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A study of bacterial pathogens causing nosocomial infection in intensive care unit patients and their antibiogram

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Abstract

Infection remains a major problem for patients in intensive care unit (ICU) and is associated with considerable mortality and morbidity and direct cost to patient and indirect to the hospital by way of hospital acquired infection. Throughout the world multidrug resistant nosocomial infections are one of the leading causes of death and morbidity amongst hospitalized patients. The aim of study is to identify bacterial pathogens causing nosocomial infections and their antibiotic susceptibility pattern for the patients admitted in different ICUs. The present study was conducted in a tertiary care teaching hospital in Bangalore over a period of 1 year from Jan 2014 2013 to Dec 2014. Out of 200 samples processed ,92 showed significant growth, maximum organisms were isolated from MICU (35%), followed by NUCU (7%) & PICU (4.5%). Highest samples were from blood and urine (28%), followed by sputum (15.5%), tracheal aspirate (11%),endotracheal tube (10%), pus (3%) throat swab (2.5%) and least from ascitic fluid (1%) and stools (1%). 2K. pneumoniae 20% was the commonest isolate, followed by E coli (8.5%) ,Cons (4.5%) , C freundii (3.5%) , P aeruginosa (3%) , S aureus (3%), E faecalis (2%) and Acinetobacter (1%). In general, organisms showed high resistance to penicillin, ampicillin, amikacin, amoxiclav, piperacillin/tazobactam, ceftriaxone co-trimoxazole, Cefuroxime, Cefepime and Ceftazidime. Imipenem. Meropenem linezolid and Vancomycin were highly effective antibiotics. This prospective study has highlighted that Nosocomial infections and antimicrobial resistance in ICUs is a major deterrent to patients outcome, increasing duration of patient stay as well as the expense.

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Introduction

Intensive care units (ICUs) have revolutionized the care of critically ill patients with trauma, shock status and other life threatening conditions leading to greatly improved outcomes. How- ever, healthcare associated infections (HAI) remains a major challenge in the ICU patients; the rate of infection in ICU s are three to five times higher than in that the rates in other hospital wards (Jarwis RW. Hospital infections 6th ed.)

Nosocomial infections are those that are acquired in a hospital setting. The centers for dis- ease control and prevention (CDC) defines ICU associated infections are infections that occur after 48 hours of ICU admission or within 48 hours after transfer from ICU. Each nosocomial infection adds 5-10 days to the affected patient's time in the hospital. Nosocomial infections have increased the morbidity and mortality of hospitalized patients and especially the ones admitted in an ICU set up. In addition these infections lead to extra hospital stay and expenditure thus overburdening the already strained health economy. In studies conducted by various authors, the incidence of nosocomial infections ranged from 2.8% to 21.6% (Deep A, Ghildiyal R, Kandian S, *et al.,*). Throughout the world multidrug resistant nosocomial infections are one of the leading causes of death amongst hospitalized patients, accounting a major burden on patients and public health system of any country (Zaveri JR, Patel SM, Nayak SN, *et al.,*).

Critically ill intensive care unit patients are most vulnerable for developing these infections. Compared with an average patient an ICU patient has five to seven folds higher risk of nosocomial infection. Although ICUs generally comprise <5% of all hospital beds, they account for 20% to 25% of all nosocomial infections. The increased risk of infection is associated with the severity of the patient's illness, length of exposure to invasive devices and procedures, increased patient contact with healthcare personnel and length of stay in the ICUs.

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 wide spread resistance among the hospital acquired organisms (Zaveri JR Patel SM , Nayak SN, *et al.,* & Maksum R, Siti F, Nurgani A).

