Original Article

Multidrug Resistant Bacteria Causing Nosocomial Urinary Tract Infection in Neurology/ Neurosurgical Unit of a Tertiary Care Hospital

Sarita Mohapatra[1], Reshu Agarwal[1], Prathyusha Kokkayil[2], Girija Prasad Rath[3], Arti Kapil[1], Bimal Kumar Das[1], Benu Dhawan[1], Seema Sood[1]

From [1]Department of Microbiology, All India Institute of Medical Sciences, New Delhi, India, [2]Department of Microbiology, Government Medical College, Palakkad, India, [3]Department of Neuroanaesthesiology, All India Institute of Medical Sciences, New Delhi, India

Correspondence to: Dr. Sarita Mohapatra, Department of Microbiology, All India Institute of Medical Sciences, New Delhi-110029, India, Email: saritarath2005@yahoo.co.in

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ABSTRACT

Introduction: Nosocomial infections with the multidrug resistant microorganisms remain the major concern in the hospitalized patients. Due to the underlying illness, trauma, various neurosurgeries, patients admitted to neurology/ neurosurgery units become more vulnerable to acquire device associated infections during their hospital stay. **Objectives**: To study the spectrum of uropathogens and their antimicrobial susceptibility pattern among patients admitted to the neurology/neurosurgery unit. **Material and methods**: A prospective study was conducted in the bacteriology laboratory, Department of Microbiology over a period of 4 months. Urine samples from the patients admitted to neurology and neurosurgical unit (ward and ICU) were processed and identified as per the standard protocol. The antimicrobial susceptibility testing was done using Kirby- Bauer method as per CLSI 2014 guideline. **Results**: Majority of the urinary isolates belonged to *Enterobacteriaceae* family in both ward and ICU patients. Among these, 91 out of 106 (86%) isolates in the ward and 43 out of 51 (84%) isolates in ICU were found to be multi drug resistant. Nitrofurantoin was observed to be resistant in more than 75% of both ward and ICU isolates. **Conclusion**: Majority of nosocomial uropathogens were found to be multidrug resistant. This study emphasizes the emergence of MDR isolates and nitrofurantoin resistance among the nosocomial uropathogens.

Key words: *neurology, neurosurgery, MDR pathogen, Enterobacteriaceae*

Patients admitted to neurology/ neurosurgical unit remain in compromised condition because of their underlying diseases and associated comorbidities. Hence, these patients are more vulnerable to health-care associated infections during their hospital stay. Urinary catheters are commonly used after neurosurgical procedures to measure the urine output or relieve the incontinence. Likewise, patients who are bed-ridden for a prolonged duration and on ventilatory support owing to respiratory difficulty also require urinary catheterization. Moreover, among the various device associated infections, catheter associated urinary tract infection (CA-UTI) is the most common infection in these patients [1]. Approximately 12-25% of the total hospitalized patients are catheterized [2]. Urinary tract infection (UTI) alone accounts for 40% of total hospital acquired infections and 80% of UTI occurred due to indwelling urinary catheter [2]. The gram-negative bacteria (GNB) are the important causes of CA-UTI [3].

When infection occurs with antibiotic resistant pathogens, it leads to increase morbidity, mortality and

hospital cost. Multidrug resistant (MDR) pathogens are currently an emerging problem in many of the hospital-acquired infection [4]. These pathogens are resistant to most of antibiotics leaving very few therapeutic options for the physicians. Hence, we carried out this study to find out the incidence of MDR bacteria causing nosocomial UTI in patients admitted to neurology and neurosurgery unit of our hospital.

