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Original Research Article

Antimicrobial Resistance Pattern of Bacterial Isolates from ICU Patients in Tertiary Care Hospital

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ABSTRACT

Background: Multidrug resistant infections in Intensive Care Units are becoming so prevalent worldwide that they are one of the leading causes of morbidity and mortality amongst hospitalized patients.

Aim: The aim of the study was to determine the microbiological profile and their changing pattern of antibiotic sensitivity in ICU patients.

Materials and Methods: The study was conducted between January 2016 to June 2016 in the Department of Microbiology, RIMS, Ranchi, Jharkhand. Antibiotic susceptibility testing was performed by the Modified Kirby Bauer method as recommended by the CLSI guidelines.

Results: The most frequent isolates were gram negative microorganisms E.coli (46.42%) and Klebsiella spp.(17.85%). Among gram positive organisms, Staphylococcus aureus (14.28%) was most predominant. Imipenem and Piperacillin-Tazobactum were the most sensitive antibiotic against the isolated organisms. Most of them were resistant to Cefotaxime and Cefuroxime.

Conclusions: Since development of drug resistance is the major issue while dealing with patients in ICU settings, this study will prove beneficial for the clinicians in knowing the present microbiological profile predominant in ICU and the antibiotic sensitivity patterns will guide them in adopting the best empirical antibiotic policy for the critical patients.

Keywords: ICU Patients, Antibiotic Sensitivity Pattern, Multidrug Resistance, Antibiotic Policy.

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INTRODUCTION

Intensive care units are those sections of hospital premises which specialize in taking care of the critically ill patients with severe, life threatening illnesses and injuries, which require constant, close monitoring and support from specialized equipment's and medications in order to ensure normal bodily functions. They are distinguished from normal hospital wards by a higher staff to patient ratio and access to advanced medical resources. The common equipments in an ICU include mechanical ventilators to assist breathing through an endotracheal tube or a tracheostomy tube, cardiac monitors, defibrillators, dialysis equipments, intravenous lines, feeding tubes, nasogastric tubes, suction pumps, drains and catheters.

Invasive procedures and increased access of hospital professionals make the admitted patients quite vulnerable to nosocomial infections like Ventilator associated pneumonia, urinary tract infections, surgical site infections, blood stream infections etc. and to spread of antimicrobial resistant strains of bacteria. Although ICUs generally comprise 5% of all hospital beds, they account for 20-25% of all nosocomial infections.[1-4]

Development of resistance can be attributed to misuse of antibiotics, prescription of multiple unnecessary drugs, irregular consumption or poor compliance by the patients. Hence, to prevent further rise in antimicrobial resistance, a proper antibiotic policy has to be framed for all hospital ICU settings as the pattern would vary from place to place.

AIM

The study was aimed at eliciting the microbial flora constituting the samples obtained from patients in ICU settings and hence determining their antimicrobial resistance pattern.

MATERIALS AND METHODS

The present study was conducted from January 2016 to June 2016 at Department of Microbiology, RIMS, Ranchi, Jharkhand which is a tertiary care hospital. The study group constituted patients of all ages and genders who developed infections after 48 hrs. of hospitalization.

The various clinical specimens collected were blood, urine, pus,

body fluids, swabs and sputum. The collections were done aseptically according to the respective standard techniques. The specimens were first subjected to direct microscopy on gram's staining and then were inoculated onto sterile Blood agar and MacConkey agar plates taking proper aseptic precautions. The plates were incubated aerobically at 37°C for 18-24 hrs. After overnight incubation, the isolates were identified by their cultural characteristics, colony morphology and biochemical tests. The isolated organisms were then subjected to antibiotic susceptibility testing by disc diffusion (Kirby Bauer) method. The Hi Media antibiotic discs used were Ampicillin, Amikacin, Gentamycin, Cefoperazone + Sulbactam, Piperacillin + Tazobactum, Imipenem, Ciprofloxacin, Gatifloxacin, Cefuroxime, Cefotaxime. For quality control strains of E. coli ATCC 25922 and Staphylococcus ATCC 43300 were used.

RESULTS

A total of 162 samples were processed which consisted of blood (9), urine (63), sputum (32), swab (29), fluid (11) and pus (18). Table 1 shows the total number of samples with gender wise distribution, their percentage ratio and the number of positive samples in the respective groups.

Urine samples showed highest frequency of being infected (57.14%) followed by pus samples (55.55%).

All patients were grouped into age groups and the total number of samples obtained as well as the number of isolates from the respective groups were delineated as shown in table 2.

