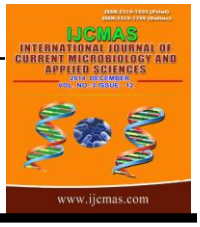
International Journal of Current Microbiology and Applied Sciences
ISSN: 2319-7706 **Volume 3 Number 12 (2014) pp. 398-403**
http://www.ijcmas.com



Original Research Article

Pattern of pathogens and their sensitivity isolated from nosocomial infections in a tertiary care hospital

Molay Banerjee[1]*, Abhishek Arun[2], Sandeep Kr.Gupta[3], Ashok Kr.Mishra[4] and Abhilasha Gupta[5]

[1]MD (Microbiology) Associate Professor, Department of Microbiology, Mayo Institute of Medical Sciences, Barabanki, India
[2]MD (Community Medicine) Resident, Era's Lucknow Medical College and Hospital, Lucknow, India
[3]MD (Internal Medicine) Chief consultant and CEO, M.V. Hospital and Research Centre, Lucknow, India
[4]MBBS, Sr. Physician, M.V. Hospital and Research Centre, Lucknow, India
[5]DNB (Obs and Gyn), M.V. Hospital and Research Centre, Lucknow, India
**Corresponding author*

A B S T R A C T

Throughout the world multi-drug resistant nosocomial infections are one of the leading causes of deaths and morbidity amongst hospitalized patients. It is critical to understand microbiology of these infections in order to create appropriate strategies to reduce this risk. Objective of the study was to determine the pattern of pathogens involved and their antibiotic sensitivity and resistance isolated from different ICU patients of a tertiary care hospital in North India. The study was conducted in the Intensive Care Unit of M.V. Hospital and Research Centre, a tertiary care hospital in Lucknow during January, 2014 to June 2014. Patients admitted in ICU of the hospital who were clinically suspected of having acquired any infection after 48 hours of admission to the ICU were included. Depending on the clinical suspicion laboratory samples were collected from the patients. Samples were subjected to the testing and antibiotic sensitivity. The commonest organisms isolated from all samples in ICU were *E. coli, Klebsiella* spp. and *Staph. aureus*. A total 400 patient's samples were analyzed which included blood 275 (68.75%), swab 34 (8.50%), body fluids 30 (7.50%), urine 36 (9.0%), pus 15 (3.75%) and sputum 10 (2.50%). Total of 140 (35.0%) samples were positive for growth of the organisms. Penicillin derivatives (Pipercillin/Tazobactam) and carbapenem, e.g. Imipenem, are the most sensitive antibiotics covering all the organisms isolated in our study. 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. The increasing trend of resistance to b-lactams is posing a great problem. So for proper management of critically ill patients and patients undergoing various operative procedures and other medical interventions, hospital antibiotic policies need frequent revisions.

K e y w o r d s

Nosocomial infections, Drug, Sensitivity, Resistance, ICU

Introduction

Nosocomial infections or healthcare-associated infections encompass all clinically evident infections that do not originate from patient's original admitting

diagnosis (Emori and Gaynes, 1993). The incidence of nosocomial infections is about 5–10% in most developed nations while in India, one in four patients admitted into hospital acquire nosocomial infection (Saranya, 2009). Common nosocomial infections in surgical patients include surgical site infections (SSIs), urinary tract infections (UTIs), pneumonias and blood stream infections (BSIs).

Critically ill Intensive care unit (ICU) patients are most vulnerable for developing these infections (Barai *et al.,* 2010). 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 (Günserena *et al.,* 1999). 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 (Barai *et al.,* 2010; Günserena *et al.,* 1999; www.moleculartb.org/gb/pdf/transcriptions/11_YZhang.pdf.). 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 (Günserena *et al.,* 1999; CME Resource, 2007; Wikipedia, 2012).

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 (Barai *et al.,* 2010).

UTIs accounts for a large number of nosocomial infections in surgical patients. The single most important factor for nosocomial bacteriuria and UTI is the presence of indwelling urinary catheter (Richards *et al.,* 1999). This issue of nosocomial infections in surgical patients is further complicated by emergence of polyantimicrobial resistant strains of hospital pathogens (Kamat *et al.,* 2008). Multiple antibiotic resistances to all useful classes of antibiotics has gradually increased among a number of gram negative hospital pathogens especially the *Klebsiella* spp., *Enterobacter* spp., *Pseudomonas aeruginosa* and *Acinetobacter* spp (Struelens, 1998). Having knowledge of spectrum of organisms causing SSIs and their resistance pattern is important when considering strategies for controlling the development and spread of resistance.

The main objective of the study was to determine the pattern of pathogens involved and their antibiotic sensitivity and resistance isolated from different ICU patients of a tertiary care hospital in North India.

Material and Methods

Study setting: The study was conducted in the Intensive Care Unit of M.V. Hospital and Research Centre, a tertiary care hospital in Lucknow. There are two major ICUs in the hospital: Medical ICU (MICU), Surgical ICU (SICU).

