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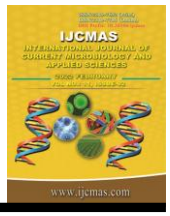

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Study of Bacteriological Profile and Antibiogram of Infections in Intensive Care Units of A Tertiary Care Hospital

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A B S T R A C T

The intensive care unit (ICU) is often called as the epicentre of infections, due to its vulnerable population. The present study aims to know the causative organisms and antibiotic susceptibility of infections in intensive care units. The Samples were processed as per standard guidelines. Antibiotic susceptibility testing and ESBL production of the organisms were tested by disc diffusion. Of the 429 samples tested, 112 of the samples were culture positive and most common isolate being *Klebsiella sps (38%) followed by Acinetobacter sp (26%), Escherichia coli (21%) and staphylococcus aureus (5%).* A local antibiogram pattern for each hospital, based on bacteriological profile and susceptibilities, is essential, to initiate empiric therapy and help in framing the appropriate institutional antibiotic policy.

Introduction

The intensive care unit (ICU) often is called the epicenter of infections, due to its extremely vulnerable population(reduced host defenses deregulating the immune responses) and increased risk of becoming infected through multiple procedures and use of invasive devices distorting the anatomical integrity-protective barriers of patients (intubation, mechanical ventilation, vascular access, etc.).

In addition, several drugs may be administered, which also predispose for infections, such as pneumonia, e.g., by reducing the cough and swallow reflexes (sedatives, muscle relaxants) or by distorting the normal nonpathogenic bacterial flora (e.g., stress ulcer prophylaxis) (Marwick and Davey, 2009).

The patterns of organisms causing infections and their antibiotic resistance pattern vary widely from one country to another; as well as from one hospital to another and even among ICUs within hospitals (Zaveri *et al.*, 2012). The ongoing emergence of resistance in the community and hospital is considered a major threat for public health. The ICU has even been described as a factory for creating, disseminating, and amplifying antimicrobial resistance, both infection and MDR result in a

considerable clinical and economic burden. Both infection and MDR result in a considerable clinical and economic burden. As such, the presence of MDR boosts the deleterious impact of nosocomial infection (Salgado *et al.*, 2005).

Antibiotic overuse and misuse partly due to incorrect diagnosis; as well as irrational and counterfeit antibiotic market combinations; and irregular consumption due to either wrong prescription or poor compliance; all contribute to the widespread drug resistance among the hospital-acquired organisms. In particular, drug-resistant pathogens are a major concern, as they lead to higher morbidity and mortality and are more difficult to identify by routine laboratory assays, which can lead to a delay in diagnosis and institution of appropriate antimicrobial therapy (Walsh *et al.*, 2002).

There is a great need for local resistance prevalence data in order to guide empirical prescription and to identify areas in which medical need for new agents is needed. The present study has been undertaken to determine the local bacteriological profile of infections and their antimicrobial drug susceptibility patterns for the patients admitted in ICU.

Materials and Methods

It is a prospective cross-sectional study of bacterial isolates from patients admitted to intensive care unit with clinical signs and symptoms of infection for period of 2016-2018. Paediatric and neonatal intensive care units and referred cases from hospital and Patient with HIV, HCV, HBV co-infections are not included in study.

Samples were sent to the laboratory from intensive care units as per the infection involved, under aseptic precautions and processed as per the guidelines and Gram stain was performed on the samples (endotrachea aspirate, pus) and Antibiotic sensitivity testing was performed on Mueller Hinton agar plates by Kirby-Bauer disc diffusion method. The antibiotic discs used were: amikacin (30 µg),amoxicillin/clavulanic acid (30 µg), aztreonam (30 µg),ceftriaxone (30 µg), ceftazidime (30 µg), cefoxitin,(30 µg), cefepime (30 µg), clindamycin (2 µg), gentamicin(10 µg), erythromycin (15 µg), imipenem (10 µg), levofloxacin (5 µg), linezolid (30 µg), penicillin G(10 units), piperacillin/tazobactam (110 µg), sulfamethoxazole/trimethoprim (25 µg), tetracycline (30 µg), and vancomycin (30 µg) (Oxoid). (Tille, 2014)

Zone diameters of different discs were interpreted according to the Clinical and Laboratory Standards Institute. Escherichia coli ATCC 25922, *Staphylococcus aureus* ATCC 25923, and *Pseudomonas aeruginosa* ATCC 27853 were used as control strains.

