# MICROORGANISM PROFILE AND THEIR SENSITIVITY PATTERN IN THE INTENSIVE CARE UNIT OF CHITTAGONG MEDICAL COLLEGE HOSPITAL

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## Abstract

**Introduction:** Nosocomial infections are one of the leading causes of morbidity and mortality among hospitalized patients. An intensive care patient has five to seven fold higher risk of infection. The rate of nosocomial infections in the ICU is rising, mainly because of increasing use of invasive procedures for therapeutic interventions. The aim of the study was to know the bacterial profiles and determine the sensitivity pattern of the isolates in the intensive care unit of Chittagong Medical College Hospital during June'2017 to August'2018.

**Materials and methods:** A prospective study was conducted in the ICU of those patients who were clinically suspected of having acquired infection. The clinically suspected laboratory samples were collected from the patients and subjected to testing and antibiotic sensitivity.

**Results:** The rate of ICU associated infection was 9.22%%. Respiratory tract infection was the most common infection (58.44%). The predominant isolate was Klebsiella pneumoniae (36.92%) followed by Acinetobacter (23.03%) Pseudomonas aeruginosa (20%). Klebsiella pneumonia was mostly sensitive to Meropenam and Amikacin, then Colistin and Acinetobacter to the Cotrimoxazole.

**Conclusion:** Klebsiella pneumoniae was the major organism identified as the causative agent of nosocomial infection and showed higher susceptibility to Meropenam. Regular surveillance of antibiotic susceptibility pattern and judicious use of antibiotics are very important in ICU for controlling resistance.

**Key words:** ICU associated infection; Nosocomial infection; Intensive care unit; Antibiotic resistance; Bacterial isolates and Antibiotic susceptibility.

## Introduction

Throughout the world multidrug resistance nosocomial infections are one of the leading causes of morbidity and mortality among hospitalized patients, leading to a major burden on public health system of any country.[1,2] An intensive care patient has five to seven folds higher risk of infection and Intensive Care Unit (ICU) infections contributes to 20% to 25% of all hospital acquired infections.[3] The international study of infections in ICU, which was conducted in 2007, demonstrated that the patients who had longer ICU stays had higher rates of infection, especially infections due to resistant to Staphylococci, Acinetobacter, Pseudomonas species, Candida species.[3] The rate of nosocomial infections in the ICU is rising, mainly because of increasing use of invasive procedures which are performed in the ICU. The therapeutic interventions which are associated with infectious complications include indwelling catheters, mechanical ventilators, intravenous fluid therapy, prosthetic devices, immunosuppressive therapy and use of broad spectrum antibiotics leading to a spectrum of multi-drug resistant pathogens, which contributed to the evolution of the problem of antibiotic resistant.[4] Moreover, the ICU mortality of infectious patients is more than twice that of non-infected patients.[5-7]

Irrational use of antibiotics 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 contributes to the widespread drug resistance among the microorganisms.[8-10] In particular, drug resistant pathogens are a major concern, as they lead to higher morbidity and mortality. 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 other. Presently, data on pattern of organism and their antibiotic susceptibility in ICU of Chittagong Medical College Hospital are lacking.

The aim of the present study was to identify the prevalence of predominantly isolated bacterial microorganisms and their drug sensitivity patterns for the patients admitted in the ICU in Chittagong Medical College Hospital.

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## Materials and methods

It was a hospital based prospective observational study carried out at 12 seated ICU in Chittagong Medical College Hospital, during the period from June 2017 to August 2018 (15 months). Patients with ICU associated infection that underwent microbiological culture of various laboratory specimens and antibiotic susceptibility of causative organism.

Samples were collected by reviewing and evaluating records kept in ICU regarding microbiological culture of various laboratory samples like urine, blood, deep tracheal aspirate, pus, wound swab, central venous line tips, end of endotracheal tube and tracheostomy tube and growth of organism with their antibiotic susceptibility. Other information regarding the patient including age, gender, date of admission was also collected from the case records of the patients.