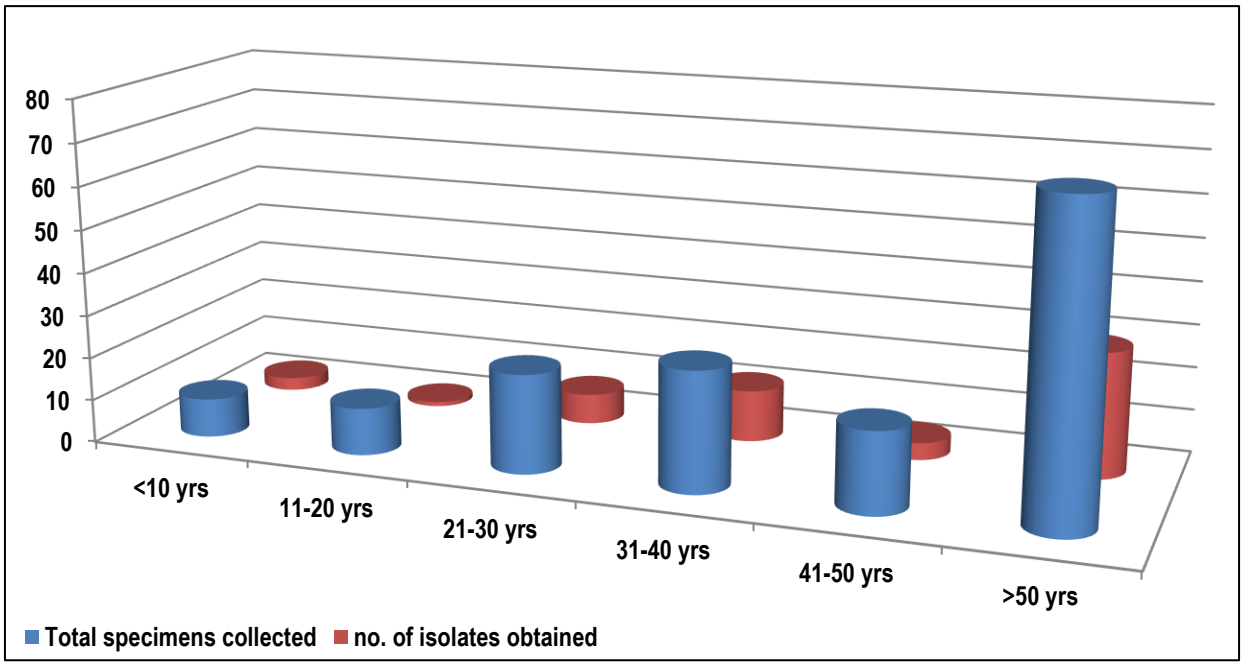
The maximum rate of isolation of pathogen was from the age group 31-40 yrs (42.85%) followed by the age group >50 yrs (40.27%) while the least number of isolates were from the group 11-20 yrs (9.09%).

Table 1: Shows percentage of samples male and female patients

SAMPLE TYPE	NO.OF SAMPLES (N= 162)			PERCENTAGE %	NO.OF POSITIVE SAMPLES (N_1=56)	PERCENTAGE%
	MALE	FEMALE	TOTAL			
BLOOD	9	0	9	5.55%	0	0%
URINE	37	26	63	38.88%	36	57.14%
SPUTUM	23	9	32	19.75%	3	9.37%
SWAB	25	4	29	17.90%	7	24.13%
FLUID	8	3	11	6.79%	0	0%
PUS	13	5	18	11.11%	10	55.55%

Table 2: Shows percentage of isolates in relation to age groups

S.NO.	Age groups (in years)	Total no. of patients in respective age groups	No. of isolates from specimens	Percentage isolates from specimens
1	<10	9	3	33.33%
2	11-20	11	1	9.09%
3	21-30	23	7	30.43%
4	31-40	28	12	42.85%
5	41-50	19	4	21.05%
6	>50	72	29	40.27%
	Total	162	56	