Knowledge of ICUs most common isolates and their antibiotic susceptibility patterns facilitates effective empirical antibiotic therapy and supports decisions to restrict or reduce the clinical availability of certain antibiotics. Antibiotic interventions should aim to limit the emergence of antibiotic resistance whilst simultaneously improving patient outcomes and decreasing drug cost (Raval PN, Patel PG, Patel BV, *et al.,*)

The pattern of organisms causing HAI infections and their antibiotic resistance pattern vary from one country to another; as well as from one hospital to other and even among ICUS within one hospital (Zaveri JR, Patel SM, Nayak SN, *et al.,*). While routinely choosing broader antibiotics may increase the appropriateness of antibiotic choice, it may further induce resistance and lead to extreme drug resistance .Hence the clinician has to choose empiric antibiotics aiming to both maximizing outcomes and minimizing emergence of resistance(KP Ravi, Durairajan S, Parivar S, *et al.,*). The aim of present study was to isolate and identify the bacterial microorganisms and their antibiogram for patients admitted in different ICUs of a tertiary care hospital in Bangalore, India

Material and methods

Study Design

The present study entitled - A study of Bacteriological pathogens causing nosocomial infection in intensive care unit patients and their antibiogram was a prospective study carried, at Vydehi institute of medical science and research center which is a tertiary care teaching hospital in Bangalore.

Statistical Analysis

The data was analyzed by using Pearson's chi square test and P value less than 0.05 was considered to be statistically significant .Statistical package for social sciences (SPSS) version -20 was used for analysis of data

Ethical and institutional issues

The study has been approved by institutional ethics committee informed consent of patients were collected while sample collection.

Source of Data

The study was conducted on admitted patients who developed signs and symptoms of infection after 48 hours of admission in different ICU's at a tertiary care hospital. The Centre of Disease Control and prevention (CDC) defines ICU associated infections as those that occur after 48 hours of ICU admission or within 48 hours after transfer from ICUs.

Study Period

Over a period of one year from Jan. 2014 Dec 2014.

Sample size

200 samples which included blood, urine, sputum, tracheal aspirate endotracheal tubes, and pus samples were processed.

Inclusion Criteria

All male and female patients and pediatric patients who developed signs and symptoms of infection after 48 hours of admission in different intensive care units

Exclusion Criteria

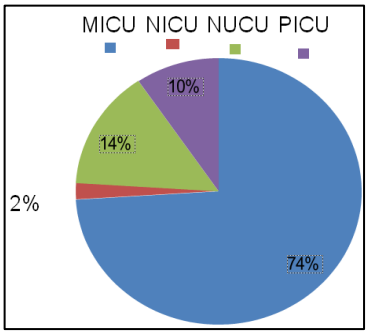
All patients who showed signs and symptoms of infection prior 48 hours of admission in different ICU's.

Methodology

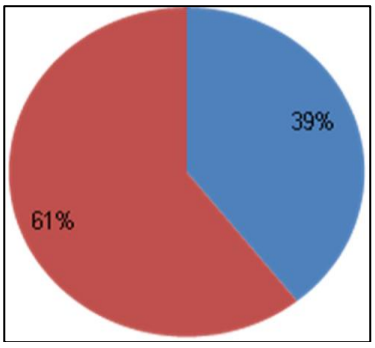
Samples which included sputum, blood, pus, urine, tracheal aspirate were collected from ICU patients who were clinically suspected of having acquired infection after 48 hours of admission in ICUS.A total of 200 samples were analyzed from different ICUS which included blood, sputum, urine, pus, tracheal aspirate. Samples were processed by manual methodology as per Mec Mecatney, and after identification organisms were subjected to antibiotic sensitivity as per CLSI guidelines.

