

A Study to Evaluate and Assess the Antibiotic Usage Pattern among Patients Admitted With Sepsis in a Tertiary Care Hospital

Guhan. K. A - Final Year MBBS,
Dr. Preetha Selva, Associate Professor, Department of Pharmacology,
Saveetha Medical College and Hospital, Thandalam, Chennai - 602 105

Abstract:-

➤ Objectives

To study the antibiotic usage pattern among patients admitted with sepsis in tertiary care hospital.

➤ Methods

- **Study Design: Observational Study.**
- **Study Duration :** The study was conducted for a period of 3 months (Feb - May 2017)
- **Study Population:**
 - **Inclusion Criteria:**
 - ✓ **Patients of age greater than 18 years of both sexes who were admitted in ICU were to be included in the study.**
 - **Exclusion Criteria:**
 - ✓ **Data of Pregnant and lactating women excluded.**
 - ✓ **Incomplete patient data's in the case record will not be included in the study.**
 - ✓ **Pediatric and neonatal ICU patients will not be included.**

➤ Results

A total of 110 patients diagnosed with sepsis who were admitted to the ICU of Saveetha Medical College and Hospital during the period of study were taken into consideration. Of these 110 adults, 57 (51.7%) were diagnosed with sepsis and 53(48.3%) were diagnosed with septic shock. The mean age of the patients was 53.6 (range: 18 - 85 years old). 50.9% of the study group were male and the remaining females.

➤ Conclusion

Inappropriate doses of antibiotics, a diagnosis of septic shock and the presence of at least two comorbidities were found to significantly increase the mortality rate of sepsis patients admitted to an ICU in India.

Keywords:- Drug Prescription, Trends, Antibiotics, Sepsis, Septic Shock, Intensive Care Units, India.

I. INTRODUCTION

➤ Advances in Knowledge

- This study found that the mortality rate of sepsis patients admitted to an intensive care unit in India is quite high.
- Factors found to significantly influence mortality included inappropriate doses and selection of antibiotics, a diagnosis of septic shock and the presence of at least two comorbidities.

➤ Application to Patient Care

The results of this study could be used by physicians, pharmacists and other healthcare workers to increase the appropriate use of antibiotics, perhaps by implementing an antibiotic stewardship programme or with the formulation of guidelines for appropriate antibiotic usage based on the source of infection and the patient's clinical condition.

Sepsis is a life-threatening condition caused by a dysregulated host immune response to infection leading to organ dysfunction. (1) It is most likely to develop in individuals with a weakened immune system, often because of treatments like chemotherapy. However, critically-ill patients are also at risk due to the prevalence of drug-resistant bacteria in hospital settings and the need for catheterisation, artificial ventilation and wound drainage which may induce or worsen the condition.(2) Sepsis occurs in approximately 2% of all hospitalised cases and among 6–30% of all patients admitted to intensive care units (ICUs) in developed countries.(3),(4) both sepsis and septic shock are leading causes of morbidity and mortality in ICUs (21% and 28%, respectively).(4)–(6)

The management of sepsis or septic shock requires a comprehensive and systematic approach combining the use of appropriate diagnostic measures, the rapid initiation of appropriate empirical antibiotics and the administration of supportive therapy. The final management is to administer the most appropriate antibiotic after proper microbiological studies.(7) According to international guidelines for the management of sepsis and septic shock, appropriate antimicrobials should be administered within one hour of diagnosis, with the dosage optimised according to standard pharmacokinetic/pharmacodynamic principles.(8) In addition, the patient's location at the time of infection, the source of the infection and the prevalence and susceptibility patterns of common local pathogens should also be factored into the choice of therapy.(8),(9)

In Intensive Care Units and High Dependency Units, antibiotics are the most common type of medicine and are prescribed approximately 10 times more than in general hospital wards.(10) However, inappropriate therapy and delays in prescribing appropriate antibiotics are important factors related to increased morbidity and mortality in sepsis patients.(8),(11), India currently tackles 750,000 cases of Sepsis every year of which overall mortality rate in ICU patients is 90,600 (12.08%) and in the severe stage Sepsis patients it is 4,44,450 (59.26%).