Results and Discussion

General characteristics and clinical profile

A total of 300 patients were admitted to the ICU between period of December 2016-may 2018, Mean age of the subjects was 45.7 ± 14 years. There were 192 men (64%) and 108 women (36%).

Bacteriological profile & Antibiotic susceptibility pattern

Total of 429 clinical samples were collected from 300 patients. Among all samples 174 (40%) of Endotracheal aspirate (40%) were the commonest samples. Other samples include 125 (29%) of urine, 121 (28%) of blood culture (28%) and 9 (2%) of pus.

Among 429 samples, 112 (26%) samples were culture positive, and predominantly culture was positive from endotracheal aspirate (74%), followed by urine (14%), 9.6% from blood culture (9.6%) and pus (5%).

The majority of bacterial isolates from all the samples were gram-negative (77%). Among them, *Klebsiella species* (38%), *Acinetobacter species* (26%) and *Escherichia coli* (21%) were the most

common. In urine samples Bacteriuria was seen in 12%, with predominant organisms were *Escherichia coli* (62.5%) followed by *Klebsiella pneumoniae* (31.3%) both of which were sensitive to Nitrofurantoin (66%) and Imipenem (66%),70% of *Escherichia Coli* and 80% of *Klebsiella pneumoniae* from urine samples were resistant to Norfloxacin. The *Escherichia coli*were not tested for Fosfomycin.

From Endotracheal aspirate, most common organism isolated were *Klebsiella sp* (40%) followed by *Acinetobacter sp* (35%), *Escherichia coli* (13%), *Pseudomonas aeruginosa* (9%) *and Staphylococcus aureus* (1%).

The organism *Klebsiella sp* showed most sensitive to Imipenem (82%) and Tigecycline (100%). In *Escherichia coli* 46% of isolates were sensitive to Ceftriaxone, 65% of isolates were sensitive to Gentamicin and Imipenem.

Sensitivity to imipenem was around 42% in *Acinetobacter sp.* Maximum sensitivity was seen in ceftazidime (60%) and levofloxacin(65%). *Pseudomonas aeruginosa* of endotracheal aspirate samples were sensitive to Imipenem (85%), 72% of them were sensitive to Amikacin, and Piperacillin-Tazobactum and Ceftazidime.

In total of 121 blood culture samples were processed and 8 (6.6%) samples were culture positive which yielded *Klebsiella pneumoniae and Pseudomonas aeruginosa, Staphylococcus aureus.* All the *Pseudomonas aeruginosa* isolated from blood culture samples were sensitive to amino-glycoside and Ceftazidime (3rd generation cephalosporin) and Cefepime (4th generation cephalosporin). Resistance of *Pseudomonas aeruginosa* to Imipenem was seen in 33%. Resistance pattern of *Klebsiella Spp* organisms isolated from blood culture sample All the *Klebsiella sp* were resistant to amino-glycoside. *MRSA* wasfound to be sensitive to *linezolid*, erythromycin, clindamycin and doxycycline but resistant to β-lactam antibiotics. In pus a total of 9 samples were received and among them 5 (55.5%) samples were culture positive and organism isolated were *Escherichia coli (n=2), Klebsiella sps. (n=1), Pseudomonas aeruginosa (n=1), and Staphylococcus aureus (n=1).* All the isolates from pus were sensitive to amikacin and gentamicin.75% of gram negatives bacteria were sensitive to imipenem, and ciprofloxacin and ceftazidime. *Staphylococcus aureus* were resistant to β-lactam.

