ORIGINAL ARTICLE

A STUDY ON BACTERIOLOGICAL PROFILE AND DRUG SENSITIVITY & RESISTANCE PATTERN OF ISOLATES OF THE PATIENTS ADMITTED IN INTENSIVE CARE UNITS OF A TERTIARY CARE HOSPITAL IN AHMADABAD

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ABSTRACT

Background: Throughout the world multi-drug resistant nosocomial infections are one of the leading causes of deaths and morbidity amongst hospitalized patients.

Objective: The aim of study was to identify prevalence of predominant bacterial microorganisms and their drug sensitivity and resistance in different ICUs of a tertiary care public hospital.

Methods: The study was conducted in the different Intensive Care Units of a tertiary care public hospital in Ahmadabad during January, 2012 to April, 2012. Patients admitted in any of the four ICUs of the hospital who were clinically suspected of having acquired any infection after 48 hours of admission to the ICUs were included. Depending on the clinical suspicion laboratory samples were collected from the patients. Samples were subjected to the testing and antibiotic sensitivity.

Results: The commonest organism isolated from all samples was E.coli 32 (25). In NICU, CONS 16(66.67), in PICU E.coli 6(27.27), in MICU, E.coli, Acinetobacter spp. and Pseudomonas spp. 10(21.28), and in SICU, E.coli 16(45.71) were predominantly isolated. E.coli is most commonly sensitive to Amikacin 28(87.5), CONS to Cefotaxime 20(95), Klebsiella sp. to Cefoperazone+Salbactum 14(78), Psudomonas to Piperacillin+Tazobactum 11(65), and Acinebacter sp. to Cefoperazone+Sulbactum 11(55). The most common multidrug resistant organisms were Citrobacter spp. (66.7) followed by Proteus spp. (33.3) and Enterococcus (33.3).

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

Keywords: Drug Sensitivity, Resistance, ICU, Nosocomial infections

INTRODUCTION

Throughout the world multi-drug resistant nosocomial infections are one of the leading causes of death and morbidity amongst hospitalized patients, accounting a major burden on the patients and public health system of any country [1-3].

Critically ill Intensive care unit (ICU) patients are most vulnerable for developing these infections [4]. 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 [5]. Factors like increasing use of invasive devices, immunosuppressive drugs and status as well as irrational use of antibiotic therapy in ICUs are all contributing for the same [1,4-6].

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 contributes to the wide spread drug resistance among the hospital acquired organisms[3,5,7,8].

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 and even among ICUs within one hospital[4].

The aim of present study was to identify prevalence of predominantly isolated bacterial microorganisms and their drug resistance patterns for the patients admitted in different ICUs of a tertiary care public hospital in Ahmadabad city, India.

MATERIALS AND METHODS

Study setting: The study was conducted in the different Intensive Care Units of the Kesar SAL medical college hospital, a tertiary care public hospital in Ahmadabad. There are four major ICUs in the hospital: Medical ICU (MICU), Surgical ICU (SICU), Pediatric ICU (PICU) and Neonatal ICU (NICU).

Study period: Samples of the patients admitted in the ICUs during January 2009 to April, 2009 were included in the present study.

Study sample: The Centre for 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 an ICU[9].

In present study patients admitted in any of the four ICUs of the hospital during the study period of three months, who were clinically suspected of having acquired any infection after 48 hours of admission to the ICUs were included. Patients showing clinical signs of infection on or prior to admission or transfer to the ICUs were not included [2].

Few clinical signs and symptoms suggestive of infections are as follows: plained fever >38°C, Leukocytosis >10000/mm^3,New infiltrates on chest X-ray, Persistent Tracheal aspirates/secretions, Turbid urine, Suprapubic tenderness, Dysuria, Burning micturition, Thrombophlebitis, Cloudy effluent containing more than 100 Polymorphonuclear cells/mm^3, Abdominal pain or tenderness, Microorganisms in peritoneal dialysis fluid.

Depending on the clinical suspicion laboratory samples like urine, sputum, pus, swab, body Fluids (E.g. Cerebrospinal fluid, Ascitic fluid, Pleural fluid), blood and stool were collected from the patients.

