultation with professor of surgery and with the help of others prescribing antibiotics during the first three weeks of study. The data were analyzed for each case and the deviations were identified.

Table 1: Phase 1(Pre training)

Criterion 1	Prescription for antibiotics: Name, frequency and duration				Indication specified in case sheet		Deviation from standard*
Indication	**Oral**	**IV**	**IM**	**Oral and IV**	**Yes**	**No**	
Indications for antibiotic prescription for each case was recorded							

*(standard means the antibiotic policy of the department)

Phase: 2 (Post training)

Training: Two-hour training was given on "antibiotic policy and prescription" to all those involved in surgical practice and prescribing antibiotics in surgical wards by the professor and head of surgery and pharmacology. Seven days after the educational program, the prescriptions were audited so as to find out the antibiotic prescription practices in the subsequent three weeks. The details for each case were entered in the format given in Table B.

Table 2: Phase 2(Post training)

Criterion 1	Prescription for antibiotics: Name, frequency and duration				Indication specified in case sheet		Deviation from standard*
Indication	Oral	IV	IM	Oral and IV	Yes	No	
Indications for antibiotic prescription for each case was recorded							

*(standard means the antibiotic policy of the department)

Exclusion Criteria

Immunocompromised and post-transplant cases getting treated in surgical department were excluded from the present study.

Quality of data collection

To ensure the quality of data collection, the data were independently reviewed by one of the senior professors of general surgery, pharmacology and medicine for indications, deviations and reason for deviation. Care was taken to maintain confidentiality and avoid inter-professional conflicts.

Ethical Committee approval

This work was carried out after an approval from the Institutional Ethics Committee from Trichy SRM Medical College Hospital and Research Centre, Trichy.

Statistical Analysis

The data was entered in Microsoft excel spreadsheet and analyzed by simple descriptive statistics.

Results

The antibiotics prescribed and the indication for antibiotic prescriptions for a total of 50 cases admitted and treated as inpatient or day care prior to training were elicited by interacting with surgeons/ doctors treating such cases and looking into the prescriptions made by them on two occasions namely at admission and after surgical intervention.

These cases belonged to Phase 1 of the study and were treated by 12 surgeons. The criterion and the route of administration of antibiotics is given in Table No 1.

Table 1: Pattern of prescription of antibiotics and indications (Phase 1=50 cases)

Criterion	Route of administration				Indications as elicited		Standard
	Oral	IV	IM and IV	Oral and IM/IV	No.	%	
Empirical antibiotics (N=48) *	8	19	16	5	48	96	No standard available in the department
Revised/ Continued antibiotics (N=50)	12	18	13	7	50	100	

*(standard means the antibiotic policy of the department)
*2 cases did not receive empirical antibiotics
*N=Number of cases

Table 2: Pattern of prescription of antibiotics and indications (Phase 2=54 cases)

Criterion	Route of administration				Indications as		Standard
	Oral	IV	IM and IV	Oral and IM/IV	No.	%	
Empirical antibiotics (N=49) *	9	19	16	5	49	90.74	Standard available but deviated in 36 cases (66.6%)
Revised/ Continued antibiotics (N=54)	13	20	13	8	54	100	

*(standard means the antibiotic policy of the department)
*5 cases did not receive empirical antibiotics
*N=Number of cases

There were 31 males and 19 females and their age ranged from 18 to 64 with a mean age of 38.5 years and the details are provided in Table No 3. The diagnostic details of the cases included for the study in relation to gender is shown in Table No 4. Though many cases required bacteriological study, only 31 cases (62%) of the 50 were subjected to microbiological analysis. The details of bacterial isolates of these cases are given in Table No 5. During the study period, single isolates were seen in 7 and polymicrobials were noticed in 3 other cases. The name of the bacterial isolates is given in Table No 11.

Table 3: Age and gender wise distribution (Phase 1=50 cases)

Age in years	Male	Female	Total	%
<25	7	7	14	28
25-44	13	6	19	38
45-64	11	6	17	34
Total	31	19	50	100

Table 4: Diagnosis among 50 cases (Phase 1)

Diagnosis	Male	Female	Total	%
Diabetic foot syndrome	5	4	9	18
Acute peritonitis	2	2	4	8
Acute appendicitis	5	1	6	12
Abscess	2	2	4	8
Post debridement fasciitis	2	2	4	8
Non- healing ulcer	3	1	4	8
RTA	6	2	8	16
Surgical site infection	3	2	5	10
Uncomplicated hernia	1	2	3	6
Gallstone disease	2	1	3	6
Total	31	19	50	100

Of the 50 cases considered prior to training on antibiotic prescription, 48 of them received one or other antibiotics. Most of them received more than one antibiotic, and the route of administration was invariably parenteral in 80% of the occasions. The details of antibiotics prescribed for these cases are shown in Table No 6. The indications for antibiotic prescription as revealed by the prescribers in an empirical manner or revised or continued on clinical grounds or after intervention is depicted in Table No7. The surgeon who prescribed the antibiotics has always expressed one or other indications. Nearly one- third of the surgeon had a fear of cross infection among the admitted cases.

