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Bacterial Isolates in ICU of A Tertiary Care Hospital in North East India: A Three Year Experience

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Abstract
Introduction: *The incidence of nosocomial infections in ICU is 4-5 times greater than in general ward. The study was to detect the pattern of bacterial isolates in ICU.*
Methods: *Specimens collected from respiratory tract, urine, blood and wound. The specimens collected sent to laboratory to identify the isolates.*
Result: *Respiratory tract infections were most prevalent with 79.5% followed by urinary tract (11.1%), blood born infection (8.1) and wound infection 1.2%. Gram negative infections like klebsiella, being the most frequent species with 54.6% followed by E coli and pseudomonas 15.8% and 14.2% respectively.*
Conclusion: *Gram negative infections were the predominant cause of icu acquired infection in the region of North East India. Pattern and prevalence of bacterial isolates in icu tends to change with time.*
Keywords: *nosocomial infections, ICU, Gram negative infections, pattern changes.*

Introduction

The incidence of nosocomial infections in ICU is 4-5 times greater than in general ward [(1)]. Critically ill patients are always at higher risk of developing nosocomial infections with resistant strains. Klebsiella, Pseudomonas, Acinetobacter, methicillin resistant Staphylococcus aureus (MRSA), vancomycin-resistant Enterococcus (VRE), Clostridium difficile, extended-spectrum β- lactamase-producing GNB (ESBL) etc .Infections caused by these microorganisms increase hospital stay and attributes to high mortality, morbidity, financial burden[(2, 3)]. The study was conducted to detect the pattern of bacterial isolates in ICU of a tertiary care hospital in north east India.

Materials and Methods

The present study was an observational retrospect-tive data analysis on bacterial isolates and changing pattern of icu acquired infections. Study was conducted in Emergency ICU of Emergency Medicine Department. Gauhati Medical College and Hospital, Guwahati for three years from November 2013 to October 2016 and divided into three phases each comprising of twelve months. Phase 1: Nov 2013- Oct 2014 Phase 2: Nov 2014- Oct 2015 Phase 3: Nov 2015- Oct 2016 March 2003 to February

2004. The study proposal was reviewed and approved by the institutional ethics committee of the hospital.

Selection of cases: Inclusion Criteria- Patients developing signs & symptoms of infections (fever, leucocytosis, shock with suggestive of septic etiology, increased amount & purulence of tracheal secretions, hematuria, purulent surgical wounds) after staying 48hours or more in EICU with positive aerobic bacterial cultures were included in the study.

Exclusion Criteria- Febrile / signs of infection on ICU admission staying less than 48 hours in the ICU. Transferred from another ICU. Positive cultures which were thought to be Contaminations & Commensals. All positive swabs of eye, ear, nose, throat and genital cultures. Positive fungal cultures were excluded from the study.

Specimens collected were from Respiratory - Tracheal aspirate, ET tube tip, Sputum. Urine (including Foley's catheter tips). Blood (including tip of central venous catheters). Wound swab from Surgical wound, bed sores.

The specimens for antimicrobial sensitivity testing were studied by Gram stains and culture growth on nutrient, blood and MacConkey agar to identify the isolates. Antibiotic susceptibility testing was performed by disc diffusion method (modified Kirby Bauer method) on Muller Hinton agar (For all antimicrobials tested, MIC interpretive standards were defined according to CLSI breakpoints (Clinical and Laboratory Standard Institute) but study on antibiotic susceptibility pattern not included in the study.

Results & Observations

Majority of the patients in the study were male with 66.1% with mean age of 48 years. Average icu stay of all patients were 18 days. Most of the patients were trauma (32.4%) followed by neurological patients (29.7%) in the form of stroke or other neurological disorders [table1]. Out of 1905 icu admissions in three years 1028 patients were eligible to be included in the study with inclusion and exclusion criteria and of which 138 patients came out to be culture positive. .Total culture positive samples were 161 as some patients showed positive culture from more than one site[table2]. Respiratory tract gives positive isolate most abundantly with 79.5% followed by urine 11.2% blood 8.1% and wound infection1.2%[Fig 1,table 3]. Of total isolates 7.4% were gram positive cocci, predominantly staphylococcus 5% and 92.6% were gram negative bacilli in the form of klebsiella, being the most frequent species with 54.6% followed by e coli and pseudomonas 15.8% and 14.2% respectively. Bacteriology of respiratory tract infection shows klebsiella, pseudomonas, E coli, staph aureus, acinetobacter, proteus and citobacter. Urinary tract infections showed similar bacterial isolats but more of E coli 18% and enterococcus 2%. Blood and urine also showed similar isolate more often klebsiella and E coli. [table 4,5,6,7,8]

Figure 1: pie diagram of different sites of icu acquired infections.

