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Study of Bacteriological Profile and Antimicrobial Susceptibility Pattern of Nosocomial Infection in Intensive Care Unit-In a Tertiary Care Hospital

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Introduction

Compared with an average patient, an ICU patient has five to seven folds higher risk of nosocomial infection and ICU infections contributes to 20% to 25% of all nosocomial infections in a hospital.

The patterns of microorganisms causing various 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 one hospital.

Having proper knowledge regarding the antibiotic resistance pattern in hospital settings will help in implementing proper antibiotic policy for the hospital and hence benefit the community in this region.

Aims & Objectives

The objectives of the present study were the following

1) To determine the prevalence of nosocomial infections in patients admitted in different Intensive Care Units of Silchar Medical College.
2) To study the bacteriological profile, their drug sensitivity and resistance pattern from the isolates of the patients.

Materials & Methods

Study Design: Observational study (cross sectional study)

Place of study:

1) Department of Microbiology, Silchar Medical College & Hospital, Silchar
2) Different Intensive Care Units (ICUs) of Silchar Medical College & hospital, Silchar

Study Period: One year from June 2018 to May 2019.

Clinical Specimen

- The different types of the samples were- Blood, Urine, Catheter tip, Endo-tracheal tube, Endo-tracheal aspirate, Pus from surgical site.
- Different departments from where samples were collected are Neonatal Intensive Care Unit (NICU), Pediatric Intensive Care Unit (PICU), Medicine ICU, Obstetrics &

Gynecology ICU, etc. and samples from patients of any age and both the sexes were included.

Collection

Under strict aseptic condition samples were collected and immediately transferred to Bacteriology section of Department of Microbiology, Silchar Medical College & Hospital for processing.

Processing of the sample

First samples were inoculated in culture media for primary isolation of bacteria. The media used are as follows:

a) 5% sheep blood agar medium and MacConkey's agar for all specimens.

b) Cysteine Lactose Electrolyte Deficient Media which was used for urine

Isolation and identification of isolates

The isolates were identified by Colony morphology and cultural characteristics, Gram stain, Motility, Biochemical tests, Sugar fermentation test.

Antibiotic susceptibility testing by disc diffusion method (CLSI 2018):

- Mueller Hinton agar plates were made till depth of 4mm.
- Pure culture was selected for preparation of inoculums.3-4 similar colonies were selected and transferred into peptone water. Incubated at 35ºC for 2-8 hours till light moderate turbidity was achieved. The turbidity was adjusted to Mac Farlands standard 0.5(1.5×10^8 CFU/ml).
- A sterile cotton swab was dipped in the suspension
- The soaked swab was rotated firmly against the upper inside wall of thetube to remove excess fluid.
- It was streaked evenly into entire agar surface of the plate three times, turning the plate 60º between each streaking.
- The inoculums is dried 5-15 minutes with lid in place.
- Commercially prepared antibiotic discs were applied using aseptic technique.
- The discs were placed with centres at least 24 mm apart.
- Incubated immediately and examined after 14-16 hours.
- The zone of inhibition was measured in millimetres with standard chart provided through CLSI Guidelines 2018.
- Quality control of Antimicrobial susceptibility testing is done by using reference strain i.e. *Staphylococcus aureus* ATCC- 25923, *Escherichia coli* ATCC-25922, *Klebsiella pneumoniae* ATCC-700603 as per standard CLSI guideline.

Results & Observations

The following observations were made in the study:

1. **Prevalence of Nosocomial infection**

   During the period of the study, a total of 160 samples were analyzed. Of these, 38 patients (23.75%) were found to develop Nosocomial infection. Type of samples & their positivity pattern on culture are shown in **table**

