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ORIGINAL ARTICLE

A Prospective Study On Evaluation Of Antibiotic Prescription Practices In An Intensive Care Unit Of A Tertiary Care Hospital

BALINGA SHRIKALA*, KOSARAJU KRANTHI**, NAFISA***

ABSTRACT:

Objective: Antibiotics are the most commonly prescribed drugs in hospitals and their irrational use is one of the important factors for the development and spread of resistance in the hospitals. The prescribing of antibiotics in the Intensive care unit (ICU) is usually empirical, given the critical condition of the patients who are hospitalized there. Since there is wide diversity in the prevalence of predominant pathogens and their antimicrobial susceptibilities, especially within individual ICUs, there is a need to formulate appropriate prescription practices, based on studies and research within the ICUs. Therefore, an audit of the antibiotic prescription practices in our Intensive care unit was planned.

Design: Prospective Hospital based cross sectional study

Setting: Intensive care unit of a tertiary care centre (Kasturba Medical College Hospital, Attavar, Mangalore)

Patients: All patients receiving a therapeutic antibiotic for the clinical suspicion of bacterial infections through to ICU discharge were included.

Interventions: Data was collected on patient demographics, date of the hospital and ICU admission, reason for the ICU admission, white cell count and the proposed site of infection.

Results: The respiratory system was the single most common site for infections in the ICU. Infections caused by Gram negative organisms were more common than those caused by Gram positive organisms. Antibiotics were administered empirically in 64% of the cases and in the rest, after microbiological confirmation.

Conclusions: The inappropriate and ineffective use of antibiotics is commonly observed in the health care system, especially in developing countries. In 32.03% of the patients who are treated on an empirical basis, microbiological reports on the antibiotic susceptibility patterns were contrary to the treatment which was given. Hence, there is a compelling reason to change the current prescribing practices by a multidisciplinary approach, in order to curtail the spread of multi-resistant pathogens in the ICUs.

Keywords: Antibiotics, Intensive care unit, Antibiotic audit, Prescription practices, ICU infections

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*Professor and HOD, Department of Microbiology, Kasturba Medical College,Mangalore ; **Assistant Professor, Department of Microbiology, Kasturba Medical college, Manipal University, Manipal; ***Intern, Kasturba Medical college, Mangalore

corresponding author:
Dr Kranthi Kosaraju,
Assistant Professor,
Department of Microbiology,
Kasturba Medical college,
Manipal – 575104
E mail – medkranthi@yahoo.co.in
Phone – 91-9886056647

INTRODUCTION

The rates of nosocomial infections range from 5 to 30% among the ICU patients. Although ICUs generally comprise 5% of all the hospital beds, they account for 20 to 25% of all nosocomial infections. Pneumonia and bacteraemia are currently the most commonly observed nosocomial infections in the United States and by far, the leading cause of death from nosocomial infections in critically ill patients.[1] Antibiotics are among the most commonly prescribed drugs in hospitals and around 30% of the hospitalized patients are treated with these antibiotics.[2] Irrational use of antibiotics is one of the most important factors for the development and spread of resistance in the hospitals and communities. The World Health Organization has established antibiotic use as a priority in its campaign for the rational use of medications.[3] The prescribing of antibiotics in the ICU is usually empirical, given the critical condition of patients who are hospitalized there. Appropriate antibiotic utilization in this setting is crucial, not only in ensuring an optimal outcome, but in curtailing the emergence of resistance and containing costs.[1]

The inappropriate use of antimicrobials is of special importance in the intensive care unit because of the large number of antibiotics prescribed, the chance for errors in antibiotic selection and the likelihood for the development of drug resistance.[4] The medically inappropriate, ineffective and economically inefficient use of antimicrobials is commonly observed in the health care system throughout the world, especially in developing countries. Although 50% or more of drug expenditures may be wasted through irrational prescribing, this often remains unnoticed by those who are involved in the health sector decision making or the delivery of health services.[5]

We propose that a study on the prescribing practices in the ICU is vitally important in guiding antibiotic selection and usage and therefore, in the achievement of the above-stated goals. There is wide institutional diversity in the relative prevalence of predominant pathogens and their antimicrobial susceptibilities and within the individual ICUs, there exist unique patient populations with varying risks and susceptibilities to infections and specific pathogens and appropriate prescription practices should be formulated with studies and research in the ICUs.[1] Therefore, we planned an audit to study the reasons for starting antibiotic therapy, the duration of antibiotic treatment, the reasons for changing antibiotics and the agreement between clinical suspicion and microbiological results in intensive care practice.