## Results

During fifteen months study period a total 748 patients were admitted to this ICU, of which 69 (9.22%) had clinically suspected ICU associated infections. A total of 77 different samples were collected from those 69 patients of which the deep tracheal aspirate were 45 (58.44%) urine 14 (18.18%) blood 08 (10.38%) pus or wound swab of tracheostomy wound 07 (9.09%) tip of central venous catheter 03(3.89%). All the samples were analyzed and out of that, 91.1% of deep tracheal aspirate sample (41 out of 45) 71.42% of urine sample (10 out of 14) 85.71% pus or wound swab of tracheostomy wound sample (6 out of 7) 66.67% of tip of central venous line sample (2 out of 3) were positive for growth of organism which yields the cumulative positivity rate was 81.81% (63 out of 77 samples) (Table I & II).

**Table I :** Frequency of different samples collected from the patients.

| Name of samples | Number of samples | Percentage (%) |
|---|---|---|
| Deep tracheal aspirate | 45 | 58.44% |
| Urine | 14 | 18.18% |
| Blood | 08 | 10.38% |
| Pus or wound swab of tracheostomy wound | 07 | 9.09% |
| Tip of central venous line | 03 | 3.89% |
| Total | 77 | 100% |

**Table II :** Sample profile & rate of positive culture in the specimens.

| Samples | Total number of samples | Samples yielding growth of the organisms | |
|---|---|---|---|
| | | n. | (%) |
| Deep tracheal aspirate | 45 | 41 | 91.1 |
| Urine | 14 | 10 | 71.42 |
| Pus or wound swab of tracheostomy wound | 07 | 06 | 85.71 |
| Blood | 08 | 04 | 50 |
| Tip of central venous line | 03 | 02 | 66.67 |
| Total | 77 | 63 | 81.81 |

Among the positive samples we found that, Klebsiella pneumoniae 24 (36.92%) was the most frequently isolated microorganism, followed by Acinetobacter 15 (23.03%) Pseudomonas aeruginosa 13 (20%) Escherechia coli 07 (10.76%) Staphylococcus aureus 04 (6.15%) Streptococcus pyogens 01 (1.53%) and Salmonella species 01 (1.53%) shown in (Table III).

**Table III :** Frequency of microorganisms isolated various specimens.

| Organism | Deep tracheal aspirate n. (%) | Urine n. (%) | Pus or wound swab of tracheostomy wound n. (%) | Blood n. (%) | Tip of central venous line n. (%) | Percentage (%) |
|---|---|---|---|---|---|---|
| Klebsiella pneumoniae | 20 (46.5%) | | 03 (50%) | 01 (25%) | | 36.92% |
| Acinetobacter | 14 (32.5%) | | 01 (16.6%) | | | 23.03% |
| Pseudomonas aeruginosa | 05 (11.6%) | 05 (50%) | 02 (33.3%) | 01 (25%) | | 20% |
| Escherechia coli | 01 (2.3%) | 05 (50%) | | 01 (25%) | | 10.76% |
| Staphylococcus aureus | 02 (4.6%) | | | | 02 (100%) | 6.15% |
| Streptococcus pyogens | 01 (2.3%) | | | | | 1.53% |
| Salmonella | | | | 01 (25%) | | 1.53% |
| Total | 43 | 10 | 06 | 04 | 02 | |

The antibiotic sensitivity pattern of major six bacterial isolates as per table IV was, Klebsiella pneumoniae was mostly sensitive to Meropenam and Amikacin, then Colistin, Ciprofloxacin and Piperacillin + Tezobactum. Acinetobacter showed higher sensitive to Collistin, then Cotrimoxazole and Cefoperazone + Sulbactum. Pseudomonas was sensitive to Meropenem & Amikacin then Levofloxacin & Gentamycin. Escherechia coli

was sensitive to Meropenam, Amikacin, Nitrofurantoin and Ceftriaxone. S.aureus was sensitive to Meropenem, Amikacin, Levofloxacin, Vancomycin & Linezolid. Streptococcus pyogens and Salmonella were sensitive to Levofloxacin, Meropenam and Amikacin.

