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Original Research Article

A prospective study on evaluation of antibiotics usage in patients with sepsis at a tertiary care hospital

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ABSTRACT

Background: Most developing countries are adopting antibiotic usage in sepsis. This study was conducted to evaluate the antibiotic usage in patients and to study medical adherence in high-risk patients. The study in particular aims to evaluate antibiotic usage in sepsis patients along with their related ADR's. The study also aims to optimize the usage of antibiotics in high-risk patients at a tertiary care hospital.
Methods: Study was prospective and observational review of patients record in the hospital. Clinical notes, medication chart and electronic data management system at the hospital were used to analyse usage of antibiotics. Culture and sensitivity reports were obtained from relevant departments. Observations were then compiled and documented.
Results: Out of 40 cases collected 22 (55%) patients were male and 18 (45%) were female. Majority of the study population belongs to 71 years and above with 15 (37.5%) followed by age group of 41-60 years with 14 (35%). Most frequently prescribed antibiotics were found to be meropenem 16 (21.33%) and piperacillin tazobactam 14 (18.67%). The most resistant antibiotic was found to be cotrimazole in 35 (87.5%). ADRs were found in 35% of all cases.
Conclusions: Prescribing patterns for antibiotics need to be optimized. Adherence to and update of the policy is also recommended. It was found that the adherence to hospital antibiotic policy is low.

Keywords: Sepsis, Antibiotics, Adverse drug reactions, Culture and sensitivity

INTRODUCTION

Sepsis can be defined as an abnormal response to infection which leads to organ dysfunction and if not controlled, death. Of the prevalent 50 million cases of sepsis yearly, around 11 million results in death.[1]

Understanding the pathogenesis of sepsis is important for the right treatment. The sepsis triad can be clearly seen as a cascade of systemic inflammation, coagulation, and disordered fibrinolysis. When there is infection in the cytokines are released in the body resulting in a systemic inflammatory response and homeostatic changes eventually leading to organ damage.[2]

To prevent early mortality due to sepsis, it is essential to start antibiotics.[3] Sepsis can be categorised into 5 depending on the symptoms displayed: Stage 1-systemic inflammatory response system, stage 2-sepsis, stage 3-severe sepsis, stage 4-septic shock and stage 5-multi-organ dysfunction syndrome.[4]

4 pathological pathways can be explained for sepsis namely, dysfunctional endothelium, coagulopathy, cellular dysfunction, and cardiovascular dysfunction. Activation of endothelium increases leucocyte transmigration into the blood stream. As the permeability increases it leads to interstitial pulmonary oedema and increased translocation

of bacteria from the gut. This exacerbates the inflammatory cascade.[5]

Damage to the endothelium, makes it a prothrombotic surface. Cytokines also activates tissue factor, thus initiating the extrinsic pathway of coagulation. This leads to a blockage in the capillaries and leads to disseminated intravascular coagulation (DIC). A generalised reduction in the energy expenditure by cells leads to increased catabolism, insulin resistance and hyperglycaemia. Cardiac output is maintained due to reduced ejection fraction, dilated left ventricle and a reduced left ventricular stroke work index due to diastolic volume increase. The resulting hypotension can lead to septic shock. Production of nitric acid is also a contributing factor that cannot be corrected by vasopressors.[5]

Management of sepsis

Resuscitation: Oxygen must be provided to maintain saturation of above 95%. Standard care is to give saline to all patients[6] Starch based fluids such as albumin must be avoided.[7,8] Persistent hypotension despite fluids will require the use of vasopressors such as noradrenaline.[9]

Anti-microbial treatment: It is wise to start as soon as possible though it is advisable to take blood cultures for sensitivity of pathogens to the antibiotics for further treatment.[10]

Fluid balance: It is of utmost importance. For accurate measurements, it is essential to place a urinary catheter. Hyperglycaemia should be treated immediately and should be always controlled.[11]