MATERIAL AND METHODS

A prospective study was conducted on the patients admitted to neurology and neurosurgery ward and ICU over a period of 4 months. Urine samples from the patients with more than 48 hours of hospitalization were collected and processed in the bacteriology laboratory, Department of Microbiology. All the urine samples were processed within 2 hours of collection. The samples were cultured on Cysteine Lysine Electrolyte Deficient (CLED) media. The analysis of culture report was done by semi quantitative method. Samples with colony count $\geq 10^5$ CFU/ml with or without symptoms were considered having significant bacteriuria. The isolated organism was identified using conventional phenotypic methods as per standard protocols. Patients were categorized to have asymptomatic bacteriuria (ASB) or CA-UTI depending on the presence or absence of symptoms as per the CDC guidelines [5]. Growths with ≥3 types of organisms or gram-positive bacilli were considered as contaminants. Same species isolated from same patient with same antibiogram within 6 days duration were considered as single isolate and same species isolated from same patient in two different occasions with a gap of ≥6 days were considered as two different isolates. Antibiotic susceptibility testing was done on Mueller-Hinton agar using Kirby-Bauer disc diffusion method as per CLSI 2014 guideline [6]. MDR was defined as the species resistant to ≥3 different classes of antibiotics.

RESULT

A total 1515 urine samples were received for microbiological processing out of which 910 were collected from wards and 605 were from the ICU. Out of 910 samples, 159 (16.5%) were culture positive ($\geq 10^5$CFU/ml) with 106 different clinical isolates from the patients of neurosurgery ward. Similarly, among the ICU samples, 74 out of 605 (12%) samples were found culture positive ($>10^5$CFU/ml) with 51 different isolates. Gram-negative bacilli were the predominant isolate in both ward and ICU patients.

Antibiotic susceptibility pattern of GNB: Majority of the isolates belong to *Enterobacteriaceae* followed by *Pseudomonas spp.* and *Acinetobacter spp.* Among *Enterobacteriaceae, Klebsiella pneumoniae, Escherichia coli, and Enterobacter spp.* were the commonest isolates (Table 1). Antibiotic resistance pattern of both ward and ICU isolates remained similar. In total 85% of the isolates were MDR and 70-80% isolates were resistant to carbapenem, cefoperazone-sulbactam, and piperacillin-sulbactam (Table 2). Among *Enterobacteriaceae* , *Klebsiella spp.* and *Enterobacter spp.* were observed to be more resistant to different class of antibiotics in comparison to *E. coli*. More ever, *K. oxytoca* was more resistant than *K. pneumoniae*. 90% isolates were resistant to aminoglycosides, flouroquinolones and third generation cephalosporins. Nitrofurantoin resistance was found in >75% of the isolates of different species except in *E. coli* where only 30% isolates were resistant.

Antimicrobial susceptibility pattern of GPC: *Enterococcus faecium* was the commonest isolate among followed by *Staphylococcus aureus*. None of the isolate found to be vancomycin resistant. However, >60% of *E. faecium* isolates were high level aminoglycoside resistant.

Table1 – Microbiological profile of samples with significant bacteriuria

Organism	Ward (n=106)	ICU (n=51)	Total
Gram negative bacilli			
Escherichia coli	31	13	44
Klebsiella spp.	33	13	46
Enterobacter spp.	9	7	16
Proteus vulgaris	2	1	3
Citrobacter spp.	3	1	4
Morganella spp.	1	1	2
Pseudomonas eruginosa	13	5	18
Acinetobacter spp.	8	4	12
Gram positive cocci			
Staphylococcus aureus	1	-	1
Enterococcus faecium	5	6	11

Table 2 - Distribution of uropathogens and antimicrobial resistance pattern (Resistance rate in %)

GNB	**AK**	**Net**	**CAZ**	**Cef**	**AC**	**Cfs**	**Imi/Mer**	**Cip**	**PT**	**FD**	**MDR**
E.coli	84	80	95	95	93	75	64	91	77	30	89
K. pneumoniae	98	98	98	95	90	76	71	93	83	83	98
K. oxytoca	100	100	100	100	100	50	50	100	83	75	100
Enterobacter spp.	88	88	94	94	94	88	69	88	88	75	87.5
Citrobacter spp.	100	100	100	100	100	75	100	100	75	100	100
P. vulgaris	67	67	100	100	100	-	33	-	-	33	33
Morganella spp	100	100	100	100	100	50	100	100	100	100	100
P. aeruginosa	89	-	94	-	-	78	89	94	67	83	94
Acinetobacter spp.	92	-	92	92	92	25	92	88	88	75	92
GPC	**Pen**	**Cefo**	**Cip**	**Ery**	**HGen**	**Cotri**	**Van**	**Tei**	**Lin**		
S. aureus	100	0	0	0	-	-	0	0	0		
Enterococcus spp.	-	-	91	91	64	-	0	0	0		