The Saveetha Medical College and Hospital is a 1,000-bedded tertiary care hospital in Chennai, India, which also serves as a referral centre. However, to the best of the authors' knowledge, no studies have yet evaluated the appropriateness of antibiotic usage for sepsis patients in the hospital's ICU. This study therefore aimed to evaluate the propriety of antibiotic use with regards to antibiotic type and dosage and factors associated with patient outcomes among ICU patients with sepsis or septic shock admitted to Saveetha Medical College and Hospital.

II. METHODS

This observational study was carried out between February and May 2017 in the ICU and HDU of Saveetha Medical College and Hospital. All adult sepsis or septic shock patients who were receiving antibiotic therapy and were hospitalised in the ICU for at least 24 hours during the study period were included. Patients with incomplete medical records, those who had subsequent episodes of sepsis/septic shock or who were admitted for less than 24 hours and those who were under 18 years of age were excluded. In addition, patients readmitted to the ICU during the study period were not evaluated again.

The diagnosis of sepsis and septic shock were based on international criteria. Data were collected from the patients' medical and drug-prescribing records using a predesigned structured form. This included the patients' demographic characteristics, diagnosis, length of stay (LOS), the presence of co-morbidities (i.e. malignancy, diabetes mellitus, cardiovascular disease, chronic kidney disease, liver disease or respiratory insufficiency), causative pathogens, antibiotic usage (i.e. type and dose), the timing of the specimen collection for culture and outcome. In addition, samples of blood, sputum, bronchial rinse and urine were collected for cultures and antimicrobial sensitivity testing.

Antibiotics were assessed for appropriateness according to type and dosage. The type of antibiotic prescribed during the study period was subsequently deemed appropriate if it was prescribed empirically according to the local microbial susceptibility data, whereas it was deemed to be inappropriate if it did not reflect the susceptibility data. This assessment was undertaken by the Antibiotic Stewardship Committee of the hospital, consisting of physicians, clinical pharmacists and nurses. Additionally, the appropriateness of each type of antibiotic was considered in light of the source of infection, as determined

by the attending physician the initial dose of the antibiotic was deemed appropriate after adjustment for the patient's clinical condition, while unadjusted dosages were considered inappropriate.

Ethical approval for this study was obtained from the Institutional Ethical Committee of Saveetha Medical College and Hospital. No patient consent was deemed necessary as permission to review the medical records was granted by the concerned authorities. All information obtained during the review of the records was kept confidential and was only used for the purpose of this study.

III. RESULTS

A total of 110 patients diagnosed with sepsis admitted to the ICU of The Saveetha Medical College and Hospital was taken into consideration during the study period. Of these 110 adults, 57(51.7%) were diagnosed with sepsis and 53(48.3%) were diagnosed with septic shock. The mean age of the patients was 53.6 (range: 16–85 years old) and 56 (50.9%) were male.

Characteristics of sepsis patients admitted to the intensive care unit and high dependency unit of Saveetha Medical College and Hospital (N = 110)

Characteristic	n (%)
Age in years	
18–39	22 (21)
40–59	30 (27)
≥60	58 (52)
Total (N)	110
Gender	
Male	56 (51)
Female	54 (49)
Diagnosis	
Sepsis	57 (51.8)
Septic shock	53 (48.2)
Number of co morbidities	
≥2	106 (96.3)
<2	4 (3.7)
Type of co morbidity*	
Malignancy	80 (72.7)
Respiratory insufficiency	51 (46.3)
Cardiovascular disease	51 (46.3)
Chronic kidney disease	46 (41.8)
Liver disease	21 (19)
Diabetes mellitus	105 (95.4)

Table 1:- *Percentages do not add up to 100% as some patients may have had more than one co morbidity.

Blood, sputum, bronchial rinse, and urine samples were available for 110 patients. A total of 250 cultures were taken from the samples, of which 221 (90.4%) were positive and 24 (9.6%) were negative. Overall, 20 microorganisms were detected in the positive cultures, the most common being *Acinetobacter baumannii* (18.2%), followed by *Escherichia coli* (9.1%), *Klebsiella pneumoniae* (14.6%) and *Staphylococcus haemolyticus* (14.6%). Of the positive cultures, 215 (97.28%) were known to be bacterial in origin, while the remaining 7 (2.72%) contained only fungi. In total, 40.3% of the microorganisms were resistant to the antibiotic administered, 36.8% were sensitive to the antibiotic administered, 5.8% had intermediate resistance to the antibiotic administered or required a higher dose and 17.1% were not tested for sensitivity. *Pseudomonas aeruginosa* was the most sensitive to the administered antibiotics (85.5%), while *A. baumannii* was the most resistant (72.2%).