Study tool: Only bacterial nosocomial infections were studied in detail in present study. Though, on gram stain Candida sp. was also identified. Samples were subjected to the testing and antibiotic sensitivity. The following antibiotics (Hi- Media disc in mcg) were tested for sensitivity: Amikacin, Cefoperazone+Sulbactum, Ampicillin, Ampicillin+Sulbactum, Piperacillin+Tazobactum, Gatifloxacin, Cefazolin, Imipenam, Cefuroxime, Gentamycin, Cefotaxime

Other information regarding the patient including age, gender, date of admission, was also collected from the case records of the patients.

RESULTS

The age and gender profile of the patients under the study is as per the Table 1.

Table 1: Age and gender profile of total patients under study

ICUs	Neonate (<28 days)		Post neonate (Upto 1 yr)		Preschool (1-5 yrs)		School (6-12 yrs)		Adolescent (13-19 yrs)		Adult (20-60 yrs)		Elderly (>60 yrs)		Total 300 Patients
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	
NICU	77	73													150
PICU			5	4	11	13	7	9	2	11					62
MICU							0	1	1	1	12	21	10	4	50
SICU					0	2					19	14	2	1	38

A total 300 patient's samples were analyzed which included blood 197 (65.66), swab 38 (12.66), body fluids 27 (9), urine 20 (6.6), pus 11 (3.66), sputum 7 (2.33) (Table 2). Total 94 (31.33) samples were positive for growth of the organisms and total of 128(42.66) different isolates were obtained. In which, 95(74.21) were gram negative bacteria, 27(21.09) were gram positive bacteria and 6(4.68) were Candida sp. (Table 3). Out of 94 samples, 75 (79.68) showed single isolates, whereas 19 (20.31) showed more than one (up to three) isolates.

The commonest organism isolated from all samples was E.coli 32 (25) followed by Acinetobacter species (sp.) 20 (15.62), Coagulase Negative Staphylococci (CONS) 21 (16.40), Klebsiella sp. 18 (14.06), Pseudomonas sp. 17 (13.28), Candida sp. 6 (4.68). Table 3 shows the details of organisms isolated from various types of samples.

Table 2: Samples profile and rate of positive culture from different samples

Samples	Number of samples (n=300) (%)	Samples yielding growth of organisms (n=94) (%)
Blood	197 (65.66)	30 (15.22)
Urine	20 (6.6)	11 (55)
Swab	38 (12.66)	34 (89.47)
Sputum	07 (2.33)	6 (85.71)
Fluid	27 (9)	5 (18.51)
Pus	11 (3.66)	8 (72.72)

Table 3: Pattern of organisms isolated from different samples

Organism	Blood (n=30) (%)	Urine (n=14) (%)	Sputum (n=11) (%)	Swab (n=55) (%)	Pus (n=13) (%)	Fluid (n=5) (%)	Total (n=128) (%)
E. coli	2 (6.67)	4 (28.57)	2 (18.18)	14 (25.45)	6 (46.15)	4 (80)	32 (25)
CONS	18 (60)	1 (7.14)	-	2 (3.64)	-	-	21 (16.4)
Acineto -bacter sp.	3 (10)	-	-	16 (29.09)	1 (7.69)	-	20 (15.62)
Pseudo -monas sp.	-	1 (7.14)	3 (27.27)	11 (20)	2 (15.38)	-	17 (13.28)
Klebsiella sp.	3 (10)	3 (21.43)	3 (27.27)	8 (14.55)	-	1 (20)	18 (14.06)
Candida sp.	-	3 (21.43)	1 (9.09)	1 (1.82)	1 (7.69)	-	6 (4.68)
Staphy aureus	1(3.33)	-	-	1(1.82)	1(7.69)	-	3(2.34)
Citro -bacter sp.	1(3.33)	1(7.14)	-	1(1.82)	-	-	3(2.34)
Entero -coccus	1(3.33)	1(7.14)	-	-	1(7.69)	-	3(2.34)
Proteus sp.	1(3.33)	--	2(18.18)	-	-	-	3(2.34)
Entero -bacter sp.	-	-	-	1(1.82)	1(7.69)	-	2(1.56)
Total	30	14	11	55	13	5	128

Pattern of different isolates from different ICUs can be seen from Table 4. In NICU, majority CONS 16(66.67) was predominantly isolated, followed by Klebsiella sp. 4(16.67). In PICU, E.coli 6(27.27) was predominantly isolated, followed by Acinetobacter spp., Klebsiella spp. and Candida spp. which were 3(13.64). In MICU, E.coli, Acinetobacter spp. and Pseudomonas spp. were predominantly isolated in 10(21.28), followed by Klebsiella spp. 8(17.02). In SICU, E.coli 16(45.71) was predominantly isolated, followed by Acinetobacter spp. 6(17.14), Pseudomonas spp. 5(14.28).