Table 5: Pattern of bacterial isolates (Phase 1=50 cases)

S. No	Name of the bacterial isolates	No. of isolates*	%
1.	Klebsiella pneumoniae	2	4
2.	Escherichia coli	1	2
3.	Staphylococcus aureus	4	8
4.	Pseudomonas aeruginosa	1	2
5.	Staphylococcus aureus (MRSA)	1	2
6.	Acinetobacter sp.	1	2
8.	Citrobacter koseri	1	2
9.	Proteus mirabilis	1	2
10.	Non fermented gram-negative bacteria	1	2
11.	No growth	11	22
12.	Not done	29	58

*Number overlaps with each other due to the presence of polymicrobial isolates

In about 42% of the cases, the surgeons have escalated antibiotics. Another 58% they continued the antibiotics prescribed at the time of admission. In this category (Phase 1) the surgeon did not deescalate the antibiotics prescribed, even though microbiological reports were different. The details of escalation, de-escalation and continuation of antibiotics during phase 1 of the study are given in Table 8. The surgeons prescribing antibiotics in phase 1 were requested to participate for a short-term interactive training on antibiotic prescription by the Professor of Pharmacology, Microbiology in collaboration with Professor and Head of Surgery. Similar to phase 1, the data were collected and analyzed for those 54 cases treated during post training period and they were included under phase 2 for study purposes. These 54 cases were seen and treated by different surgeons during the post training period. The age and gender wise distribution of these 54 cases are given in Table No 9. There were 36 males and 18 females, and their ages ranged from 24 to 70 yrs. with a mean of 46.4 years. The diagnostic details of 54 cases are furnished in Table No 10.

Table 6: Antibiotics prescribed (Phase 1=50 cases)

S.No.	Antibiotics prescribed	Empirical		Revised/ Continued	
		No.	%	No.	%
1	Semisynthetic Penicillins	4	8		
	Amoxicillin + clavulanic acid			-	-
2	Cephalosporins				
a.	1st generation	-	-	-	-
b.	2nd generation	-	-	-	-
c.	3rd generation	2	4	-	
d.	4th generation	-	-	-	
3	Quinolones	2	4	2	4
a.	Ciprofloxacin				
4	Amoxicillin + clavulanicacid + Metronidazole	4	8	3	6
5	Cephalosporin + Metronidazole	7	14	7	14
6	Cephalosporin + Amikacin	3	6	6	12
7	Cephalosporin + Ciprofloxacin	2	4	4	8
8	Cephalosporin + Ciprofloxacin + Metronidazole	9	18	8	16
9	Cephalosporin + Amikacin + Metronidazole	4	8	6	12
10	Linezolid + Amikacin	2	4	4	8
11	Linezolid + Ciprofloxacin	1	2	-	-
12	Linezolid + Ciprofloxacin + Metronidazole	3	6	2	4
13	Linezolid + Amoxicillin + Metronidazole	2	4	4	8
14	Amoxicillin + clavulanic acid + Rifaximin	-	-	-	-
15	Piperacillin + Metronidazole	3	6	4	8
16	No antibiotics	2	4	-	-
	Total	50	100	50	100

Table 7: Indication as felt by prescribers (Phase 1=50 cases)

S.No.	Indications	Empirical	Revised/ Continued		
		No.	%	No.	%
1.	Diabetes mellitus	7	14	7	14
2.	Clinical severity	13	26	19	38
3.	Debilitated status	9	18	9	18
4.	Treated outside	11	22	11	22
5.	Potential for infection	17	34	20	40
6.	Fear of cross infection	16	32	11	22

*Number overlaps with each other/multiple

Table 8: Escalation/ De-escalation of antibiotics (Phase 1=50 cases)

S. No.	Character	No.	%
1.	Escalation	21	42
2.	De-escalation	-	-
3.	No change/ continued	29	58
	Total	50	100

Table 9: Age and gender wise distribution (Phase 2=54 cases)