Importance of antibiotic treatment

Delay in the administration of antibiotics can cause serious problems in the progression of sepsis.[12] Treating sepsis with broad spectrum antibiotics can lead to antibiotic related ADRs and might also cause antimicrobial resistance.[13] Increase of multidrug resistant (MDR) pathogen limit the treatment plan drastically.[14] One of the main issues that persists in patients with septic shock is the selection of appropriate antibiotic treatment while preventing the emergence of resistant strains.[15]

Successful antibiotic therapy in sepsis is dependent on early detection of infection and administration of the right antibiotic treatment at the right time.[16] The sequential organ failure assessment (SOFA) score is used to detect organ dysfunction. The simplified scoring can be used to identify infection and mortality rate.[17] Correct and timely treatment is essential to prevent life threatening complications. To reduce the risk of death, physicians usually administer a broad-spectrum antibiotic.[18]

Early empirical treatment with antibiotics during hospitalisation is vital. However, duration of therapy is a point of debate. The surviving sepsis campaign (SSC) guideline recommends 7 to 10 days sufficient to treat infections associated with sepsis. This duration is increased when the patient has neutropenia, Staphylococcus aureus infection etc. It is decreased when the patient develops pyelonephritis or spontaneous bacterial peritonitis.[19]

Aim and objectives

The study aims to identify antibiotic usage in patients with sepsis. Other parameters studied are ADRs due to antibiotic usage and prescribing pattern and culture/sensitivity test of antibiotics.

METHODS

Study design

A prospective, observational study conducted at Bangalore Baptist hospital (a tertiary care hospital) in Bangalore, India.

Study population

The 40 patients with diagnosis of sepsis admitted to the Inpatient Ward for a period of 6 months from February 2022-July 2022.

Inclusion criteria

The study enrolled patients of both genders who are also 18 years and above. Only patients diagnosed with sepsis who are admitted to the ICU, HICU and CCU were assessed.

Exclusion criteria

The study excluded patients of both genders who are under the age of 18 years. Patients who are pregnant or breastfeeding are also not included.

Study procedure

Clinical case charts and notes are reviewed to identify patients diagnosed with sepsis and septic shock. Once patients who fulfil the inclusion criteria have been identified, the study procedure and format are explained to the caregivers or patients, whichever is applicable. The parameters and the objectives of the study is also explained. Once consent is obtained from either the patient/ caregiver, the study commences.

Demographic details and case history are studied and compiled. Prescription is also studied to understand pattern of antibiotic usage and daily doctors and nurses notes for any ADRs observed. Lab reports are also checked when necessary. Once all the details have been entered into the patient profile form and then analysed using Microsoft excel and the office libre, a report is prepared and submitted.

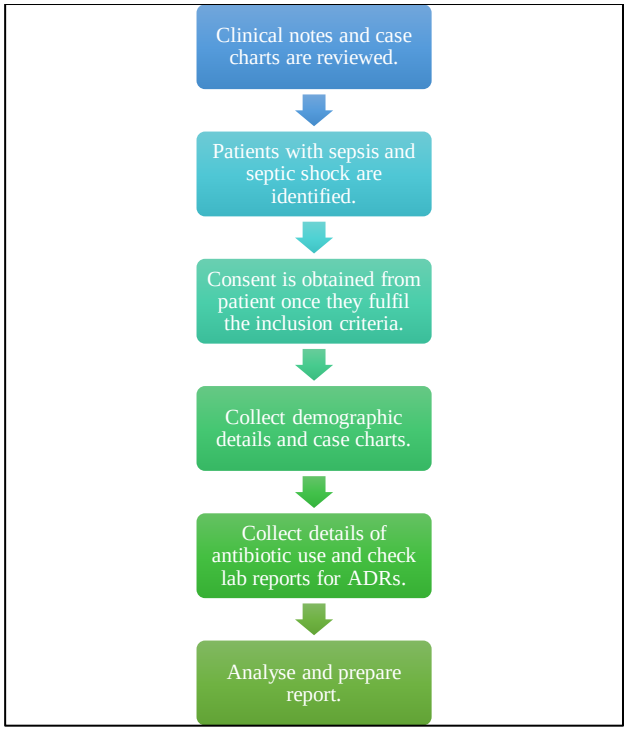

Figure 1: Flowchart depicting study procedure.

