

BACTERIOLOGICAL PROFILE OF PATIENTS WITH SEPSIS ADMITTED IN INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL OF RAWALPINDI

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ABSTRACT

Objectives: To determine bacteriological profile of patients with clinical signs of sepsis admitted in Intensive care unit of a tertiary care hospital.

Materials and Methods: A cross-sectional study was conducted among 220 patients having sepsis and admitted in intensive care unit of Bahria International Hospital Rawalpindi from November 2021 to October 2022. Various clinical specimens including blood, urine, central venous catheter tip, and Foley catheter tip were collected from target subjects and immediately transported to Pathology laboratory for microbiological analysis.

Results: Out of total 220 patients, our data showed that 140 (63.6%) were male while 80 (36.4%) were female subjects with mean age of 41.623 ± 6.782 . Patients were recorded with various illnesses including Diabetes Mellitus (56.8%), Hypertension (25%), Asthma illness (24.5%) and end stage renal disease (26.8%). Least cases were observed for Stroke (29.1%), Malignancy (5.4%) and other diseases (3.6%). Urine sample was sent for 170 (77.2%) patients while blood cultures were sent for 110 (50%) patients. Bacteriological profile of samples revealed that 168 (76.3%) were Gram negative bacteria while 52 (23.7%) were Gram positive bacteria. The prevalent Gram negative bacteria was recorded as *Escherichia coli* 45.9% ($n=101$) followed by *Pseudomonas aeruginosa* 14.8% ($n=25$). Among the Gram bacteria, methicillin resistant *Staphalococcus aureus* ($n=41$, 78.8%) was most frequent followed methicillin sensitive *Staphalococcus aureus* ($n=8$, 15.3%).

Conclusion: Patients with sepsis in ICU were presented with different clinical presentations. Gram negative were the frequent cause of sepsis in ICU as compare to Gram positive bacteria. The study will be helpful for clinicians to know the frequent causative cause of sepsis in an ICU and thus appropriate antibiotic policy can be formulated.

Key words: Bacteria; Culture; Intensive care unit; Sepsis

INTRODUCTION

Intensive care unit is a clinical setting which deals with the patients of failing organs requiring vigorous support for more than one organ systems of the body.¹ Usually these patients are having multiple problems directly or indirectly related to underlying

primary medical or surgical condition.² Sometimes prolong admission in wards before coming to critical care unit or admission in critical care unit prone them to multiple health related conditions which further complicate the clinical picture.³ Sepsis leading to multi-organ failure may sometimes be the primary condition for which patients get admitted in the intensive care unit so that their organ systems could be supported till the resolution of infection.⁴ In most of the cases septic condition develops secondarily to the primary medical or surgical condition which is responsible for patients' admission first in the

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hospital and then in the critical care unit.⁵ Critical care team should be well aware of the common pathogens in order to treat and prevent the infective conditions in their already critically ill patients.⁶ Most of the intensive care units routinely check the presence of infections in their units and audit the protocols but still infection related problems remain common cause of mortality and morbidity in patients admitted in wards and critical units of hospitals. A recent study published by Madkour et al. from a respiratory ICU in Egypt revealed that around 1/4th of the patients admitted in their unit had presence of sepsis and it was main cause of mortality in their patients.⁷ Mohakud et al. from India in 2022 tried to look for the bacteriological profile of patients admitted in critical care unit. They found out that commonest organisms found out in their patients were *Staphylococcus aureus*, Coagulase negative *Staphylococcus* (CONS) and *E. coli*.⁸ Similar study published in 2021 via retrospective cohort design concluded that 68.1% of the cultures from septic patients had gram-negative organisms while 31.9% had Gram-positive organisms. *Klebsiella pneumoniae* and *E. coli* were the commonest organisms isolated in their study participants.⁹

Lower and middle income countries like ours have high mortality and morbidity related to infective causes in almost all settings. Situation becomes difficult in settings like critical care unit where already patients are having compromised organ systems and they are prone to all types of infections and hazards. A local study published in 2022 regarding ICU bacteriological profile in Peshawar concluded that *E. Coli* were found in most of the patients managed for sepsis¹⁰. The goal of this study was to evaluate the detailed bacteriological profiles of patients with clinical signs of sepsis admitted to the intensive care unit of a tertiary care hospital in Rawalpindi. This was done because there are few local data sources and because bacterial patterns have been changing over time.