METHODS

The present study was a hospital based cross sectional study which was conducted in the intensive care unit of a 400 bedded hospital (Kasturba Medical College Hospital, Attavar, Mangalore) for a period of 3 months (from 1st June 2008 to 31st August 2008) after obtaining approval from the institutional ethical committee. A total of 262 patients were included in our study. . At the time of starting antibiotics, data was collected on patient demographics, the date of hospital and ICU admission, the primary admitting diagnosis and the reason for ICU admission, white cell count at the time of receiving antibiotics and the proposed site of infection. All patients who received a therapeutic antibiotic for the clinical suspicion of bacterial infections through to ICU discharge were included for evaluating the antibiotic prescription practice. The early discontinuation of antibiotics due to the absence of infection and patients who died during the stay in the ICU, were excluded.

The patients who were included in the study group were followed up daily to monitor the type and duration of the antibiotics used, the reasons for stopping or changing antibiotics, the microbiological results and the sensitivity pattern of the organisms which were isolated from such patients and for monitoring physician compliance with the microbiological reports. Culturing of the patients' specimens and their identification was performed according to standard microbiological procedures and antimicrobial susceptibility testing was performed by the modified Kirby-Bauer method and was interpreted according to the CLSI guidelines.[6]

RESULTS

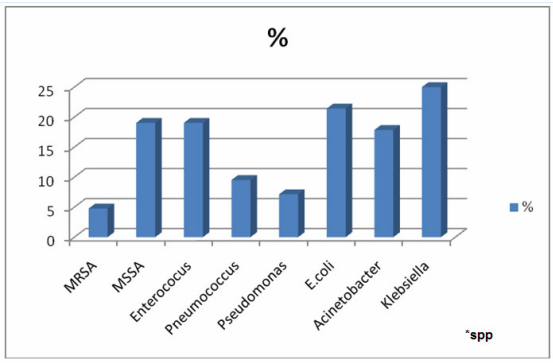
The prevalence of infections in our ICU was 17%. The median age of the patients who were admitted to the ICU during the study period was 59 years. The respiratory system (35.92%) was the most common site of infection in the ICU, followed by septicaemia (19.41%) and wound infections (6.79%). The male to female ratio was 1.5:1. The median WBC count at the start of antibiotics was 12,330cells/mm^3, with a majority of patients (55%) having counts > 11000. Device associated infections in the ICU were 9.7%, of which 70% were caused by endotracheal tubes, and 30% were caused by central lines. [Table/Fig 1] shows the reasons for admission in the ICU.

[Table/Fig 1]: Reasons for various primary admitting diagnoses in ICU

PATHOLOGY	PERCENTAGE
RESPIRATORY INFECTIONS	35.92
SUSPECTED SEPSIS	19.41
POST OPERATIVE WOUND INFECTIONS	6.79
MENINGITIS/CNS INFECTIONS	17.47
HEPATOBILIARY INFECTIONS	5.82
OTHERS	14.56

Antibiotics were started empirically in 64% of the cases. The infections were confirmed microbiologically in 45.91% of the cases (in 5.10% before starting antibiotics and in 40.81% after starting antibiotics). The median duration of antibiotic treatment in the ICU was 6 days. The most common initial antibiotics prescribed at admission were cefaperazone-sulbactum or piperacillin-tazobactum. In 32.03% of the patients who were treated on an empirical basis, the microbiological reports were contrary to the treatment given.

Infections caused by Gram negative organisms (57.14%) were more common than those caused by Gram positive organisms (42.85%). Candida accounted for 28.57% of the Gram positive infections. [Table/Fig 2] shows the common Gram positive and Gram negative organisms which were isolated from the patients who were admitted to the ICU.



[Table/Fig 2]: Percentage of various microorganisms causing infections in ICU (MRSA: Methicillin resistant *Staphylococcus aureus*; MSSA: Methicillin susceptible *Staphylococcus aureus*)

DISCUSSION

The prevalence of infections in the ICU in our set-up was 17% and ICU-acquired infections were 20.38%. This was less as compared to those observed in few other studies from India and the West, with a reported prevalence of ICU infections between 33.5% and 44.8%.[7],[8] This could be because of better infection control practices, early recognition and treatment as well as better care of indwelling lines and catheters.

The respiratory system was the single most common site which was reported for clinically suspected and bacteriologically proven infections. The high frequency of deep organ space infections and blood stream and wound infections, and the low frequency of urinary tract infections may reflect the differences in either practice or diagnosis. Respiratory infections in the ICU are the most common infections and countering them accounts for almost 50% of all the antibiotics used. Therefore, in the ICU setting, preventing respiratory tract infections is the most cost effective method of reducing antibiotic consumption.[8] Also, out of 20% patients on the ventilator, 30% developed fever and leukocytosis with purulent ET secretions, thus growing significant pathogens.