RESULTS

Distribution of patients based on gender

In gender distribution of the study population, 22 (55%) patients of the total population were found to be male and 18 (45%) patients were female.

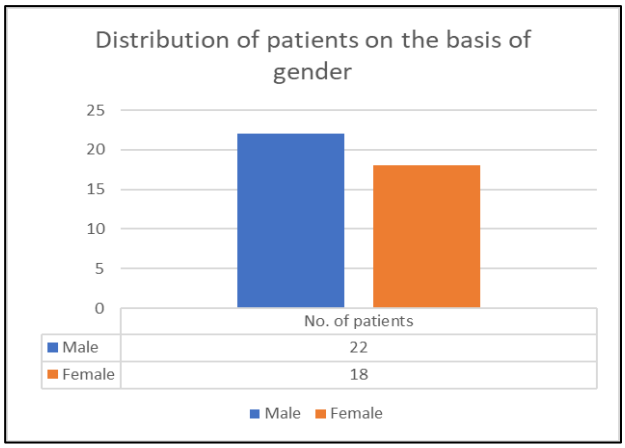

Figure 2: Distribution of patients based on gender.

Distribution of study population according to age group

Most of the study population belongs to (71 years and above) with 15 (37.5%) of the total study population having the highest followed by age group of (41-60 years) with 14 (35%) individuals, (61-70 years) with 7 (17.5%) and lastly with the age group of (18-40 years) with 4 (10%) individuals.

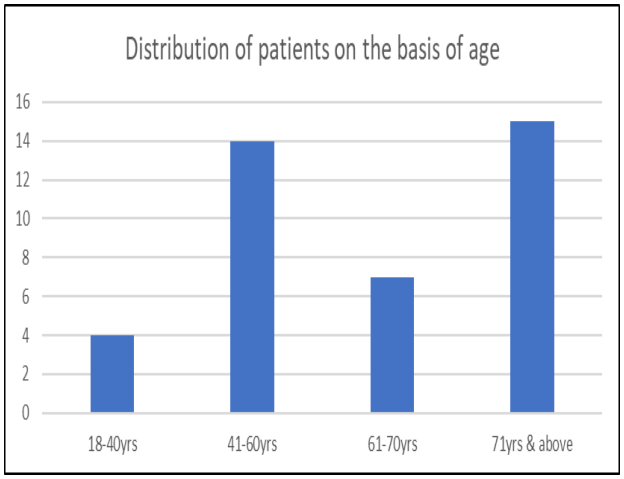

Figure 3: Distribution of patients based on age.

Distribution of various antibiotics use for treatment in the study population

The distribution of various antibiotics can help to understand that the most common preferred antibiotics in treatment of the population. The most common antibiotic used is meropenem 16 (21.33%) followed by piperacillin tazobactam 14 (18.67%).

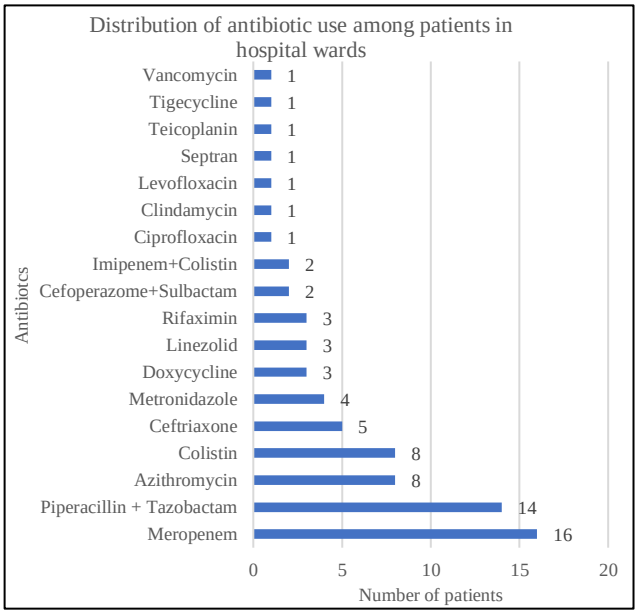

Figure 4: Prescribing pattern of antibiotics.