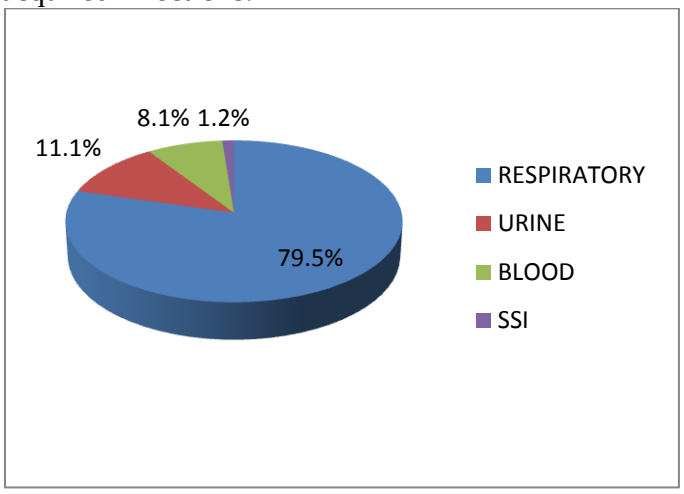

Table 1: Baseline characteristics of patients during three year period.

Sex, male, n (%)	680 (66.1%)
Age, years (mean)	48.6 ± 12.4
Average length of ICU-stay, days	18.3±8.7
Trauma	334 (32.4%)
Neurological disorders	306 (29.7%)
Immediate postoperative patient	95 (9.2%).
Pulmonary diseases,	66 (6.4%)
Diabetes mellitus,	65 (6.3%)
Undiagnosed diseases	55 (5.3%)
Renal diseases	46 (4.4%)
Cardiovascular diseases	41(3.9%)
Malignancy	20 (1.9%)

Table 2: Total number of icu admission with culture positive patients

	Phase 1	Phase 2	Phase 3	Total
Total admitted patients	578	662	665	1905
Included in study	273	380	375	1028 (53%)
Culture positive isolates	56 (49)	48 (43)	57 (46)	161 (138) (15%)

Table 3: Types of ICU acquired Infections

SPECIMEN	Frequency	%
RESPIRATORY	128	79. 5 %
URINE	18	11.1 %
BLOOD	13	8.1 %
WOUND	2	1.2 %
TOTAL	161	100 %

Table 4: Etiological agents in infections acquired in ICU

ORGANISM		Phase 1	Phase 2	Phase 3	Total
GRAM NEGATIVE BACILLI (92.6%)	KLEBSIELLA SPP	25 (44.6%)	31 (62.5%)	32 (56.1%)	88 (54.6%)
	E COLI	12	4	10	26 (15.8%)
	PSEUDOMONAS SPP	12	4	7	23 (14.2%)
	PROTEUS SPP	1	2	2	5 (3.1%)
	ACINETOBACTER	1	1	4	6 (3.7%)
	CITROBACTER KOSERI	0	1	0	1 (0.6%)
GRAM POSITIVE COCCI (7.4 %)	STAPH AUREUS	5 (MRSA =2)	1	2 (MRSA 1)	8 (5%) 3MRSA
	COAGULASE NEGATIVE STAPH	0	1	1	2 (1.2%)
	ENTEROCOCCUS	0	1	1	2 (1.2%)
	TOTAL	56	48	57	161 (100%)

Table 5: Bacteriology of respiratory tract infection.

ORGANISM	Phase 1	Phase 2	Phase 3	Total
KLEBSIELLA	23	25	28	76 (59.3%)
PSEUDOMONAS	11	4	5	20 (15.6%)
STAPH AUREUS	4 (MRSA =1)	1	2 (MRSA=1)	7 (MRSA 2) (5.4%)
E COLI	3	1	1	5 (27.7%)
ACINETOBACTER	1	1	3	5 (3.9%)
PROTEUS MIRABILIS	0	0	1	1 (O.7 %)
CITROBACTER	0	1	0	1 (0.7%)
TOTAL	48	36	44	128 (100 %)

Table 6: Bacteriology of urinary tract infection.