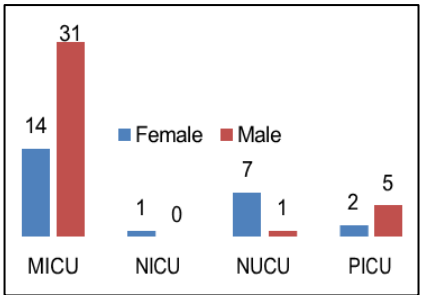
Results

A total of 200 samples were processed. In the study maximum patients were in age group were 30-40yrs (26.2%), followed by 60- 70yrs (22.9%), 40-50yrs (11.4%), 50-60yrs (9.8%), 1-10yrs (9.8%), 10-20yrs (6.5%), 70-80yrs (4.9%), 80-90 (3.2%) & below 1yrs (1.6%). Maximum patients were from MICU (73.7%), followed by NUCU (13%), PICU (11.4%) and NICU (1.6%) which is shown in table 1. In the study there was male predominance (60.6%) and females accounted up to (39.3%) which is shown in table 2 Out of 200 clinical samples 92 (46%) showed significant growth. Maximum organisms were isolated from MICU 35% followed by NUCU (7%) and PICU (4.5%) 1 which is shown in table 3. Highest studied samples from different ICUs and the pattern of organisms isolated is shown in table 4. Antibiotic susceptibility pattern of gram positive cocci isolated is shown in table 5 and table 6. Antibiotic susceptibility pattern of gram-negative bacilli is shown in table 7 antibiotic susceptibility pattern of non-fermenters is shown in table 8.

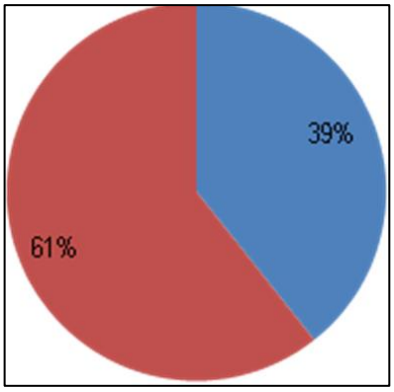


Graph.1. Percentageofisolatesfrom differentICUs.

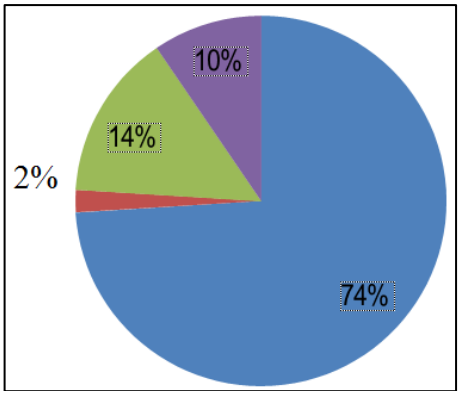




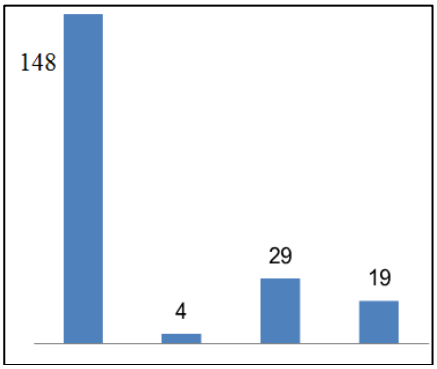
Graph. 2. Gender ICU.



Graph. 3. Gender with respect to ICUs.



Graph. 4. Percentage of Isolates from different ICUs.



Graph. 5. Samples with respect to ICUs.

Table 1. Age & ICU wise distribution of total patients from different ICUs under study.

		Age group										Total
		Below 1yr	1 to10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	
	MICU	0	0	2	2	13	5	6	12	3	2	45
	NICU	1	0	0	0	0	0	0	0	0	0	1
ICU's	NUCU	0	0	1	0	3	2	0	2	0	0	8
	PICU	0	6	1	0	0	0	0	0	0	0	7
Total		1	6	4	2	16	7	6	14	3	2	61

Pearson chi - square: 119.275, P value<0.0001.

Table 2. Gender profile of total patients under study.

		Sex		Total
		Female	Male	
	MICU	14(32%)	31(68%)	45
ICU	NICU	1(100%)	0	1
	NUCU	7(87.5%)	1(12.5%)	8
	PICU	2(28.5%)	5(78.5%)	7
Total		24(39.3%)	37(60.6%)	6

Table 3. Pattern of organism isolated from the different ICU's.