Distribution of positive and negative culture test based on gender

Culture and sensitivity test were taken from a sample of urine and blood, after the c/s test, 20 (57%) patients were male and 15 (47%) were female of the total 35 culture tests obtained. Various organisms found in patient's culture sensitivity tests are responsible for the infections. They may be either gram-positive or gram-negative microorganisms.

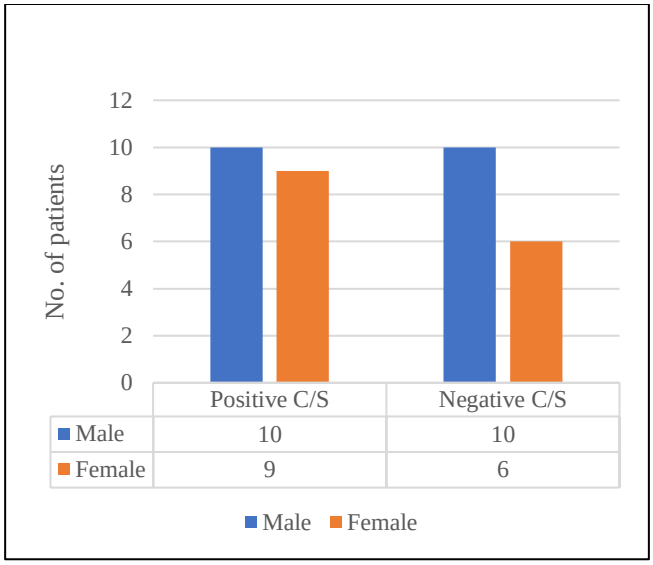

Figure 5: Comparison of positive and negative culture tests based on gender.

Adverse drug reactions

Meropenem with 3 (22%) cases has been cause for most of the suspected ADR's followed by the beta-lactam antibiotics piperacillin tazobactam and azithromycin and ceftriaxone are next causing ADRs. High risk patients in sepsis reminds these groups about the importance of sepsis prevention, early recognition, and appropriate treatment. From the c/s test, antibiotic co-trimazole was the most frequent resistant found in the C/s report. Followed by gentamycin, ciprofloxacin, cefazoline and ampicillin are also the most common resistant show by the reports. These findings were based on the average of occurrence observed in the study population.

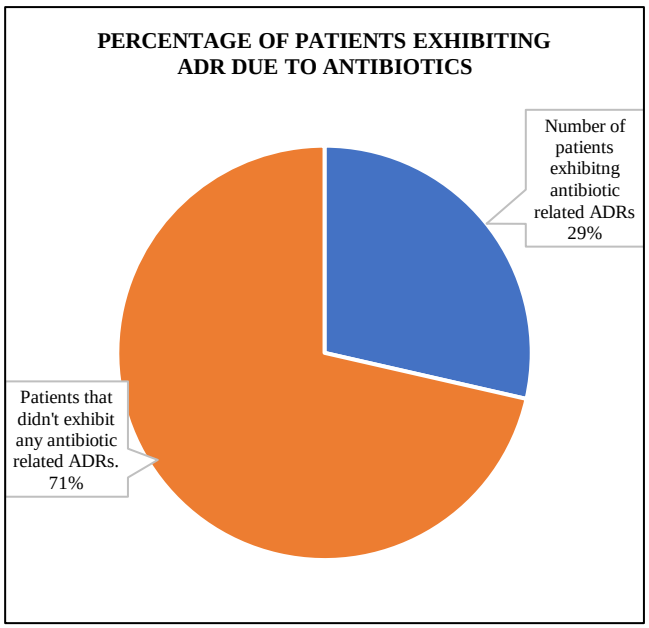

Figure 6: Percentage of patients exhibiting ADRs to antibiotics.