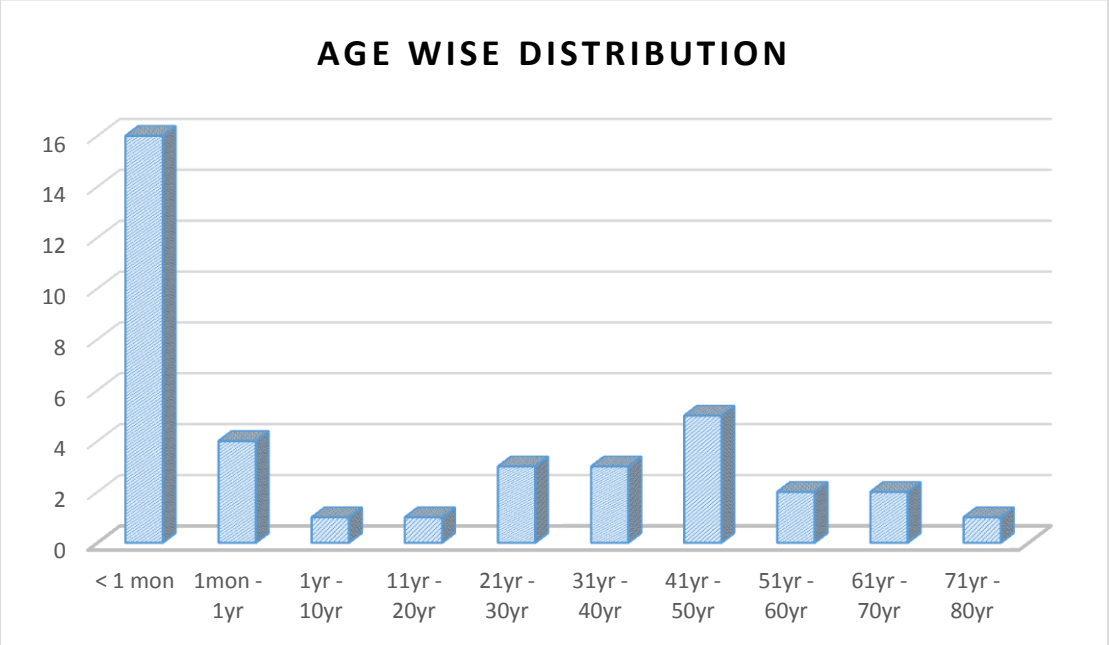
Type of Sample	Total number	Positivity (%)
Urine, Catheter tip	52	21 (40.38%)
Blood, Peripheral venous line etc.	68	08 (11.76%)
Tracheal aspirate, Endotracheal tube	30	08 (26.66%)
Pus from surgical site, Drain tip	10	01 (10%)

2. Demographic characteristics of Nosocomial infection:

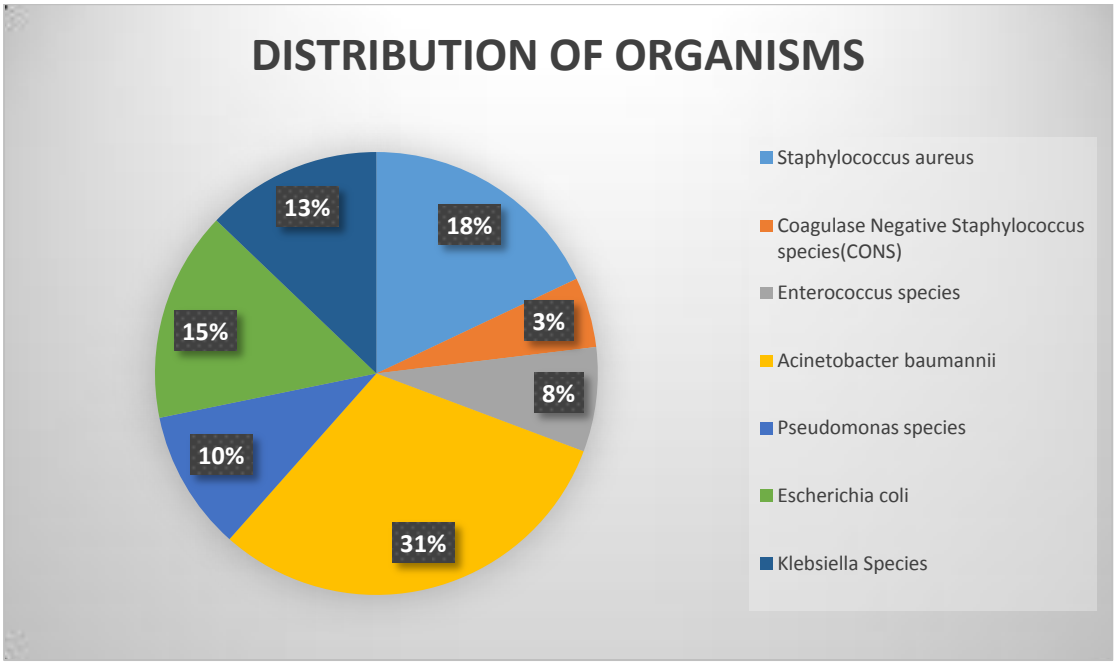
A) Isolation of the samples were from various ICUs, & showed that more number of specimens were isolated from NICU 29.31% (17 out of 58) followed by SNCU 26.66% (4 out of 15), ICU 26.08% (6 out of 23), PICU 19.04% (4 out of 21), SICU 20% (1 out of 5), MICU 18.51% (5 out of 27), HDU 9% (1 out of 11) as follows in Table / chart 4

B) Patients who developed nosocomial infection, among them 59 (37%) were male and 101 (63%) were female (P value 0.039)

C) The isolates belonged to different age groups. Prevalence of nosocomial infectionamong different age group is depicted in table.