		ICU									
		MICU	%	NICU	%	NUCU	%	PICU	%	Total	%
Organism	Acinetobacter	0	0	0	0	0	0	2	11	2	1
	C freundii	7	5	0	0	0	0	0	0	7	4
	Commensal flora	10	7	0	0	3	10	3	16	16	8
	CONS	4	3	0	0	3	10	2	11	9	5
	E Faecalis	2	1	0	0	1	3	1	5	4	2
	E .coli	11	7	0	0	5	17	1	5	17	9
	K pneumonie	36	24	0	0	4	14	0	0	40	20
	K. oxytoca	0	0	0	0	0	0	1	5	1	1
	mixed growth	1	1	0	0	0	0	0	0	1	1
	no enteric	1	1	1	25	0	0	0	0	2	1

	ICU									
	MICU	%	NICU	%	NUCU	%	PICU	%	Total	%
pathogen										
No growth	66	45	3	75	12	41	8	42	89	45
P. aeruginosa	4	3	0	0	1	3	1	5	6	3
S aureus	6	4	0	0	0	0	0	0	6	3
Total	148	74	4	2	29	14.5	19	9.5	200	100

Chi square: 79.75, p-value: ≤ 0.0001(statistically significant).

Table 4. Pattern of organism isolated from different samples.

		Samples																		
		Ascitic Fluid	%	Blood	%	Endo tube	%	Pus	%	Sputum	%	Stool	%	Throat swab	%	Tracheal Aspirate	%	Urine	%	Total
Organism	Acinetobacter	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	4	2
	C Freundii	0	0	0	0	3	15	0	0	0	0	0	0	0	0	1	5	3	5	7
	Commensal flora	0	0	0	0	0	0	0	0	16	52	0	0	0	0	0	0	0	0	16
	CONS	0	0	9	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
	E Faecalis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	7	4
	E coli	0	0	1	3	0	0	0	0	1	3	0	0	0	0	3	14	12	21	17
	K Pneumonie	0	0	0	0	15	75	0	0	9	29	0	0	0	0	14	64	2	4	40
	K oxytoca	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1
	mixed growth	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1
	no enteric pathogen	0	0	0	0	0	0	0	0	0	0	2	100	0	0	0	0	0	0	2
	No growth	2	100	42	75	1	5	1	17	5	16	0	0	5	100	3	14	30	54	89
	P aeruginosa	0	0	1	2	1	5	2	33	0	0	0	0	0	0	1	5	1	2	6
	S aureus	0	0	3	5	0	0	3	50	0	0	0	0	0	0	0	0	0	0	6
Total		2		56		20		6		31		2		5		22		56		200

Table 5. Antibiotic Susceptibility Pattern of Gram Positive Cocci.

Organism	Sensitivity Pattern	CX	E	CD	P	COT	LZ	TET	TE	G	C	CIP
S aureus n=6	S	6.0	3.0	4.0	0.0	3.0	6.0	6.0	3.0	1.0	3.0	1.0
	R	0.0	3.0	2.0	6.0	3.0	0.0	0.0	3.0	5. 0	3.0	5.0
Cons n=9	S	9.0	2.0	8.0	0.0	2.0	9.0	9.0	3.0	3.0	2.0	4.0
	R	0.0	7.0	1.0	9.0	7.0	0.0	0.0	6.0	6.0	7.0	5.0

Table 6. Antibiotic susceptibility pattern of Gram Positive Cocci (Enterococci faecalis).

Enterococcus faecalis n=4	Sensitivity pattern	P	AMP	V	TEI	E	TE	CIP	HLG	LZ	C	NIT	NX
	S	0	0	4	4	3	2	1	4	4	2	2	1
	R	4	4	0	0	1	2	3	0	1	2	2	3

Table 7. Antibiotic susceptibility pattern of GNB – Enterobacteriaceae.

Organism	Sensitivity Pattern	AMP	G	AK	AMC	PIT	CXM	CPM	CTR	CIP	IMP	MRP	NA	AZ	CAZ	TCC	NX	NIT	COT
K pneumoniae n=40	S	0.0	8.0	15.	5.0	20.0	18	15	12	7	28	29	4	18	16	31	1	1	1
	R	40	32	25	35	20	22	25	28	33	12	11	36	22	24	9	0	0	0
E coli n=17	S	4.0	7.0	8.0	5.0	10.0	7.0	8.0	10.	7.0	14	12	4	11	8	16	6	2	3
	R	13	10	9	12	7.0	10	9.0	7.0	10	3.0	5.0	13	6.0	9.0	1.0	6	10	9
C freundii n=7	S	0.0	3.0	3.0	0.0	7.0	3.0	2.0	3.0	2.0	6.0	7.0	0.0	3.0	3.0	4.0	1.0	1.0	0.0
	R	7.0	4.O	4.0	7.0	0.0	4.0	5.0	4.0	5.0	1.0	0.0	7.0	4.0	4.0	3.0	2.0	2.0	3.0

Table 8. Antibiotic Susceptibility Pattern of GNB- Non fermenters.