ORGANISM	Phase 1	Phase 2	Phase 3	Total
KLEB PNEUMONIAE	1	2	2	5 (27.7%)
PSEUDOMONAS SPP	1	0	2	3 (16.7%)
PROTEUS	1	1	0	2 (11.1%)
E COLI	9	2	7	18 (14%)
STAPH AUREUS	1 (MRSA)	0	0	1 (5.6%)
ENTEROCOCCUS	0	1	1	2 (11.1%)
TOTAL	7	5	6	18 (100%)

Table 7: Bacteriology of blood stream infection

ORGANISM	Phase 1	Phase 2	Phase 3	Total
KLEB PNEUMONIAE	1	3	2	6 (46.2%)
PROTEUS MIRABILIS	0	1	1	2 (15.4%)
E COLI	0	1	1	2 (15.4%)
COAGULASE NEGATIVE STAPH	0	1	1	2 (15.4%)
ACINETOBACTER	0	0	1	1 (7.6%)
TOTAL	1	6	6	13 (100%)

Table 8: Bacteriology of wound infection.

ORGANISM	Phase 1	Phase 2	Phase 3	Total
KLEBSIELLA SPP	0	1	0	1 (50 %)
E COLI	0	0	1	1 (50%)
TOTAL	0	1	1	2 (100%)

Discussion

Infections acquired during stay in the ICU is very common and inevitable because of reduced host defenses, invasive devices use, damage of anatomical barrier in the form of intubation, mechanical ventilation, frequent suctioning, catheterization etc and several drugs like sedatives, muscle relaxants, H2 blockers, over use of antibiotic itself create a predisposition for infections [4,5,6].

The present study was an observational retrospective data analysis on bacterial isolates of icu acquired infections. The study was conducted in Emergency ICU of Emergency Medicine Department for three consecutive years. Trauma and neurological patients in the form of stroke were maximum with male predominance that received in our icu. [7,8]

Infection rate in the current study was 15.0%.The ICU infection rates may vary between centers, depending on types of patients and icu, standard of laboratory, techniques of sample collection, diagnostic criteria etc. Current study was in single centre and for 3 consecutive year, bronchoalveolar lavage (BAL) or protected specimen brush (PSB) sample could not be collected as bronchoscope was not available. Many studies are multicentric and 1-day point-prevalence study. So percentage of acquired infections in the ICU worldwide shows wide range from 9.6 to 48.7%. [9,10,11]. In the current study, intubation and mechanical ventilation, Foleys catheter and central venous catheter, were main source of infections. Invasive procedures, mechanical ventilation, prolong icu stay, inability to maintain proper nutrition etc have been reported as risk factors for mortality in many studies [12,13,14]

Respiratory tract infection is reported to be the most frequent site of infection in the ICU, followed by urinary tract and bloodstream infection respectively in the present study. Most of the patients were intubated or ventilated. Various studies showed pneumonia is predominant cause of icu acquired infection. [15,16,17,18,19]

Infection with multidrug resistant pathogens develops because of frequent use of broad spectrum antibiotics and causes an increase in morbidity, mortality, and economic burden.[20,21,22,23].

Pseudomonas tends to be most resistant to treat followed by klebsiella, Acinetobacter baumannii and ecoli in our experience.[24,25] The impact of increased length of ICU stay on nosocomial infections and mortality has been investigated in many studies. In the majority of the studies icu-acquired infection was found to be an independent risk factor of increased length of icu stay. In this study, infection with klebsiella pneumoni followed by E coli, pseudomonas, staphylococcus and acinetobacter baumannii respectively were major causative organism. Tracheal aspirate harbor most of klebsiella and pseudomonas. Urine sample shows most of klebsiella and E coli. Here in our region of North East India klebsiella being most abundant isolates in icu similar to the majority of studies in which gram-negative organisms were the predominant agent and staphylococcus is still not a frequent isolate in our icu. Acinetobacter baumannii culture tends to increase gradually. [26,27,28,29,30].

Conclusion

Gram negative infections were the predominant cause of icu acquired infection in the region of North East India. Pattern and prevalence of bacterial isolates in icu tends to change with time. Prolong icu stay, poor nutrition, invasive techniques are few causes that increases the chance of icu acquired infection. MDR organisms are increasing day by day. Antibiotic stewardship and strict infection control protocol particularly in ICU are need of the hour to prevent flaring up of antimicrobial resistance.

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Declaration

Conflicting Interests: The authors declare that they have no conflict of interest.

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