3. Distribution of isolated organisms in nosocomial infection



4. **Antibiotic Susceptibility pattern:**
Antibiotic susceptibility pattern of the isolates of our as follows—

- In our study we noted that non-fermenting *Acinetobacter species* ranks top in the list among clinical isolates from ICU. Antimicrobial susceptibility pattern was analyzed among these isolates and it was observed that most of NF-GNB were multi drug resistant organisms (MDRO) being resistant to three or more class of antibiotics. High rates of resistance was noted to even carbapenems and aminoglycosides.
- Second most common organism in our study was *Staphylococcus aureus*. 42.8% of *Staphylococcus aureus* were found to be MRSA and the proportion of VRE was 0%.
- Members of the Enterobacteriacae family are the third in the list of most common clinical isolates. *Escherichia coli* and *Klebsiella* spp were most common clinical isolates in this family. In both of these GNB, high rates of non susceptibility was noted against quinolones, cephalosporins and beta lactam inhibitor group of drugs. Resistance to carbapenems was also significantly higher.

[Table/Fig-7]: Antimicrobial resistance pattern of non-fermenting GNB.

Antimicrobial Agent	***Acinetobacter species* (12)**	***Pseudomonas species* (4)**
Ceftazidime	11 (91.6%)	2 (50%)
Cefoperozone+ Salbactam	3 (25%)	1 (25%)
Meropenem	10 (83.3%)	2 (50%)
Gentamicin	10 (83.3%)	3 (75%)
Amikacin	10 (83.3%)	2 (50%)
Ciprofloxacin	10 (83.3%)	3 (75%)
Levofloxacin	9 (75%)	1 (75%)
Tetracycline	5 (41.6%)	--
Piperacillin+Tazobactam		1(25%)

*% indicates resistance to corresponding antimicrobial agent.

[Table/Fig-8]: Antimicrobial resistance pattern of gram positive cocci.

Antimicrobial agent	***Staphylococcus. aureus* (7)**	***Enterococcus species*(3)**	**CoNS (1)**
Penicillin	6 (85.7%)		0 (0.00%)
Ampicillin		2 (66.6%)	
Amoxycillin+ Clavulanic acid	6 (85.7%)		
Gentamicin	2 (28.5%)		
Ciprofloxacin	4 (57.1%)		0 (0.00%)
Erythromycin	3 (42.8%)		
Clindamycin	1 (14.2%)		1 (100%)
High level Gentamicin		1 (33.3%)	
Vancomycin	0 (0.00%)	1 (33.3%)	0 (0.00%)
Cefoxitin	3 (42.8%)		1 (100%)
Linezolid	0 (0.00%)		

*% indicates resistance to corresponding antimicrobial agent.

[Table/Fig-9]: Antimicrobial resistance pattern of Enterobacteriacae

Antimicrobial agent	***Escherichia coli* (6)**	***Klebsiella species* (5)**
Ceftriaxone	5 (83.3%)	4 (80%)
Ceftazidime	5 (83.3%)	4 (80%)
Cefoperazone+ Sulbactam	1 (16.6%)	1 (20%)
Meropenem	2 (33.3%)	2 (40%)
Gentamicin	4 (66.6%)	3 (60%)
Amikacin	2 (33.3%)	3 (60%)
Ciprofloxacin	5 (83.3%)	4 (80%)

*% indicates resistance to corresponding antimicrobial agent

So, it can be concluded from our study that overall MDRO (resistant to 3 or more class of antimicrobial agents) isolates were 59.2%, MRSA isolates were 42.8%, MR CoNS isolates 100%, VRE 0.00%

As the limitation of our study is small sample size, further studies on resistance pattern with larger sample size, and also samples from the health care providers would provide a clearer picture of the prevalence in this hospital.

Conclusion

From this prospective cross-sectional study, it can be concluded that Nosocomial infection is a significant problem in this region.

The risk of the development of nosocomial infections is directly related to the duration of ICU stay and the duration of the use of the use of the indwelling catheters/ tubes. The prolonged use of indwelling devices needs careful prophylactic standards of microbiological monitoring.

The empirical and the indiscriminate usage of antibiotic should be avoided in order to curtail the emergence and spread of drug resistance among nosocomial pathogens.

A sustained co-ordination between the clinician and the clinical microbiologist is essential not only for improving clinical outcome but also for optimizing resource utilization. Use of higher antibiotics like carbapenems results in increased healthcare associated cost and burden, also contributing to spread of drug resistance among nosocomial pathogens

Improper detection and reporting of Nosocomial infection may lead to major clinical and epidemiological consequences. Antibiotic policies, effective surveillance and scrutiny of epidemiological trends of the infections are need of the hour for better management of ICU infections with resistant organisms.

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