Table 4: Pattern of organisms isolated from different ICUs

Organisms	NICU (%)	PICU (%)	SICU (%)	MICU (%)	Total (%)
E.coli	-	6(27.27)	16(45.71)	10(21.28)	32(25)
CONS	16(66.67)	2(9.09)	1(2.86)	2(4.25)	21(16.4)
Acinetobacter sp.	1(4.17)	3(13.64)	6(17.14)	10(21.28)	20(15.62)
Pseudomonas sp.	-	2(9.09)	5(14.28)	10(21.28)	17(13.28)
Klebsiella sp.	4(16.67)	3(13.64)	3(8.57)	8(17.02)	18(14.06)
Candida sp.	-	3(13.64)	-	3(6.38)	6(4.68)
S. aureus	1(4.17)	1(4.54)	-	1(2.13)	3(2.34)
Citrobacter sp.	1(4.17)	-	1(2.86)	1(2.13)	3(2.34)
Enterococcus	1(4.17)	1(4.54)	1(2.86)	-	3(2.34)
Proteus sp.	-	-	1(2.86)	2(4.25)	3(2.34)
Enterobacter sp.	-	1(4.54)	1(2.86)	-	2(1.56)
Total	24(18.75)	22(17.19)	35(27.34)	47(36.72)	128(100)

Antibiotic sensitivity pattern of major five isolates is as per Table 5. E.coli is most commonly sensitive to Amikacin 28(87.5), majority of CONS was sensitive to Cefotaxime 20(95), Klebsiella sp. is most commonly sensitive to Cefoperazone+Salbactum 14(78), Psudomonas was commonly sensitive to Piperacillin+Tazobactum 11(65), Acinetobacter sp. was sensitive commonly to Cefoperazone+Sulbactum 11(55).

Table 5: Antibiotic sensitivity pattern

Code	E. coli (n=32) (%)	CONS (n=21) (%)	Klebsiella Sp. (n=18) (%)	Pseud. Sp. (n=17) (%)	Acineto -bacter Sp. (n=20) (%)
Amikacin	28(87.5)	8(38)	11(61)	8(47)	1(5)
Cefo-perazone + Sulbactum	26(81)	10(48)	14(78)	9(53)	11(55)
Ampicillin	2(6.25)	17(81)	-	1(6)	3(15)
Ampicillin + Sulbactum	1(3.12)	5(24)	-	1(6)	3(15)
Piperacillin + Tazobactum	26(81)	11(52)	9(50)	11(65)	-
Gatifloxacin	9(28.1)	8(38)	8(44)	3(18)	1(5)
Cefazolin	1(3.1)	8(38)	-	1(6)	-
Imipenam	2(6.25)	17(81)	-	1(6)	-
Cefuroxime	3(9.3)	14(67)	-	-	-
Gentamycin	11(34.3)	12(57)	2(11)	3(18)	1(5)
Cefotaxime	4(12.5)	20(95)	-	1(6)	-
Cipro -floxacin	5(15.65)	17(81)	-	6(3)	2(10)

Percentage of different organisms totally resistant to all antibiotics under study is as per Table 6. The most common multidrug resistant organisms were Citrobacter spp. (66.7) followed by proteus spp. (33.3) and Enterococcus (33.3).

Table 6: Frequency of Multidrug Resistant Organisms

Organisms	Resistance to all Antibiotics (n=11)(%)
Klebsiella sp.	4(22.22)
Acinetobacter sp.	2(10)
Citrobacter sp.	2(66.67)
Proteus sp.	1(33.33)
Pseudomonas sp.	1(5.89)
Enterococcus	1(33.33)

Out of 300 patients, 291(97) were cured and 9(3) were expired.

