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Study of Parenteral Antimicrobial Therapy in ICUs of an Indian Public Teaching Hospital Using Glasgow Antimicrobial Audit Tool (GAAT)

Pramil Tiwari[1]*, Bhanu Naga Sireesha Gudapati[1], Satinder Gombar[1], Sanjay D'cruz[2] and Atul Sachdev[2]

[1]Pharmacy Practice, National Institute of Pharmaceutical Education and Research (NIPER), Department of Pharmacy Practice, Mohali, S.A.S Nagar, 160062, India

[2]General Medicine, Government Medical College and Hospital, GMCH-32, Chandigarh, 160030, India

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*For Correspondence

Dr. Pramil Tiwari, M. Pharm., Ph. D, Professor and Head Department of pharmacy practice, National Institute of Pharmaceutical Education and Research (NIPER), S.A.S Nagar, 160062, India, Tel: 9878488050

E-mail: pramiltiwari63@gmail.com

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ABSTRACT

Background and objectives: In this study, the Glasgow Antimicrobial Audit Tool was employed to assess the appropriateness of parenteral antimicrobial therapy in the intensive care units of an Indian public teaching hospital.

Methods: This 3-month prospective observational study was carried out at the ICUs of a public teaching hospital. Only patients with more than 24 hrs of ICU stay and those prescribed at least one antimicrobial were included in this study. Patients receiving antibiotic treatment for prophylaxis or for treatment of *H. pylori* infection and records with incomplete documentation were excluded.

Results: These results are based on a total of 74 patients' data. As per the audit tool used, the parenteral therapy was found to be appropriate in 61 patients (82%). The extent of appropriateness, as per this tool, in surgical cases was to the tune of 74% and 91% in medical cases.

Interpretation and conclusions: The results of this study provide early evidence for the usefulness of GAAT in the ICUs of an Indian public teaching hospital.

INTRODUCTION

The total antimicrobial consumption is approximately ten-fold greater in intensive care units (ICUs) than in general hospital wards. And, this high density of antimicrobial use favours the development of multi-drug resistant pathogens [1].

In 2009, Michael et al. reported that the increase in the prevalence of drug resistant pathogens is occurring at a time when the discovery of new antimicrobial agents is slowing down [2].

Further, it was found that after a single treatment of intravenous (IV) antibiotics, tests for fecal bacteria demonstrated a significant change in the variety of bacterial strains, and the development of the pathogen *Clostridium difficile* [3].

Such overuse of expensive broad-spectrum intravenous agents in ICUs is a matter of immense global concern. Glasgow antimicrobial audit tool (GAAT) is an audit tool that assesses the appropriateness of parenteral antimicrobials. GAAT is not only designed to monitor patient group or condition and specific trends in antimicrobial prescribing but also allows qualitative understanding of antimicrobial prescribing patterns [4].

Used first time in 1999 and reported by Seaton et al. GAAT has found very limited applications. The publications employing the GAAT are scanty. Very few research groups have used this in their studies [5-9].

The aim of this study was to assess the appropriateness of parenteral antimicrobial therapy in the ICUs of a public teaching hospital, using GAAT.

MATERIALS AND METHODS

Study Design, Setting and Study Population

This 3-month prospective observational study was carried out at the ICUs of a public teaching hospital.

Only patients with more than 24 hrs of ICU stay and who were prescribed at least one antimicrobial were included in this study. Patient records with incomplete documentation (i.e. demographic details, medication chart and relevant laboratory parameters) were excluded. The patients receiving antibiotic treatment for prophylaxis or for treatment of H. pylori infection were also excluded.

Data Collection

The age, gender, disease details and treatment regimen were recorded in a pre-designed standardized performa and analyzed. The patients were followed for the first 7 days of ICU stay and any changes made in the treatment regimen were carefully evaluated.

The clinical data collected included signs of sepsis recorded within 24 h of the day of the data collection, severe sepsis and severe pneumonia, etc.

The appropriateness of parenteral antimicrobial therapy was assessed using GAAT. The parenteral antimicrobial therapy was considered appropriate if 1 or more of the following criteria matched the captured information of the patient.

1. 2 or more of these (RR > 20/min, WBC < 4000 or >12000/mm^3, Temp ≥ 38°C and tachycardia >90 beats/min)

2. Sepsis source unknown

3. Systolic BP ≤ 90mm Hg

4. Chills, rigors/ sweats + (oliguria/renal failure/hepatic decompensation/confusion)

5. Pneumonia + (RR > 30/min/ DBP ≤ 60 mmHg, Urea > 7mmol/L)

6. Immunocompromised patient

7. Skin and soft tissue infection

8. Oral route compromised

9. Exacerbation of cystic fibrosis/bone and joint infection/endocarditis/meningitis/encephalitisscreening for consideration as drug candidate.

Statistical Analysis

Descriptive statistics were applied. Results are expressed in percentages and average ± SEM (standard error of the mean), as applicable.