Study period: Samples of the patients admitted in the ICUs during January 2014 to June 2014 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 (Deep *et al.,* 2004). In present study patients admitted

in any of the two ICUs of the hospital during the study period of six 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. Few clinical signs and symptoms suggestive of infections are as follows: pained 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, 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 and Discussion

A total 400 patient's samples were analyzed which included blood 275 (68.75%), swab 34 (8.50%), body fluids 30 (7.50%), urine 36 (9.0%), pus 15 (3.75%), sputum 10 (2.50%) (Table 1). Total 140 (35.0%) samples were positive for growth of the organisms and total of 140 different isolates were obtained. In which, 100 (71.42%) were gram negative bacteria, 32 (22.85%) were gram positive bacteria and 08 (5.71%) were *Candida* sp. Out of 140 samples, 105 (75.0%) showed single isolates, whereas 35 (25.0%) showed more than one (up to three) isolates.

During the study period 140 culture and sensitivity reports were analyzed. In this study *E. coli* was the causative organism in 51.42% of cases followed next in frequency Klebsiella, (21.42%). The other isolates were *Staphylococcus aureus, Pseudomonas, Enterobacter, Proteus* and *Staphylococcus epidermidis.* The distribution is shown in Table 2.

Penicillin derivatives (Pipercillin/ Tazobactam) and carbapenem e.g. Imipenem are the most sensitive antibiotics covering all the organisms isolated in our study. Cephalosporins are ineffective against the common pathogens in our study and are associated with super infection except 3rd generation which is showing some promise (Table 3).

This 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 35.0%. In this study *E. coli* was the causative organism in 51.42% of cases followed next in frequency *Klebsiella,* (21.42%). The other isolates were *Staphylococcus aureus, Pseudomonas, Enterobacter, Proteus* and *Staphylococcus epidermidis.*

In one study from Eastern Mediterranean Health Journal, *E. coli* isolates was 14% (Shehabi and Baadran, 1996). 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) (Maksum *et al.,* 2011). 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 (Barai *et al.,* 2010). 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) (Barai *et al.,* 2010).

When considering sensitivity patterns, all strain of pathogenic *E. coli* and *Klebsiella* showed 100% sensitivity to penicillin derivatives (Pipracillin/ Tazobactum) followed by Carbapenem (Imipenem). Pseudomonas also showed a maximum sensitivity to penicillin derivatives (Pipracillin/Tazobactum) in our study as already reported in other international studies (Livermore *et al.,* 2003; Karlowsky *et al.,* 2003). Third generation Cephalosporin (ceftazidime) and Aminoglycoside (gentamicin) has a potent anti-pseudomonas activity (Zelenitsky *et al.,* 2003; Rizvi *et al.,* 2007). The antibiotic sensitivity of other isolates showed a variable pattern. Cephalosporins are ineffective against most of the pathogens isolated in our study and are associated with super infection. Different Cephalosporin groups have different propensities for promoting super infection. Demographically we are witnessing an increasing proportion of hospitalized elderly patients who are much more susceptible to such super infections. This may be due to extensive and over use of the Cephalosporins in last two decades as documented in other studies (Morgan, 2006). Quinolones, aminoglycosides and monobactum showed average spectrum of sensitivity for isolated organisms.

Table.1 Different types of samples and rate of positive cultures from different samples

Sample type	No. of samples (N=400)	Percentage %	Samples yielding positive growth of microorganisms (n=140)	Percentage %
Blood	275	68.75	55	20.00
Urine	36	9.00	25	69.44
Swab	34	8.50	30	88.23
Sputum	10	2.50	08	80.00
Fluid	30	7.50	12	40.00
Pus	15	3.75	10	66.67

Table.2 Distribution of causative organisms in samples

Organisms	No.	Percentage %
E. coli	72	51.42
Klebsiella	30	21.42
Staphylococcus aureus	18	12.85
Pseudomonas	10	7.14
Proteus	05	3.57
Enterobacter	03	2.14
Staphylococcus epidermidis	02	1.42

Table.3 Antibiotic sensitivity and resistance pattern of different micro organisms

	E. coli		***Klebsiella***		***S. aureus***		***Pseudomonas***		***Proteus***		***Entero bacter***		***S. epidermidis***	
Antibiotics	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**	**S**	**R**
Amikacin	64	08	22	08	18	0	06	04	02	03	02	01	01	01
Cefoperazone + Sulbactum	60	12	24	06	18	0	10	0	05	0	03	0	02	0
Ampicillin	06	66	15	15	18	0	08	02	05	0	03	0	02	0
Piperacillin + Tazobactum	62	10	19	11	18	0	10	0	05	0	03	0	02	0
Gatifloxacin	10	62	10	20	18	0	05	05	05	0	0	03	01	01
Imipenam	08	64	28	02	18	0	09	01	05	0	03	0	02	0
Cefazolin	05	67	10	20	05	13	07	03	01	04	0	03	0	02
Cefuroxime	12	60	10	20	04	14	05	05	03	02	0	03	0	02
Gentamycin	22	50	08	22	15	03	03	07	03	02	02	01	01	01
Cefotaxime	06	66	17	13	12	06	08	02	04	01	01	02	0	02
Cipro -floxacin	04	68	13	17	18	0	05	05	05	0	01	02	01	01

In 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. The increasing trend of resistance to b-lactams is posing a great problem. So for proper management of critically ill patients and patients undergoing various operative procedures and other medical interventions, hospital antibiotic policies need frequent revisions.