**Table IV :** Antibiotic sensitivity pattern of isolated microorganism from patients.

| | Klebsiella (24) | Acinetobacter (15) | Pseudomonas (13) | E.coli (7) | S. aureus(4) | S.pyogens (1) | Salmonella (1) |
|---|---|---|---|---|---|---|---|
| Meropenem | 12 | | 03 | 04 | 02 | 01 | 01 |
| Amikacin | 12 | 01 | 03 | 04 | 02 | 01 | |
| Colistin | 11 | 11 | 01 | 01 | 01 | | |
| Ciprofloxacin | 07 | | 01 | | | | |
| Piperacillin + Tazobactum | 06 | 01 | 01 | | | | |
| Levofloxacin | 03 | 02 | 02 | | 02 | 01 | 01 |
| Azithromycin | 03 | | 01 | 01 | | | |
| Gentamycin | 02 | | 02 | 01 | 01 | | |
| Cotrimoxazole | 01 | 04 | 01 | 01 | | | |
| Tigecycline | 01 | 01 | | | 01 | | |
| Doxycycline | 01 | 03 | 01 | 01 | | | |
| Ceftriaxone | 01 | | | 02 | | | |
| Cefuroxime | | | 01 | 01 | | | |
| Cefoperazone + Sulbactum | | 03 | 01 | | 01 | | |
| Vancomycin | | | | | 01 | | |
| Linezolid | | | | | 01 | | |
| Nitrofurantoin | | | | 03 | | | |

## Discussion

Nosocomial infections have been associated with substantial morbidity, mortality and increased health care lost. An integrated infection control program can reduces the incidence by as much as 30% and reduce the health care cost.[11] So monitoring the use of antimicrobial agents and review of sensitivity pattern are, therefore, important.

In the present study, the infection rate in ICU is about 9.22%, which is within the value of the reported range (2.8-34.6%).[11,12] The nosocomial infections observed in this study could be due to different clinical profiles of the patients and the absence of a powerful hospital acquired infection control program. Respiratory tract infections were the most common infection (58.44%) followed by the urinary tract infection (18.18%). In total, predominant organisms isolated were Klebsiella pneumoniae (36.92%) followed by Acinetobacter (23.03%) Pseudomonas aeruginosa (20%) Escherechia coli (10.76%) Staphylococcus aureus (6.15%) and Streptococcus pyogens (1.53%). These findings were comparable to the observation of previous studies, where the predominant organism was Klebsiella pneumoniae.[13,14] In this study E .coli & Pseudomonas were equally responsible for urinary tract infections which supports the claim in a study conducted in a tertiary care hospital in Dhaka.[15] A study was conducted in 12 ICUs in seven different Indian cities showed Enterobactericae (46%) Pseudomonas (27%) Acinetobacter (6%) Candida (8%) Staphylococcus aureus (6%) as causative agent of nosocomial infection. In the present study Klebsiella was highly sensitive to Meropenam, Amikacin, Colistin, Ciprofloxacillin, Piperacillin + Tezobactum which were contrary to a study on antibiotic sensitivity pattern conducted in an ICU of Indian hospital.[16-18] Acinetobacter showed higher sensitivity to Colistin.

The gram positive cocci, Staphylococcus aureus were moderately positive to Levofloxacin and Amikacin which support the claim of Shalini et al.[11] The higher degree of resistant to Cephalosporin was probably due to extensive use of this drug in this hospital and local community.

## Limitations

- Sample size was small.
- Patients who were in the incubation period of nosocomial infections on discharge from the ICU, who manifest it after discharge were not included in the current study. Contribution of their load to current study prevalence is unknown.

## Conclusion

It was found that Klebsiella pneumoniae was the major organism identified as the causative agent of nosocomial infection in this ICU. Then Acinetobacter & Pseudomonas hold the prior position in the list. The sensitivity pattern data revealed that the isolated organisms showed higher susceptibility to Meropenam, Colistin & Amikacin. The findings of the study might help the clinicians to formulate their first line empirical antibiotic treatment regimen for the patients admitted in the ICU and the judicious use of antimicrobial agents is essential for prevent the emergence of multi drug resistant bacteria in the ICU.

## Recommendations

- Physicians should be more cautious regarding judicious use of antimicobials in Intensive Care Unit (ICU).
- A Practical guideline regarding antimicrobials practice should be adapted in this institute as soon as possible.
- Large multicentre study with long term follow up and meta analysis to have more detailed and retiable scenario.

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## Contribution of authors

AD-Conception, acquision of data, drafting & final approval.

RB-Design, data analysis, drafting & final approval.

TT-Acquisition of data, data analysis, critical revision & final approval.

AKMSA-Interpretation of data, critical revision & final approval.

## Disclosure

All the authors declared no competing interest.

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