Organism	Sensitivity pattern	CAZ	G	PIT	AK	AZ	CPM	CIP	IPM	MRP	TCC	CL	NX	NIT	COT
P aeruginosa n=6	S	5.0	4.0	3.0	4.0	5.0	3.0	2.0	5.0	4.0	5.0	5.0	1.0	-	-
	R	1.0	2.0	3.0	2.0	1.0	3.0	4.0	1.0	2.0	1.0	1.0	1.0	-	-
Acinetobacter n=2	S	1.0	1.0	2.0	1.0	0.0	1.0	1.0	2.0	2.0	1.0	1.0	-	1.0	1.0
	R	1.0	1.0	0.0	1.0	2.0	1.0	1.0	0.0	0.0	1.0	1.0	-	1.0	1.0

Discussion

It is well documented that higher rates of infection and mortality among ICU Patients are mostly related to factors such as exposure to invasive procedures, underlying disease conditions, duration of stay in the ICUs, infection sites and association with nosocomial multidrug resistant pathogens (Raval PN, Patel PG, Patel BV, *et al.,*). Our study included both major infection sites and types of organisms and their resistance pattern to commonly used antimicrobial agents. Percentage microbial isolation is variable in different studies.

In our study total of 200 clinical samples were processed, out of which 92(46%) showed evidence of infection, which is comparable to (Raval PN, Patel PG, Patel BV, *et al.,* (48.5%) and (Maksum R, Siti F, Nurgani A) (64.6%) which have also shown high culture positive samples.

Maximum patients were from (MICU) 73% with diverse age group ranging from 10 – 90yrs, maximum in 30-40 and 60-70yrs followed by (NUCU) 13%, (PICU) 12%. Percentage of males was 60.6% and females 39.3% in the study. Similar to our study, another study by (Oznur A K, Aysee Bartirel *et al*) showed same age diversity and male dominance in nosocomial infections. A total of 200 samples were analyzed which included blood 56(28%), sputum 31(15.5%), tracheal aspirate 22(11%), endotracheal tube 20(10%), urine 56(28%), pus 6(3%), ascitic fluid 2(1%), throat swab 5(25%) and stool 2(11%).

Similar to our study (Zaveri JR, Patel SM, Nayak SN, *et al*), also had analyzed 300 samples which included blood 197 (65.66%), swab 38 (12.66%), body fluids 27 (9%), urine 20 (6.6%)and sputum 7 (2.33%) Infection rate among ICU patients due GNB is significantly higher than GPC. .In our study out of 92 isolates 73 (79%) were gram negative bacilli, and 19 (20%) were gram positive cocci. Among GNBs, K pneumoniae was 20%, E coli was 9% and C freundii was 4% and among GNB (non-fermenters) P aeruginosa was 3% and Acinetobacter was 1%.

Among GPC, S aureus was 3%, Cons was 5% & E faecalis was 2 % in the study K pneumoniae, E coli, C freundi, S aureus, Cons are most isolated organisms in our study. Among GNB Klebsiella and E coli predominate and among GPC Cons predominate. In another study by (Deep A, Ghildiyal R, Kandian S, *et al.,*) pneumoniae (33.3%) and E coli (16.7%) were the commonly isolated organisms. Infection rate among ICU patients due to gram negative bacilli GNB is significantly higher than gram positive bacteria GPC. In the present study out of 92 isolates 73 (79%) were gram negative bacilli and 19 (20%) were gram positive cocci.