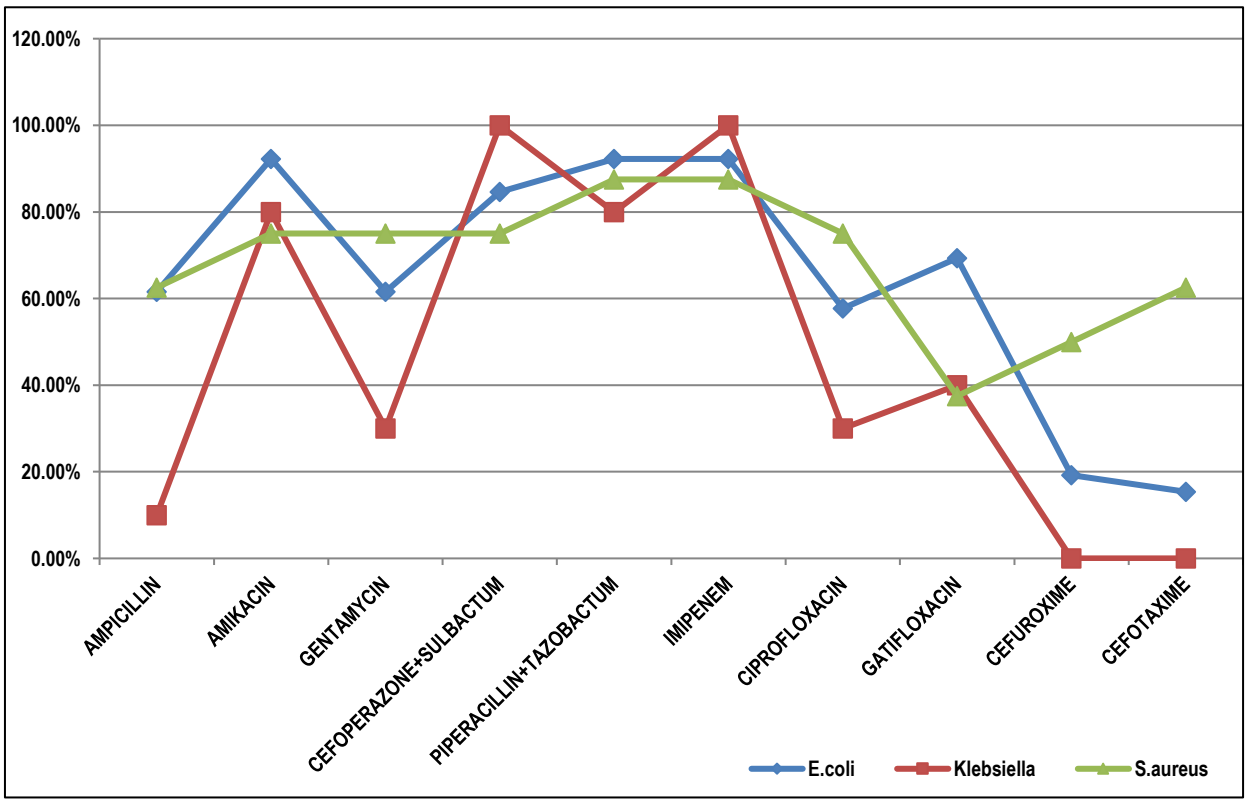
Graph 1: Showing percentage of isolates in relation to age groups

Table 3: Profile of organisms isolated from clinical specimens.

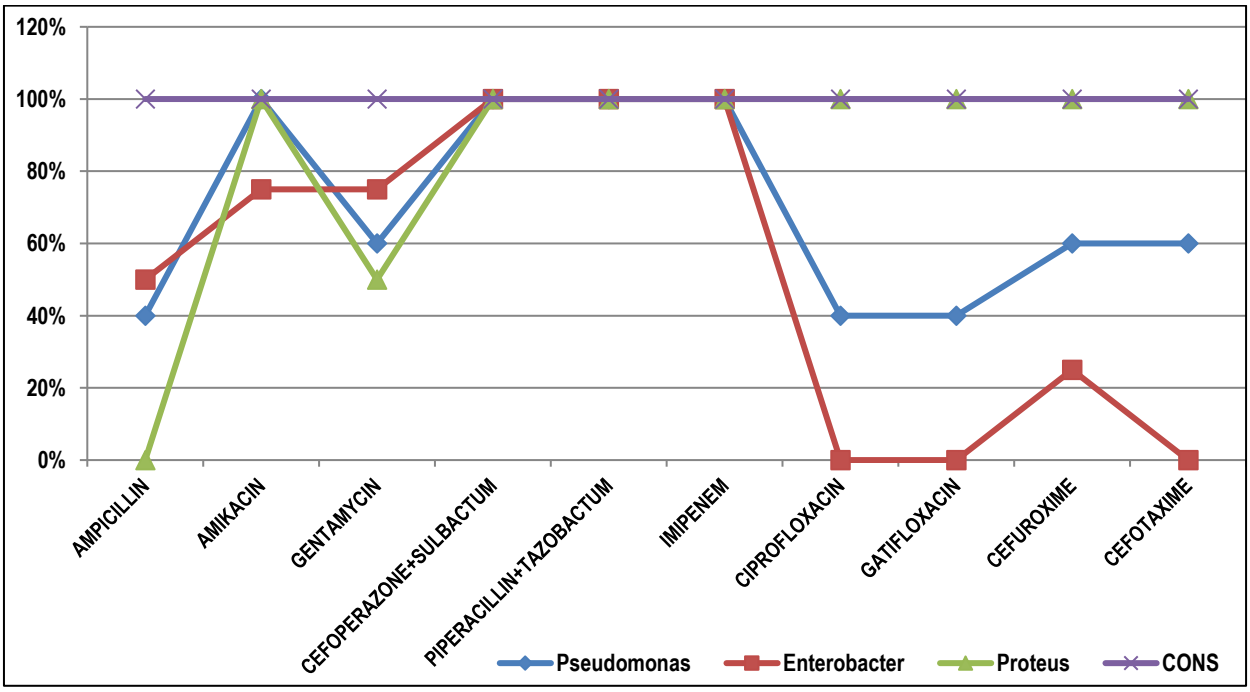
S.NO.	ORGANISMS ISOLATED	TOTAL NO. OF ISOLATES	PERCENTAGE(%)
1.	Escherichia coli	26	46.42%
2.	Klebsiella species	10	17.85%
3.	Staphylococcus aureus	08	14.28%
4.	Pseudomonas	05	8.92%
5.	Enterobacter	04	7.14%
6.	Proteus species	02	3.57%
7.	CONS	01	1.78%
	TOTAL	**56**	