In total, there were 115 different antibiotic regimens, of which eight (7%) constituted definitive therapy and 107 (93%) were empirical. A total of 16 antibiotics were prescribed. Meropenem (42.1%) was most frequently prescribed, followed by levofloxacin (22.2%) and amikacin (14.3%). Levofloxacin was prescribed in three of the definitive regimens (38.5%)

IV. DISCUSSION

In the current study, sepsis was more common among patients over 60 years old as the mortality rate was higher among those over 60 years old. In the USA, the risk of sepsis increases with every year of age by 1.5% (22) Increased age over 60 years is a predictor of mortality in sepsis, particularly if adequate empirical antibiotic therapy is not initiated.(23) In terms of gender, there were slightly more male than female patients in the current study. However, the frequency of sepsis among male patients was higher in a similar study conducted by Ferrer et al. (61.9%).(24) Adrie et al. demonstrated that older men are more vulnerable to sepsis than women.(25) Another study showed that cross-linked mutations or polymorphisms in female mice resulted in the more dynamic activation, regulation and function of immune cells during the inflammatory process, while male mice only demonstrated a partial response to inflammation.(26)

Unfortunately, the mortality rate of patients with septic shock in ICUs and HDUs remains high, despite fluid resuscitation measures, adequate care and the early administration of empirical antibiotics.(27) In the current study, a diagnosis of septic shock was significantly associated with mortality, despite septic shock being less common. In sepsis, venodilation, fluid transudation from the vesicular space into the tissues, decreased oral intake and increased fluid loss facilitates the occurrence of hypovolaemic events; in septic shock, ventricular dysfunction and arteriolar dilatation contribute to the failure of function and organ perfusion.(27) This could be due to differences in the location of the study, the sample and

incidence of infections, as well as the extent of each individual patient's immune response.

Empirical antibiotic therapy is key in the initial management of sepsis patients. The type of antibiotic to be prescribed is usually determined by an assessment of the potential pathogens responsible for the infection, taking into account local antibiotic susceptibility patterns.(30) However, failure to determine the source of infection can potentially lead to the misidentification of pathogens, resulting in the inappropriate selection of antibiotics.(8), (9) previous research has established that the administration of inappropriate antimicrobials substantially increases mortality among sepsis patients.(8),(11–13) In the current study, a significant association was noted between inappropriate doses of antibiotics and mortality; however, there was no significant association between inappropriate types of antibiotics and mortality. In contrast, Katu et al. found that inappropriate types of antibiotics were significantly associated with mortality.(14) This variation in results may again be due to differences in the sample as well as study design, such as the inclusion and exclusion criteria and antibiotic guidelines used. Nevertheless, the multivariate analysis in the present study indicated that the most significant factors associated with mortality were septic shock and the presence of at least two co morbidities; therefore, regardless of the appropriateness of the antibiotics administered, the mortality rate was still high. This is likely due to the critical clinical condition of such patients, which is generally poor in light of their admission to the ICU.

According to international guidelines, it is strongly recommended that appropriate antimicrobial therapy be administered within one hour of recognising cases of sepsis or septic shock.(8) However, the exact antibiotic delivery time in the current study could not be assessed as almost all of the patients had received antibiotics prior to their admission to the ICU. Furthermore, antimicrobial sensitivity testing was not performed for all of the antibiotics administered during the study period due to interdepartmental miscommunication, wherein staffs of the microbiology laboratory were unaware of the specific antibiotics being administered to sepsis patients in the ICU. Additionally, as the Antibiotic Stewardship Committee was still under development during this time, no uniform reference was available for the selection of antibiotics by hospital staff. Finally, microbial cultures could not be performed in 19 cases due to difficulties collecting samples from these patients.

V. CONCLUSION

This study found that inappropriate doses of antibiotics were significantly associated with mortality among sepsis patients in an Indian ICU, whereas inappropriate types of antibiotics were not. Furthermore, a diagnosis of septic shock in the presence of at least two co morbidities was a significant risk factor related to mortality.

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