MATERIALS AND METHODS

This cross-sectional study was conducted at the surgical intensive care unit of Behria International Hospital Rawalpindi from November 2021 to October 2022. The size of the sample was determined with the use of the WHO Sample Size Calculator. The population prevalence proportion of sepsis in critical

care patients was used to determine the sample size. The margin of error was set at 10%. A method known as non-probability consecutive sampling was utilised in order to collect the sample. Inclusion criteria: All patients between the age of 18 and 60 years who were admitted in critical care unit either from wards of own hospital or any other hospital due to any reason and had signs of sepsis were recruited in the study.

Exclusion criteria: patients whose caregivers refused consent for the study or those whose culture and sensitivity report was not issued due to technical problems or faulty sample collection were excluded. Those patients who died before the result came were also excluded. Those with invasive fungal infections or having HIV or any other reason making them high risk for atypical infections were also not included in the study.

Patients who were admitted to the critical care unit of Behria International Hospital with clinical signs of sepsis were recruited for the study after receiving written informed consent from potential participants' caregivers and ethical approval from the ethical review board committee (letter no. XXX; see below). The consultant overseeing the patient's treatment in the critical care unit evaluated the patient's clinical sepsis symptoms.¹² Appropriate specimen was selected by treating team (blood, urine, specific site, central venous catheter tip, Foley catheter tip) and sent for culture and sensitivity analysis in microbiology department of laboratory of our own hospital.¹³ Consultant microbiologist handled the individual samples as per protocols and did relevant staining and processing of the samples as per protocols.¹⁴ Detailed reports were issued after 72 hours and sent to critical care unit. All the relevant details of patients and laboratory parameters were entered in structured proforma and later in software for data processing.

All statistical analyses were conducted using Statistics Package for the Social Sciences, version 24.0 (SPSS-24.0). Frequency and percentages were calculated using SPSS-24.0. for gender, site of specimen collection and types of bacteria isolated from individual cultures were calculated. Mean and standard deviation for age was also calculated for the patients recruited in this study. Descriptive statistics were used to present the main data i.e. type of bacteria representing the bacteriological profile of our

study participants.

RESULT

A total of 220 patients who were admitted in intensive care unit for any reason and had clinical signs of sepsis were included in the study. Table-I showed general characteristics of patients admitted in ICU with clinical signs of sepsis. Out of total 220 patients, 140 (63.6%) were male while 80 (36.4%) were female. The minimum age of the patients was 19 years while 60 years was the maximum age of the patients with 41.623 ± 6.782 Mean $\pm$ SD. The patients admitted in ICU were having different primary illness. Most of the patients were having Diabetes Mellitus (56.8%) followed by Hypertension i.e. 25%. About 24.5% patients were living with Asthma illness. There was 26.8% end stage renal disease was found out total patients. Stroke, Malignancy and other diseases were found with the percentage of 29.1%, 5.4% and 3.6% respectively. Urine sample was sent for 170 (77.2%) patients while blood cultures were sent for 110 (50%) patients. Other than this, specific site for 35 (15.9%), Central venous catheter for 45 (20.4%)

Table-I: Characteristics of patients with clinical signs of sepsis admitted in ICU of a tertiary care hospital of Rawalpindi

Study parameters	n (%)
Age (years)	
Mean + SD	41.623 $\pm$ 6.782 years
Range (min-max)	19 years - 60 years
Gender	
Male	140 (63.6%)
Female	80 (36.4%)
Primary or Comorbid illnesses	
Diabetes Mellitus	125 (56.8%)
Hypertension	55 (25%)
Asthma/COPD	54 (24.5%)
End stage renal disease	59 (26.8%)
Stroke	64 (29.1%)
Malignancy	12 (5.4%)
Others	08 (3.6%)
Specimen sent to laboratory	
Urine culture	170 (77.2%)
Blood culture	110 (50%)
Specific site	35 (15.9%)
Central venous catheter	45 (20.4%)
Foley Catheter tip	45 (20.4%)

and Foley catheter tip for 45 (20.4%) patient was also sent to laboratory.

Table-II showed detailed analysis of bacteriological profile of patients included in the study. Out of 220, 168 (76.3%) samples showed presence of gram negative bacteria while 52 (23.7%) samples showed gram positive bacteria. Among Gram negative bacteria, *Escherichia coli* was the most abundant bacteria found in targeted patients i.e. 101 (45.9%) patients followed by *Pseudomonas aeruginosa* in 25 (14.8%) patients and then *Klebsiella pneumoniae* in 22 (13.1%) patients. *Proteus mirabilis* was isolated from 13 patients with percentage of 7.7%. *Morgenella morgeni* was in 3 (2.3%) and *Acitenobacter baumannii* was found in 4 (2.3%) patients.