Table 4: Antibiotic sensitivity and resistance pattern of isolates

ORGANISMS	E.coli (N=26)		Klebsiella (N=10)		S.aureus (N=8)		Pseudomonas (N=5)		Enterobacter (N=4)		Proteus (N=2)		CONS (N=1)	
ANTIBIOTICS	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Ampicillin	16	10	01	09	05	03	02	03	02	01	00	02	01	00
Amikacin	24	02	08	02	06	02	05	00	03	01	02	00	01	00
Gentamycin	16	10	03	07	06	02	03	02	03	01	01	01	01	00
Cefoperazone+ Sulbactam	22	04	10	00	06	02	05	00	04	00	02	00	01	00
Piperacillin+ Tazobactum	24	02	08	02	07	01	05	00	04	00	02	00	01	00
Imipenem	24	02	10	00	07	01	05	00	04	00	02	00	01	00
Ciprofloxacin	15	11	03	07	05	03	02	03	00	04	02	00	01	00
Gatifloxacin	18	08	04	06	03	05	02	03	00	04	02	00	01	00
Cefuroxime	05	21	00	10	04	04	04	01	01	03	02	00	01	00
Cefotaxime	04	22	00	10	05	03	04	01	00	04	02	00	01	00



Graph 2: The graph shows Percentage of E.coli, Klebsiella and S.aueus isolates that were found susceptible to different antibiotics.



Graph 3: The above graph shows Percentage of Pseudomonas, Enterobacter, Proteus and CONS isolates that were found susceptible to different antibiotics.

The most predominant organism isolated from the specimen was Escherichia coli (46.42%) followed by Klebsiella spp.(17.85%).
Imipenem and Piperacillin Tazobactum were the most active antibiotics against all the isolated pathogens while Cefotaxime was the one showing least activity against the organisms.

DISCUSSION

In this study, the infection rate among ICU patients due to microorganisms was 34.56%. The rest of the specimens being sterile can be attributed to multiple reasons like initiation of antibiotics before collection of specimens or causative agent might be fungal in origin or anaerobic bacteria or other bacteria which could not grow under the conditions exercised in the present study.

Overall, the most predominant pathogen isolated in our study was Escherichia coli (46.42%) which is in accordance to studies conducted by Molay et al[5] (51.42% E.coli) and Zaveri et al[6] (25% E.coli) while in other similar studies like Anurag et al[7], Mahin et al[8] and Sanjana et al[9], the most common isolate was reported to be Pseudomonas species. Kaushal et al[10] found Klebsiella to be the most predominant pathogen in his study which was followed by Pseudomonas species.

In our study, Cefotaxime and Cefuroxime were found to be highly resistant to all isolated organisms while isolates showed highest susceptibility against Imipenem and Piperacillin-Tazobactum. This was different from the observations made by Zaveri et al[6], who found Imipenem along with Cefazolin and Cefuroxime to be highly resistant to all organisms and Cefoperazone- Sulbactam showed high sensitivity. Molay et al[5], similar to our study reported high sensitivity of organisms to Imipenem and Penicillin derivatives (Piperacillin/ Tazobactum).

Knowing the resistance pattern guides the clinician in starting an alternative chemotherapy and hence helps in treating the resistant bacteria and thereby preventing their spread in the hospital that would cause nosocomial infections.[11,12]

CONCLUSION

Studies regarding the prevalent microbial flora and their respective antimicrobial susceptibility as well as resistance pattern helps in knowing the epidemiological trends in a locality and thus guides in coming up with Antibiotic policies. These policies are the need of the hour as they will directly determine the prevention and spread of multidrug resistant strains of bacteria in the hospital.

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