Age in years	Male	Female	Total	%
<25	2	0	2	3.7
25-44	10	3	13	24.08
45-64	17	1o	27	50
≥65	7	5	12	22.22
Total	36	18	54	100

Table 10: Diagnosis among 54 cases (Phase 2)

Diagnosis	Male	Female	Total	%
Diabetic foot syndrome	8	2	10	18.55
Acute peritonitis	5	-	5	9.25
Acute appendicitis	2	1	3	5.55
Abscess	5	1	6	11.11
Post debridement fasciitis	2	-	2	3.7
Non- healing ulcer	2	-	2	3.7
RTA	4	2	6	11.11
Surgical site infection	4	3	7	12.96
Uncomplicated hernia	4	3	7	12.96
Gallstone disease	2	4	6	11.11
TOTAL	38	16	54	100

Table 11: Pattern of bacterial isolates (Phase 2=54 cases)

S. No	Name of the bacterial isolates	No. of isolates*	%
1.	Klebsiella pneumoniae	9	16.7
2.	Escherichia coli	7	13
3.	Staphylococcus aureus	7	13
4.	Pseudomonas aeruginosa	6	11
5.	Staphylococcus aureus (MRSA)	3	5.6
6.	Acinetobacter sp.	3	5.6
8.	Citrobacter koseri	2	3.7
9.	Proteus mirabilis	1	1.9
10.	Non fermented gramnegative bacteria	1	1.9
11.	No growth	19	35.18

*Number overlaps with each other due to the presence of polymicrobial isolates

Table 12: Antibiotics prescribed (Phase 2=54 cases)

S.No.	Antibiotics prescribed	Empirical		Revised/ Continued	
		No.	%	No.	%
1	Semisynthetic penicillin's	4	7.4	1	1.85
	Amoxicillin+ clavulanic acid				
2	Cephalosporins	-	-	-	-
a.	1st generation				
b.	2nd generation	-	-	-	-
c.	3rd generation	2	3.7	1	1.85
d.	4th generation	-	-	-	-
3	Quinolones	2	3.7	3	5.55
a.	Ciprofloxacin				
4	Amoxicillin + clavulanic acid+ Metronidazole	5	9.3	4	7.4
5	Cephalosporin + Metronidazole	7	12.9	7	12.9
6	Cephalosporin + Amikacin	3	5.55	4	7.4
7	Cephalosporin + Ciprofloxacin	2	3.7	5	9.3
8	Cephalosporin + Ciprofloxacin + Metronidazole	8	14.8	7	12.3
9	Cephalosporin + Amikacin + Metronidazole	4	7.4	5	9.3
10	Linezolid + Amikacin	2	3.7	5	9.3
11	Linezolid + Ciprofloxacin	1	1.85	1	1.85
12	Linezolid + Ciprofloxacin + Metronidazole	3	5.55	3	5.55
13	Linezolid+ Amoxicillin+ Metronidazole	2	3.7	4	7.4
14	Amoxicillin + clavulanic acid + Rifaximin	1	1.85	1	1.85
15	Piperacillin + Metronidazole	3	5.55	3	5.55
16	No antibiotics	5	9.3	-	-
	Total	54	100	54	100

After training, the surgeons took care to collect sample for bacteriological studies in 43 (79.62%) of the 54 cases who had overt manifestation of infection before prescribing antibiotics. Among the

54 cases, 49 (90.74%) received empirical antibiotic therapy and escalation and de- escalation were noticed in 17 (31.4%) and 15 (27.77%) cases respectively (Table No.14). After the microbiological reports, in another 22 cases the surgeons continued the antibiotics prescribed prior to intervention based on clinical and laboratory data. The pattern of antibiotic prescription invariably reflected a combination of antibiotics and these were administered parenterally in 74% of cases. The details of antibiotics prescribed for these 54 cases are given in Table No12. The criterion, route of administration of antibiotics and deviation from standard are given in Table No2. The indication for prescription of antibiotics as disclosed by the treating surgeons are given in Table No13. None of the surgeons made any statement or remarks or reasons for prescribing antibiotics in the case record.

Overall, during the study period, 36(70%) prescribers have deviated from the standard antibiotic policy of the department explained to them during training period. The reasons stated by the surgeons were clinical deterioration which were supported by hematological parameters, fear of adverse outcome and non- willingness to take the risk.