On the other hand, *Staphalococcus Aureus* with methicillin resistant was commonest gram positive bacteria and was isolated from 41 (78.8%) samples. *Staphalococcus Aureus* with methicillin sensitive was isolated from 8 (15.3%) patients. *Enterococcus fecalis* and *Pneumococcus pneumoniae* was isolated from 2 (3.8%) and 1 (1.9%) patients.

DISCUSSION

Intensive care physicians mainly deal with organ support and usually underlying primary illnesses are managed by input of treating team. Sepsis is the condition which could be primary condition and cause of multi-organ failure leading to critical care unit admission but it could also be result of hospital

Table-II: Type of bacteria isolated from various specimens sent from patients admitted in ICU

Type	Number (%)
Gram positive	52 (23.6%)
<i>Staphylococcus aureus</i> (Methicillin resistant)	41 (78.8%)
<i>Enterococcus fecalis</i>	2 (3.8%)
<i>Staphylococcus aureus</i> (Methicillin sensitive)	8 (15.3%)
<i>Pneumococcus pneumoniae</i>	1 (1.9%)
Gram negative	168 (76.4%)
<i>Escherichia Coli</i>	101 (60.1%)
<i>Pseudomonas aeruginosa</i>	25 (14.8%)
<i>Klebsiella pneumoniae</i>	22 (13.1%)
<i>Morgenella morgeni</i>	3 (1.7%)
<i>Acitenobacter baumannii</i>	4 (2.3%)
<i>Proteus mirabilis</i>	13 (7.7%)

and ICU admission. Targeted and empirical antibiotic therapies both have been used in these patients. It is very important to start management timely in these already critically ill patients to prevent further harm. Adequate knowledge of common bacteria causing sepsis in local settings becomes extremely vital for the intensive care physicians. We conducted this study with an aim to assess the detailed bacteriological profile of patients with clinical signs of sepsis admitted in ICU of a Behria International Hospital Rawalpindi.

Dawit et al. in 2021 published a study for Ethiopia regarding trends of infections patients getting while hospital of ICU stay. They revealed that *Klebsiella* was the commonly found bacteria among their patients and longer duration of ICU stay was associated with more incidence of infections among ICU patients.¹⁵ Most of our patients had urine cultures and *E. coli* was the most commonly found bacteria in patients managed at our intensive care unit with clinical signs of septic illness.

Samples from blood, sputum, lower Respiratory Tract and urine were studied from patients admitted in ICU in Saudi Arabia by Kabrah et al. in 2021.¹⁶ It was found that *Klebsiella pneumoniae*, Coagulase-negative staphylococci (CoNS) and *Escherichia coli* were seen most commonly in their patients. Our results were not very different and *Escherichia coli* was the commonest bacteria found in our patients followed by *Staphylococcus aureus*.

Luo et al. targeted patients admitted in burn ICU for presence of catheter related infections and found out that 65.0% strains were of Gram-negative bacteria while 35% were of Gram-positive bacteria.¹⁷ Though our sample was from medical ICU and not burn ICU but still most of the organisms identified in our patients were also gram negative bacteria. *Escherichia coli* was at the top of the list in our study participants.

A study on nasal swabs of patients with sepsis admitted in ICU was published in 2019 by Tan et al.¹⁸ It was revealed that *Corynebacterium*, *Staphylococcus* and *Acinetobacter* were three most common bacteria isolated from nose of these patients. Urine sample was the commonest specimen sent for culture and sensitivity analysis in our ICU during the study period followed by blood culture. Most of the organisms identified were gram negative bacteria.

Escherichia coli was the commonest bacteria found in our patients followed by *Staphylococcus aureus*. One of our study limitations was that a lot of patients with culture negative sepsis also account for septic illness managed in ICUs. Some patients when shifted from wards were already on antibiotics which may blur the true picture of bacteriological profile in our intensive care unit.

CONCLUSION

Patients with sepsis in ICU were presented with different clinical presentations. Gram negative were the frequent cause of sepsis in ICU as compared to Gram positive bacteria. Among Gram negative the Gram negative bacteria *Escherichia coli*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, *Proteus mirabilis* were most frequent. While among the Gram positive bacteria, Methicillin resistant *Staphylococcus aureus*, methicillin sensitive *Staphylococcus aureus*, *Enterococcus faecalis* (n=2, 3.8%) and *Pneumococcus pneumoniae* (n=1, 1.9%) were observed as the most frequent causative agent of sepsis.

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