This study demonstrates that the median duration of antibiotic therapy in this sample of ICU patients was 6 days (with a wide range from 3-14 days) and this was similar for both community and ICU acquired infections. This is in accordance with the recent guidelines in 2007, where the duration of treatment was halved.[9] This widespread use of antibiotics

for a short period of 1 week or less may encourage bacterial resistance and promote relapses after therapy.[8] This strategy of using short courses of antibiotics has recently received support, although the rate of relapses, especially with resistant organisms needs to be monitored. The duration of treatment was longer for those infected with resistant organisms, in few cases with bacteriologically proven infections and in severely ill patients. Also, there is no clear evidence as to the optimal duration of therapy for these patients and many of these clinical decisions are individualised.

Antibiotics were administered empirically in 64% of the cases, whereas in the rest of the 36%, only after infection was proved microbiologically. In an Indian study, 62% of the prescriptions were therapeutic, of which 36% were therapeutic prescriptions without bacteriological support, while 59% were made on a bacteriological basis.[10] The most common initial antibiotics which were prescribed in our practice were cefoperazone-sulbactum or piperacillin-tazobactum. The adequacy of the initial empirical antimicrobial treatment is crucial in terms of outcome, although the ~~y~~early mortality rate was unaffected by the appropriateness of the empirical antibiotic therapy.[11]

Our finding that 45.91% of the infections were bacteriologically proven (only 5.10% before antibiotic prescription and 40.81% after antibiotic prescription), is less as compared to the study by Cuthbertson *et al.* [7] In the study conducted by Cuthbertson *et al*, 57% of the infections were bacteriologically proven before antibiotics were prescribed and 32% were proved only after antibiotic prescription .

Device associated infections in the ICU were 20.38%. In the Center for Disease Control and Prevention (CDC) National Nosocomial Infections Surveillance (NNIS) System report, U.S. reported the mean rates of central venous catheter (CVC)–related bloodstream infections, ventilator-associated pneumonia and catheter-associated urinary tract infections to be 4.0 per 1000 CVC days, 5.4 per 1000 mechanical ventilator days and 3.9 per Foley catheter days, respectively. Device associated infections in the ICUs of the developing countries pose greater threats to patient safety. Active infection control programs that perform the surveillance of infection and implement guidelines for prevention can improve patient safety and must become a priority.[12] In our study, 20% of the patients were on ventilator, of whom 30% developed infections, as stated previously. Catheter related infections were the second commonest device related infections in the ICU.

In 32.03% of the patients who were treated on an empirical basis, the microbiological reports were contrary to the treatment given, which means that these isolates were a) either resistant to the antibiotics being administered or b) sensitive to the first-line agent and hence, needed a step down from the prescribed antibiotics. Among these, only 57.57% of the patients had the shift of antibiotics accordingly, whereas in the rest of the 42.42% patients, the same treatment was continued irrespective of the sensitivity reports.

Despite numerous guidelines from governmental and professional groups, there is broad evidence that antibiotics are prescribed inappropriately in upto 50% of the cases. Goldmann *et al* stated that 'previous efforts have not worked because medical practice is locally driven, and national guidelines simply do not reflect or determine the system of care and the pattern of practice in individual hospitals'.[9]

Several studies have also shown that the administration of antibiotics was inappropriate in 22% to 65% of the patients that received treatment.[13] Clinicians are warned of the dire consequences that the overuse of antibiotics would bring; now, these predictions have become a reality, with a multitude of antibiotic resistant organisms and inflated hospital pharmacy costs.[13]

CONCLUSION

Audit is a firmly established quality assurance method and can answer the question 'What is the effect of what we are doing?'

Since there is a compelling reason to change the current prescribing practices by a multidisciplinary approach to curtail the spread of multi-resistant pathogens in the ICUs, an important question which can be asked is: 'How can these practices be

altered?' Educating Physicians alone is generally not effective. The control of antibiotic use seems to require a multidisciplinary approach involving ID physicians, microbiologists, pharmacists and administrators.

To be effective, we need to bring discipline in the prescriptions of antibiotics in all settings – hospital, ambulatory including office practice and primary care.

The areas that require further investigation and improvement include the following:

- Prescribing recommendations for choice of empiric antibiotic for the seriously ill and for those infected with MDR organisms
- Lack of adherence/follow-up of Microbiology team recommendations
- Conducting further audits that specifically focus on the need to step down of antibiotics which are prescribed according to microbiological reports and the adherence to antibiotic test based prescriptions.

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