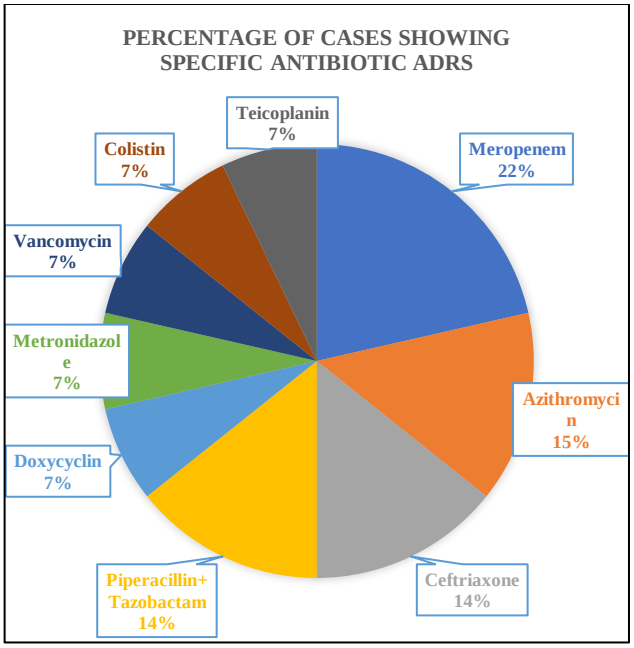

Figure 7: ADRs related to antibiotics as seen in the reported cases.

DISCUSSION

In our study, we noted that the patients admitted were mostly male. Patients were also the highest in the age group of 61-70 years. Wang et al noted that most patients will be older male patients that will most likely have numerous chronic health conditions.[20] Ferrer et al also noted that males had a confirmed higher risk for sepsis.[21] Pradipta et al noted that the most used antibiotics used were levofloxacin, ceftazidime, ciprofloxacin, cefotaxime, ceftriaxone, and erythromycin. Pradipta et al saw 66.3% of samples testing positive for microbes.[22] Out of 40 patients 36 (90%) prescription whose c/s test were done and 16 (44%) show negative result and 19 (56%) shows positive culture reports. Pattern of antibiotics sensitivity test can be used as supporting data to optimize appropriateness of empirical antibiotics therapy in sepsis patients as previously noted by Miller et al and Mc Cabe et al.[23,24] ADRs could have profound effects on the patient's quality of life, as well as create increased burden on healthy system. ADRs are one of the rising causes of morbidity and mortality. Shehab et al and Kigubaet al found that one in four ADRs related to hospital admission in the US and Uganda, respectively was linked to antibiotic use.[25,26] In comparison, ADR's are lesser in Netherlands as noted by van der Hooft et al and India as found by Sonal et al.[27,28]

Limitations

The number of patients included in the study were comparatively less. This was because most of the patients admitted with an infection did not progress towards sepsis or did not meet the inclusion criteria. Few of the enrolled patients did not survive for the full length of their hospitalisation due to an untimely demise. Result analysis

was impeded by the inability of procuring culture and sensitivity reports on time. Few cases were excluded from the study due to this. Prescribing policies of antibiotics need to be optimised.

CONCLUSION

In the study population, 55% were male and the remaining female. Majority of the patients belonged to the age group of 71 years and above. Followed by patients between the ages of 41-60 years. This shows that elderly males are more prone to sepsis. Culture and sensitivity test were taken from a sample of urine and blood with a total of 35 culture tests obtained. Various organisms found in patient's culture sensitivity tests are responsible for the infections. They may be either gram-positive or gram-negative microorganisms. Medication-related adverse events or ADR are harmful events caused by medication. ADRs could have profound effects on the patient's quality of life, as well as create increased burden on healthy system. ADRs are one of the rising causes of morbidity and mortality internationally and will continue to be significant public health issue with the increased complexity in medication, to treat various diseases in an ageing society. Adults 65 or older, chronic medical conditions such as diabetes, lung disease, cancer and kidney disease, recent severe illness or hospitalization, including due to severe COVID-19 can be classified as high risk patients for sepsis. These groups in particular remind us about the importance of sepsis prevention, early recognition, and appropriate treatment.

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