Table 13: Indication as felt by prescribers (Phase 2=54 cases)

S.No.	Indications	Empirical		Revised/ Continued	
		No.	%	No.	%
1.	Diabetes mellitus	21	38.88	21	38.88
2.	Clinical severity	19	35.18	24	44.44
3.	Debilitated status	7	12.96	7	12.96
4.	Treated outside	5	9.25	5	9.25
5.	Potential for infection	11	20.37	13	24.07
6.	Fear of cross infection	16	29.62	16	29.62

*Number overlaps with each other/multiple

Table 14: Escalation/ De-escalation of antibiotics (Phase 2=54 cases)

S.No.	Character	No.	%
1.	Escalation	15	27.77
2.	De-escalation	17	31.48
3.	No change/ continued	22	40.75
	Total	54	100

Discussion

Antibiotics are used in surgical practice very often as surgeons handle infected cases mostly. Since the cross infections among the hospitalized have gone up, surgeons do not want to take the risk and prescribe antibiotics even to the clean and elective cases without any co- morbidities [16,17].

Of late, surgeons started prescribing high end antibiotics which has led to increase in antibiotic resistance among the bacterial isolates. As AMR bacteria poses threat to regular as well as emergency cases, international bodies including WHO have started introducing AMSP [18]. To achieve antimicrobial stewardship, one has to understand the antibiotic prescription practices in a given area by audit of antibiotic prescribing. Keeping these in mind, the present study was undertaken. The study was carried out in two phases namely Phase 1(Pre-training) and Phase 2 (post training) [18,19,20].

In the present study, males predominated and male to female ratio was 2:1 among the cases included in Phase 1 (50 cases) and Phase 2 (54 cases). The mean age of the subjects included in the study was 38.5 years for Phase 1 and 46.4 years for Phase 2 cases. The distribution of cases and age group of patients tallied with previous publication. Nearly, 90% of the patients had one or other evidence of overt infections. However, samples were sent to microbiological studies from 62% among Phase 1 cases and 79.6% of cases belong to Phase 2[21].

Many earlier studies revealed that surgeons prescribed antibiotics prior to microbiological studies, and it varied from 30 to 70%. The reasons explained by the surgeons were Pre- hospital treatment, non- affordability, non-availability and no growth reports from Microbiology. This attitude has made surgeons to select high end antibiotics and they were unable to de-escalate the antibiotics prescribed which was included under the non-availability of Microbiological reports [21,22,23].

Audit of antibiotics revealed the surgeons' prescription attitude and it varied from 28 to 60% given in same hospital or other centres also. Training on antibiotic policy has motivated surgeons to send the samples for microbiological laboratory and look for sensitivity pattern [24,25]. However, these observation gives confidence that regular teaching training and surveillance/ audit of antibiotic prescription may likely to restrict the use of higher end antibiotics and make them think twice before prescribing antibiotics. In the present study, deviation of antibiotic prescription from the department policy was noticed in 60.6% of cases. Previous publications

also demonstrated deviation of antibiotic prescription among medical practitioners, Surgeons and Physicians, and varied from 30 to 74%.

This study on audit of antibiotic prescription has brought out the apprehensions of Surgeons with regard to cases admitted under them. The Surgeons are mostly in favor of prescribing antibiotics and do not want to take any risk. This is confounded by high expectation from the patients and their care giver [26,27,28].

Unless the consequences of antimicrobial resistance and non-availability of antibiotics to tackle such cases are realized by the medical fraternity, the prescribers are less likely to change their attitude [16]. A joint effort of professional associations and their motivation through the educational programmers and audit are the need of the hour. Intensive support from the health authorities is essential to implement antimicrobial stewardship at all levels.

Conclusion

Audit of antibiotic prescriptions were carried out in two phases namely phase 1 prior to training and phase 2 after training on antibiotic prescription. Prior to training, surgeons prescribed antibiotics in 98% of cases. Combination of antibiotics prescribed was observed in 80% of cases. Microbiological investigations were carried out for 21 cases (42%), even though, another 30% had overt manifestations of infections. Antibiotics were prescribed in their own manner for 48 cases (96%) and escalation was noticed in 21 cases (42%) based on microbiological reports and/ or clinical status. Surgeons in general preferred parenteral administration of antibiotics in more than 70% of occasions and it was independent of training. The training on antibiotic prescription to the surgeons included for the study has motivated them to send samples for microbiological studies prior to antibiotic prescriptions and look for antimicrobial sensitivity in order to escalate or de-escalate the antibiotics prescribed. Our study is the first detailed study from south India, which will be an eyeopener for further research studies.

Limitation of the study

Single centered study and limited to General Surgery alone. Since the work was carried out in an open manner, the possibility of pear auditing might have influenced/ altered antibiotic prescriptions. Categorical demarcation of the clinical cases requiring antibiotics cannot be over emphasized or differentiated, as many had co morbid illnesses also.

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