DISCUSSION

Our study included types and antibiotic susceptibility pattern of bacterial organism isolated from different samples from critically ill patients after 48 hours of admission to identify hospital acquired infections.

In this study, the infection rate among ICU patients due to organism was 31.33%. In total, predominant organisms isolated were E.coli in 32 (25) followed by Acinetobacter sp. in 20 (15.62), Coagulase negative staphylococci in 21 (16.40), Klebsiella sp. in 18 (14.06), Pseudomonas sp. in 17 (13.28), and Candida sp. in 6 (4.68).

In one study from Eastern Mediterranean Health Journal, E.coli isolates was 14%[1] .While in the ICU of Fatmawati Hospital, Indonesia during January 2009 to March 2010, the most predominant isolates were Pseudomonas aeruginosa (26.5) followed by Klebsiella pneumoniae (15.3) and Staphylococcus epidermidis (14.9)[10] . Another study in ICU at Birdem also showed growth obtained from 34% of the samples yielding 632 organisms with major organism isolates as Pseudomonas spp. (29.1), Acinetobacter spp. (27.5), Candida spp. (12.8), Escherichia coli (10.3) and Klebsiella spp. (9.7), and Staphylococcus aureus, Enterobacter spp., Citrobacter spp., Enterococcus spp., Providentia spp. and Serratia spp. (10.6) of isolates[4]. But in a European ICU, Staphylococcus aureus was as the most frequently isolated organisms (30.1) followed by Pseudomonas aeruginosa (28.7), Coagulase negative staphylococcus (19) and yeast (17.1) [4]. While in the Jordan University hospital isolated pathogens, in descending order were Staphylococcus aureus (40), Acinetobacter spp. (28), Pseudomonas spp. (23), Enterobacter spp. (20), Coagulase negative staphylococcus (19), Candida spp. (19), Klebsiella spp. (17), Escherichia coli (15) and Enterococcus[11].

In our study, Cefazolin, Cefuroxime and Imipenam were highly resistant to all isolated organisms. Cefoperazone + Sulbactum were sensitive to most of all isolates. E.coli were highly sensitive (81) to Cefoperazone + Sulbactum, whereas sensitivity to Cephazolin was only 3.1%, to Cefotaxime was 9.3% and to Ciprofloxacin was 15.65%. In another study of Ibrahim Medical College and Birdem ICU also, E.coli isolates were highly resistant (>80) to Cephalosporins and Fluoroquinolones[4]. Similarly, in a Jorden based study too, majority of the isolates were highly resistant (66%-100) to Ampicillin and Cephazolin[11].

Resistance to antibiotics poses a serious and growing problem, because such resistant infectious diseases are becoming more difficult to treat. Resistant bacteria do not respond to the antibiotics and continue to cause infection. Some of these resistant bacteria can be treated with more powerful medicines, but there some infections that are difficult to cure even with new or experimental drugs [12].

CONCLUSION

The commonest organism isolated from all samples was E.coli. In NICU CONS; in PICU E.coli; in MICU E.coli, Acinetobacter spp. and Pseudomonas sp.; and in SICU E.coli; were predominantly isolated. E.coli was most commonly sensitive to Amikacin, CONS to Cefotaxime, Klebsiella sp. to Cefoperazone+Salbactum, Psudomonas to Piperacillin+Tazobactum, and Acinebacter sp. to Cefoperazone+Sulbactum. The most common multidrug resistant organisms were Citrobacter sp. followed by Proteus sp. and Enterococcus.

Nosocomial infections and antimicrobial resistance in the ICUs is a major deterrent to patient outcome, increasing duration of patient stay as well as expense. Reduction of the same is both challenge and goal of all intensive care units around world. Strict infection control measures like universal precautions and stringent adherence to hand washing practices[7,13]; formulation and antibiotic policy; Survillence activities[3,7]; appointment of infection control practitioners; might be required for the same for which further research is advocated.

LIMITATIONS

Patients who were in Incubation Period of nosocomial infections on discharge, who manifests it after discharge, were not covered in current study. Contribution of their load to current study prevalence is unknown.

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