*Ak: amikacin, Net: netilmicin, Caz: ceftazidime, Cef: cefotaxime, AC: amoxicillin-clavulanate, Cfs: cefoperazone-sulbactam, Im/Me: imipenem/meropenem, Cip: ciprofloxacin, PT: piperacillin-tazobactam, Fd: nitrofurantoin, Pen: penicillin, Cefo: cefoxitin, Ery: erythromycin, HGen: high level gentamycin 120µg), Co-tri: co-trimoxazole, Van: vancomycin, Lin: linezolid

DISCUSSION

Catheter associated UTI is the commonest infection in neurosurgical patients because of prolonged catheterization during hospital stay. Detection of microbiological etiology along with its antimicrobial resistance gives an idea about the local epidemiological trend, and its antibiotic resistance pattern. This information can be utilized for decision making with regard to antibiotic prophylaxis, control of potential outbreaks, and treatment of unusual pathogen etc. It provides the knowledge on pathogens and their resistance patterns. The present study highlights the high prevalence of MDR strains causing nosocomial UTI or persistent colonizers in neurology or neurosurgery patients. It also gives us knowledge about the spectrum of pathogens and their resistance pattern.

Mohanty et al (2003) carried out a similar study in our center and found that *E. coli* was the commonest nosocomial uropathogen followed by *K. pneumoniae* and other GNB [7]. However, the present study show increase in resistance rates for third generation cephalosporins, aminoglycoside, and flouroquinolone group of antibiotics among the GNBs. The resistance in the present study was found to be 67%-100% for the above three group of antibiotics in comparison to earlier where it was reported as 75%. Increase in resistance to nitrofurantoin was observed (55.6% to ≥75%) (except *E. coli* and *Proteus spp.*). An increase in resistance to imipenem, meropenem, cefoperazone-sulbactam, piperacillin–sulbactam was also observed. This is worrisome as these were the most active drugs in hospitalized patients. Contrary to our finding, previous study have shown lower rates of antimicrobial resistance to cephalosporins, aminoglycoside, flouroquinoles [8]. It may be due to rapid emergence of carbapenem resistance in India due to frequent use of carbapenem group of drugs among the hospitalized patients.The prevalence of GPC, especially *Enterococcus spp.* and *Staphylococcus spp.* constitute a small subset (<1%) in causation of nosocomial UTI in this study.

Colonization with MDR organism is the major concern for the management. This group of organism is not only high risk for management of infection control but also disseminate the MDR genes in the hospital environment [9]. It is also accompanied with challenges in the implementation of antibiotic prevention strategies and antibiotic stewardship program. The study has certain limitation like risk factors analysis, correlation of MDR colonizers with subsequent infection. It is also important to

know how many among these patients are getting antibiotics for UTI without having actual disease. Further longitudinal studies can be conducted to evaluate the risk factors and to proof the above concept. The other limitation of our study was lack of complete clinical history of the patients. Hence, the exact number of patients having ASB or CA-UTI could not be analyzed. Several studies have proven that prolong use of multiple antibiotics is a prominent risk factor for antibiotic resistance [10-13]. These factors of MDR colonization should be analyzed to target the preventive strategies. Standard contact precaution, hand hygiene practice, and aseptic techniques should be implemented to prevent the transmission of these MDR genes from one to other.

CONCLUSION

In conclusion, antibiotic drug resistance is an alarming condition especially in developing countries. We found increased resistance to multiple antibiotics among the urinary isolates including both pathogen and colonizers. Hence, judicious use of antibiotics and implementation of antibiotic stewardship programme is highly essential to prevent the emergence and spread of MDR genes in these patients.

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