Acknowledgement

We are thankful to the laboratory staff and paramedical personnel of M.V. Hospital and Research Centre Lucknow for their cooperation and sincere thanks to all those who willingly participated in the present study.

References

Barai, L., Fatema, K., Ashraful Haq, J., Omar Faruq, M., Areef Ahsan, A.S.M., Golam Morshed, M.A.H., *et al.* 2010. Bacterial profile and their antimicrobial resistance pattern in an intensive care unit of a tertiary care hospital in Dhaka. *Ibrahim Med. Coll. J.*, 4(2): 66–69. doi: 10.3329/imcj.v4i2.6499.

CME, Resource. 2007. Nosocomial Infections. California. Report no: Course#9447. 72 Pp.

Deep, A., Ghildiyal, R., Kandian, S., Shinkre, N. 2004. Clinical and microbiological profile of nosocomial infections in the pediatric Intensive Care Unit (PICU). *Indian Paediatr.*, 14: 1238–1246.

Emori, T.G., Gaynes, R.P. 1993. An overview of nosocomial infections, including the role of the microbiology laboratory. *Clin. Microbiol. Rev.*, 6(4): 428–42.

Günserena, F., Mamıkog˘lua, L., Öztürkb, S., Yücesoyc, M., Biberog˘luc, K., Yulug˘c, N., *et al.* 1999. A surveillance study of antimicrobial resistance of Gram-negative bacteria isolated from intensive care units in eight hospitals in Turkey. *J. Antimicrob. Chemother.*, 43: 373–378.

Kamat, U., Ferreira, A., Savio, R., Motghare, D. 2008. Antimicrobial resistance among nosocomial isolates in a teaching hospital in Goa. *Indian J. Commun. Med.*, 33(2): 89–92.

Karlowsky, J.A., Draghi, D.C., Jones, M.E., Thornsberry, C., Friedland, I.R., Sahm, D.F. 2003. Surveillance for antimicrobial susceptibility among clinical isolates of *Pseudomonas aeuroginosa* and *Acinetobacter baumannii* from the hospitalized patients in the United States. 1998 to 2001. *Anti Microb. Agents Chemother.*, 47: 1681–8.

Livermore, D.M., Mushtaq, S., James, D., Potz, N., Walker, R.A., Chariett, A., *et al.* 2003. *In vitro* activity of piperacillin/Tazobactam and other broad spectrum antibiotics against bacteria from hospitalized patients in the British Isles. *Int. J. Antimicrob. Agents*, 22: 14–24.

Maksum, R., Siti, F., Aribinuko, N. 2011. Antibiotic sensitivity pattern of bacterial pathogens in the intensive care unit of Fatmawati Hospital, Indonesia. *Asian Pac. J. Trop. Biomed.*, 1(1): 39–42.

Morgan, M. 2006. Surgery and cephalosporins: A marriage made in heaven or time for Divorce? *Intnet. J. Surg.*, 8(1).

Richards, M.J., Edwards, J.R., Culver, D.H., Gaynes, R.P. 1999. Nosocomial infections in medical intensive care units in the United States. National Nosocomial Infections Surveillance System. *Crit. Care Med.*, 27(5): 887–92.

Rizvi, M.F., Hassan, Y., Memon, A.R., Abdullah, M., Rizvi, M.F., Saleem, F., *et al.* 2007. Pattern of nosocomial infection in two intensive care hospital in Karachi. *J. Coll. Physicians Surg. Pak.*, 17(3): 136–9.

Saranya, N.K. 2009. Nosocomial infections. Available at: medscape.com/viewarticle/535488.

Shehabi, A.A., Baadran, I. 1996 Microbial infection and antibiotic resistance patterns among Jordanian intensive care patients. *East. Mediterr. Health. J.*, 2(3): 515–520.

Struelens, M.J. 1998. The epidemiology of antimicrobial resistance in hospital acquired infections: problems and possible solutions. *BMJ*, 317(7159): 652–4.

Wikipedia. Antibiotic Resistance [Internet].Wikimedia Foundation Inc.; [Updated 2012 July 29; Cited 2012 July 30].

Zelenitsky, S.A., Harding, G.K., Sun, S., Ubhi, K., Ariano, R.E. 2003. Treatment and outcome of *Pseudomonas aeuroginosa* bacteraemia: an antibiotic pharmacodynamic analysis. *J. Antimicrob. Chemother.*, 52: 668–74.

Zhang, Y. Mechanisms of Antibiotic Resistance in the Microbial World. Baltimore. Available from:www. molecular tb.org/gb/ pdf/ transcriptions/11_YZhang.pdf.