Among GNB, K pneumoniae was isolated from 20% of samples followed by E coli (9%), C freundii (4%). Among GNB (non -fermenters) P aeruginosa was isolated from 3% of samples and Acinetobacter 1%. Among GPC, S aureus was isolated from 3% of samples followed by Cons (5%) & E faecalis (2%) in the study. Among GNB Klebsiella and E coli were predominant bacterium and among GPC Cons were predominant bacterium. Similar to our study (Sheth V K, Patel K T, *et al.,*) analysis also revealed K pneumoniae 26.6% and P aeruginosa 16.3%. In another study by (Deep A, Ghildiyal R, Kandian S, *et al.,*) K pneumoniae were 33.3% followed by E coli (16.7%), were the commonly isolated organisms. Almost similar pattern of isolation was seen in studies by (Bas A Y, Damirel N, *et al.,* & Vijaya, Saldanha R.M.D *et al.,*). In our present study it was found that staphylococcus aureus showed 100% resistance to penicillin (100%) followed by ciprofloxacin (83.3%), gentamicin (83.3%) ,erythromycin (50%), tetracycline (50%) and clindamycin (33%). All isolates showed 100% sensitivity to cefoxitin, linezolid and teicoplanin. Cons showed 77.8% resistance to penicillin, erythromycin, cotrimoxazole and chloramphenicol followed by tetracycline and gentamicin (66.7%). It showed 100% sensitivity to linezolid and teicoplanin.

In a similar study by (Randrianirina F, Vaillant L etal) S aureus showed 92.2% resistance to penicillin followed by tetracycline (59.2%), erythromycin (19.4%). Teicoplanin showed 100% sensitivity to S aureus. Similarly in same study cons showed 77.8% resistance to penicillin followed by erythromycin (44.4%), ciprofloxacin (33.3%), gentamicin (33.3%) tetracycline (33.3%). Teicoplanin showed 100% sensitivity to Cons. Enterococcus faecalis showed 100% resistance to penicillin & ampicillin followed by ciprofloxacin (75%), norfloxacin (75%), tetracycline (50%) nitrofurantoin (50%) chloramphenicol (50%), erythromycin (25%) and high-level gentamicin (25%). It showed 100% sensitivity to teicoplanin and vancomycin followed by high level gentamicin (75%), linezolid (75%) and erythromycin (75%). In a study by Dodd Amani K P Dr. Srikanth Dr. etal enterococci faecalis showed (92.9%) resistance to gentamicin followed by (79.5%) erythromycin, (73.5%) nitrofurantoin, (70.5%) penicillin, (66.1%) ciprofloxacin, (64.7%), tetracycline, (92.9%) and gentamycin, (58%) respectively. Linezolid showed 100% sensitivity followed by vancomycin (95%) and teicoplanin (98%). In another study by (Bose S, Ghosh KA) enterococcus showed 100% sensitivity to Vancomycin & linezolid followed by high level gentamicin (58%) tetracycline (47.1%), ampicillin (43%), chloramphenicol (32%) and imipenem (14.1%) respectively. In present study K pneumoniae showed 100% resistance to ampicillin followed by norfloxacin (90%), amoxiclav (87%), gentamicin (80%), ceftriaxone (62.5%), ceftazidime (60%), aztreonam (55%), cotrimoxazole (50%), nitrofurantoin (50%). norfloxacin (50%) Imipenem (30%), meropenem (27.5%) and ticarcillin/clavulanic acid (22.5%) respectively. It showed 77.5% sensitivity to ticarcillin/clavulanic acid followed by meropenem (72%), imipenem (70%), piperacillin/tazobactam (50%) and cefuroxime (45%) respectively. E coli showed 83% resistance to nitrofurantoin followed by cotrimoxazole (75%). ampicillin (76.5%), nalidixic acid (76%), amoxiclav (70.6%), gentamicin and cefuroxime (58.8%), cefepime (52%), ceftazidime (52.9%), ceftriaxone (41.2%), ciprofloxacin (58.8%), amikacin (52.9%), norfloxacin (50%), ceftriaxone (41.2%) piperacillin/tazobactam (41.2%), aztreonam (35%) and meropenem (29.4%) respectively. It showed 94.1% sensitivity to ticarcillin/clavulanic acid followed by imipenem (82.4%) and meropenem (70.6%) respectively. C freundii showed 100% resistance to ampicillin, amoxiclav, cotrimoxazole and nalidixic acid followed by Cefepime (71%), ciprofloxacin (71%), nitrofurantoin (66.6%), ceftazidime (57%), ceftriaxone (57%), gentamicin (57%), amikacin (57%), cefuroxime (57%), ticarcillin/clavulanic acid (42%) respectively.