Infections are one of the most important causes of mortality in the world, more so in low and lower middle income countries. The intensive care units constitute less than 10% of total hospital beds but they harbour up to 30% of the nosocomial infections in the hospital. Ghanshani *et al.,*

Infections in ICU consists of both community acquired and hospital acquired. With the emergence of multi-drug resistant strains the early identification and diagnosis are of utmost concern. Hence, understanding the bacteriology and antibiogram of infections in ICU is of immense importance for better management.

A total of 429 samples were processed, 26% (112) were culture positive which is similar to the study done by Ghanshani *et al.*, where culture positive was 28% (623).

But the culture positive seen in study by Divatia *et al.,* (2016) and Vincent *et al.,* (2009) showed 38.3% and 35.9% respectively which was higher than the present study, these findings may be due to the relatively small sample size of the present study.

The predominant organism isolated were Gram-negative organisms and includes *38%* of *Klebsiella sp, 26% of Acinetobacter sp, 21% of Escherichia coli* and *10% Pseudomonas aeruginosa.*

The study conducted by Ghanshani *et al.,* has similar organisms but most frequently isolated were *Acinetobacter baumannii* (20.9%), *Klebsiella pneumoniae* (19.7%), *Escherichia coli* (18.3%), and *Pseudomonas aeruginosa* (14.0%). In the present study, isolates of *Klebsiella sp* showed resistant to Amoxy-clavulanate (100%) and Ciprofloxacin

(74%) and were sensitive to amino-glycoside (60%) and Imipenem (82%) and Tigecycline (100%).

In the study by Goel and Hogade (2012) of the 27 isolates of *Acinetobacter sp*, 3.70% was resistant to all groups of antibiotics, including carbapenems. In present study, most of the *Acinetobacter sp were* resistant to ciprofloxacin *(100%)* and 70% to Gentamicin, 58% to Imipenem. Maximus numbers of *Acinetobacter sp* were sensitive to levofloxacin (65%) and ceftazidime(60%).

In the present study, *Pseudomonas aeruginosa* was showed 85% sensitive to Imipenem, 72% sensitive to amikacin, pipercillin tazobactum and ceftazidime. In study conducted by Goel and Hogade (2012) Showed *Pseudomonas aeruginosa* was resistant to Gentamicin (100%), Aztreonam (88.23%), Ciprofloxacin and Amikacin (82.35%), Imipenem (47.06%), Ceftazidime (35.29%) and Piperacillin-tazobactam (23.53%).

Infections are a common problem for patients in intensive care units (ICUs) and are associated with substantial morbidity, mortality, and costs. (Zaveri *et al.*, 2012)

There is need for local bacteriological profile and their susceptibility in reducing antibiotic overuse, a step towards the antimicrobial stewardship.

In this prospective observational study, majority of the cultures yielded Gram negative organisms. Among Gram negative bacteria *Klebsiella sp. and Acinetobacter sp, Escherichia coli* were most commonly isolated and other species like, *Pseudomnas aeruginosa,* were less frequently isolated. Most of the organism belong to *Enterobacteriaceae* were sensitive to Tigecycline and that of *Non Enterobacteriaceae* were sensitive to cefepime, ceftazidime and levofloxacin.

Staphylococcus aureus isolated from most of the samples were resistant to β-lactam and sensitive to doxycycline, clindamycin and linezolid. Molecular testing of drug resistance isolates were not performed. There is need for effective formulations of hospital specific guidelines for rational use of 3rd and 4th generation cephalosporins, carbapenems and β-lactam and β-lactam inhibitors.

The finding of the study may help in formulating local empirical antibiotics therapy, it will aid clinicians in timely intervention with empirical antibiotic therapy based on local data thus reducing morbidity and mortality contributing towards antimicrobial stewardship.

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