RESULTS

85 ICU patients' records were screened during the study period. Out of total 85 patients, 44 patients were male while remaining 41 were females. Of these, 74 patient records were found to have complete data for studying GAAT criteria. The results, therefore, are based upon a total of 74 patients' data. The average age of patients was found to be 39.93 ± 2.16 yrs.

Patients were divided in two groups i.e. those who underwent surgery and those who did not. They were labelled as "surgical" and "medical" patients, respectively. Their numbers were 39 and 35, respectively. The average age was found to be 42.6 ± 3.37 yrs in surgical patients and 36.9 ± 2.58 yrs in medical patients, and this difference was statistically insignificant.

The average number of antimicrobials prescribed was found to be 3.1. 95% of the total 226 antimicrobials were prescribed by parenteral route.

The most frequently prescribed intravenous antimicrobial class was β-lactams, contributing 45% of total parenteral antimicrobials (97/215). Of the 97 β-lactams, Penicillins were most commonly prescribed (39/97) followed by Cephalosporins (30/97) and Carbapenems (28/97).

The next most common classes prescribed were Nitroimidazoles and Aminoglycosides, accounting to 21% and 11%, respectively **(Table 1).**

35% of parenteral antimicrobials were given as fixed dose combinations (FDC).The most frequently prescribed FDCs were Piperacillin + Tazobactam, Imipenem + Cilastatin, Cefoperazone + Sulbactam, and Ceftriaxone + Sulbactam.

As per GAAT, the parenteral antimicrobial therapy in this study was found to be appropriate in 61 patients, accounting for 82%.The appropriateness in surgical patients was 74% against 91% in medical patients (29/39 and 32/35, respectively).

Further, a microscopic analysis of the patients in each of these two categories was performed. GAAT, as explained, has 9 points. Patients in each group were studied as to how many points of GAAT matched.

Table 1. Profile of intravenous antimicrobials prescribed.

#	Antimicrobial class	Percentage
1	β-lactams	45%
2	Nitroimidazoles	21%
3	Aminoglycosides	11%
4	Fluoroquinolones	8%
5	Oxazolidinones	3%
6	Macrolides and Antifungals	2%, each
7	Others	8%
	Total	**100%**

28 out of 29 surgical patients and 31/32 medical patients complied with the criterion 1 of GAAT (i.e. 2 or more of (RR > 20/min, WBC< 4000 or > 12000/mm^3, Temp ≥ 38°C and tachycardia > 90 beats/min)). 16 out of 29 surgical patients and 19/32 medical patients were immuno compromised (met criterion 6). Criterion 3, systolic BP ≤ 90 mmHg, was fulfilled in 9 surgical and 11 medical patients **(Table 2).**

Table 2. Fulfillment of GAAT criteria - microscopic view.

GAAT criteria	Surgical (n=29)	Medical (n=32)
1	28	31
2	2	6
3	9	11
4	2	3
5	0	2
6	16	19
7	1	0
8	0	0
9	0	1
(29 out of 39 surgical patients and 32 out of 35 medical patients were found to be given appropriate parenteral antimicrobial therapy. Column 2 and 3 represent number of surgical and medical patients who met with the corresponding criteria).		

Discussion

This study has used the GAAT, which has also been reported earlier in very limited number of published reports [6-8].

In the present study, the average number of antimicrobials prescribed was found to be 3.05. Williams and co-workers analyzed 200 prescriptions and reported an average of 2.09 antimicrobials [10].

The assessment of parenteral antimicrobial therapy, in this study, is relevant as a total of 95% antimicrobials were prescribed through parenteral route.

Of these 215 parenteral antimicrobials, β-lactams were most commonly prescribed (45%). These findings are in concurrence with the results of Tiwari et al. at a private setting [5,11].

The appropriateness of parenteral antimicrobial therapy was observed in 82% of patients in the present study. Our findings are very close to the results of Seaton et al, where the parenteral antimicrobial therapy was found appropriate in 84% patients [7]. It needs to be underlined that Seaton has reported the point prevalence survey of antimicrobials in 10 Scottish hospitals. In contrast, this study was limited only to the ICUs of only one public teaching hospital in India.

However, the extent of appropriateness in this study is slightly lower than that of findings from a private setting, where it was shown that a total of 93% of parenteral antimicrobials were appropriate [5]. This difference is most likely due to the difference in the nature of intensive care unit and sample sizes of the two studies. Tiwari et al had reported results based on 702 patients drawn from medical ICU and cardiac care units. Compared with that, the results of the present study are based upon a far smaller sample.

In the present study, the appropriateness of parenteral antimicrobial therapy in 'medical' patients was found to be better compared to the 'surgical' patients (91% vs. 74%). At this stage, it is not possible to elaborate upon why this difference was noted.

In essence, to the best of our knowledge, this is the first study assessing the parenteral antimicrobial therapy in an Indian public hospital ICU - using GAAT.

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