It showed 100% sensitivity to meropenem and 86% sensitivity to imipenem. In a similar study by (Randrianirina F, Vaillant L etal) Klebsiella showed 100% resistance to amoxicillin followed by cotrimoxazole (76.1%) acid (46.8%), gentamicin (42%), ciprofloxacin (40.4%) cefotaxime and ceftazidime (39.1%). In the same study E coli showed 82.9% resistance to amoxicillin& cotrimoxazole followed by nalidixic acid (52.3%) & ciprofloxacin (52.3%). In another similar study by (Bas A Y, Damirel N, etal) Klebsiella showed 100% resistance to ampicillin followed by cefotaxime (88%) gentamicin (73%) and amikacin (23%). Imipenem and meropenem showed 100% sensitivity to Klebsiella and E coli.

In the present study P aeruginosa showed 88% resistance to ciprofloxacin followed by gentamicin, amikacin (66.6%), piperacillin/ tazobactam (50%), cefepime (50%), aztreonam (33%) ceftazidime (33.3%), meropenem (33.3%) and ticarcillin/clavulanic acid (33.3%) whereas meropenem and colistin showed 84.5% sensitivity. Acinetobacter showed 100% resistance to gentamicin, cefepime, aztreonam, Ceftriaxone, Amikacin and ciprofloxacin. Whereas Meropenem showed 50% resistance Imipenem, colistin and ticarcillin/clavulanic showed 100%

sensitivity. In a similar study by (Randrianirina F, Vaillant L etal) Pseudomonas showed 98.4% resistance to ceftazidime and imipenem followed by ciprofloxacin (96.1%) amikacin (94.2%), ticarcillin (68%). It showed 92% sensitivity to co-trimoxazole followed by ticarcillin (32%), amikacin (5.8%), ciprofloxacin (3.9%). In the same study Acinetobacter spp showed 87% resistance to cotrimoxazole, followed by gentamicin (76%), ciprofloxacin (72%), ceftazidime (62%) and amikacin (46%).

Conclusions

This prospective study has highlighted that Nosocomial infections and antimicrobial resistance in ICUs is a major deterrent to patient's outcome, increasing duration of patient stay as well as the expense. Reduction of the same is both challenge and goal of all intensive care units around the world.

Following conclusions were drawn from this study:

1. ICU infections are most commonly associated with gram negative bacilli when compared to Gram positive cocci in the present study.
2. There was not much significant age disparity in the study and infections were seen in all the age groups (1-80) years under study.
3. There was male predominance with maximum isolates from MICU. The predisposing factor was because of maximum male inflow in the hospital and prolonged hospital stay.
4. K pneumoniae, E coli, Cons, E faecalis, S aureus, P aeruginosa , C freundii were the common bacterial isolates .
5. The antibiotic drugs which were found to be highly effective as per the sensitivity pattern in present study were imipenem, meropenem, piperacillin/tazobactam, ticarcillin/clavulanic acid and Ceftazidime for GNB. Teicoplanin, Vancomycin (for Enterococci), Linezolid for GPC.
6. The isolates showed sensitivity to high end reserve drugs like teicoplanin, vancomycin Linezolid among GPC and imipenem among GNB. Thus the antimicrobial Susceptibility pattern showed that the isolates are increasingly becoming resistant to routinely used antibiotics as well as second line drugs.
7. Majority of isolates were multidrug resistant.
8. Empiric treatment should not be given in absence of clinical and microbiological data supporting the presence of infection to avoid emergence of drug resistance but in in case clinically there is evidence of infection and patients life is endangered, empiric antibiotics can be given.

The antibiotics which can be given as empiric treatment include imipenem, meropenem, piperacillin/tazobactam, ticarcillin/clavulanic acid, vancomycin and teicoplanin.

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