

ESBL Positive *E. coli* and *K. pneumoniae* are Emerging as Major Pathogens for Urinary Tract Infection

Muhammad Abdur Rahim*, Palash Mitra*. Tabassum Samad*. **Tufayel Ahmed Chowdhury***. Mehruba Alam Ananna*. Khwaja Nazim Uddin**

*Department of Nephrology, **Department of Internal Medicine, BIRDEM, Dhaka, Bangladesh

Background

- Urinary tract infection (UTI) is the second most common infection through-out the world*
- *Escherichia coli* and *Klebsiella pneumoneae* are responsible for UTI in 90% cases**
- Extended spectrum beta-lactamase (ESBL) producing *E. coli* and *K. pneumoneae* are increasingly being isolated from urine samples
- Data regarding ESBL positive organisms are limited in our country

*Amin M et al. Study of bacteria isolated from urinary tract infections and determination of their susceptibility to antibiotics. Jundishapur J Microbiology 2009; 2(3): 118-123.

**Rahman MR et al. Pattern of Bacterial Pathogens Causing Urinary Tract Infection and Their Antibiotic Sensitivity: A Tertiary Care Hospital Experience. Birdem Med J 2015;5(1):20-23.

Objectives

- To describe the frequency of ESBL positive *E. coli* and *K. pneumoniae* causing UTI
- To describe the associated risk factors
- To describe the antibiotic sensitivity pattern of these organisms

Materials and Methods

- **Type of study:** Cross-sectional study
- **Place of study:** Departments of Internal Medicine and Nephrology, BIRDEM General Hospital
- **Period of study:** January to March, 2014
- **Inclusion criteria:** One hundred consecutive culture positive UTI cases due to *E. coli* or *K. pneumoniae* infection irrespective of their ESBL positivity
- **Exclusion criteria:** UTI due to organisms other than *E. coli* and *K. pneumoniae*
- **Sampling method:** Purposive

Results

Total number of Patients	100 (82% of all culture positive UTI)
Mean age	59.1±11.7 (18-83) years
Male:Female	1:3.3
DM:non-DM	24:1
Mean duration of DM	9.7±4.9 years
Mean HbA1c	9.5±2.3%
Mean RBS at admission	15.7±6.6 m.mol/L
<i>DM= diabetes mellitus</i>	<i>RBS= random blood glucose</i>

Co-morbidities (N=100)

Co-morbidity	Frequency	Percentage
DM	96	96
Hypertension	58	58
IHD	19	19
CKD	39	39
Stroke	4	4
Dyslipidaemia	42	42
Fatty Liver	19	19
<i>DM= diabetes mellitus</i>	<i>IHD= ischaemic heart disease</i>	<i>CKD= chronic kidney disease</i>

Presenting features (N=100)

Presenting Features	Frequency	Percentage
Fever	94	94
Increased Urinary frequency	42	42
Dysuria	41	41
Loin pain	31	31
Supra-pubic pain	37	37
Incontinence	11	11
Vomiting	72	72
<i>*All patients had >1 symptoms</i>		

Risk factors for infection with ESBL producing organisms

Risk factors	ESBL positive organisms (n=58)	Non-ESBL positive organisms (n=42)	<i>p</i> value	OR
Mean age (years)	59.8	57.5		
Sex				
Female	41	26	0.358	1.48
Male	17	16		
DM				
Present	56	40	0.741	1.40
Absent	2	2		
Duration of DM				
<5 years	3	5	0.000	2.48
6-10 years	11	27		
>10 years	44	10		

Risk factors for infection with ESBL producing organisms

Risk factors	ESBL positive organisms (n=58)	Non-ESBL positive organisms (n=42)	<i>p</i> value	OR
HbA1c				
<7%	1	6	0.015	9.50
7% or more	57	36		
Catheterized				
Yes	19	5	0.016	3.61
No	39	37		
CKD				
Yes	49	17	0.000	8.01
No	9	25		
Renal stone				
Yes	2	1	0.222	1.46
No	56	41		
Past H/O UTI				
Yes	19	4	0.006	4.63
No	39	38		

Risk factors for infection with ESBL producing organisms

Risk factors	ESBL positive organisms (n=58)	Non-ESBL positive organisms (n=42)	<i>p</i> value	OR
H/O antibiotic intake				
Yes	15	3	0.016	4.53
No	43	39		
H/O hospitalization last year				
Yes	11	2	0.038	4.68
No	47	40		

Antibiotic sensitivity and resistance patterns of *E. coli* (n=84) and *K. pneumoniae* (n=16)

Bacterial organism	E.coli (non-ESBL)		E. coli (ESBL positive)		K. sp (non-ESBL)		K. sp. (ESBL positive)	
	n=36	(%)	n=48	(%)	n=6	(%)	n=10	(%)
Antibiotic	sen	res	sen	res	sen	res	sen	res
Amikacin	36 (100)	0 (0)	47 (97.9)	1 (2.13)	3 (50)	3 (50)	10 (100)	0 (0.0)
Augmantin	0 (0)	36 (100)	0 (0)	48 (100)	0 (0)	6 (100)	0 (0)	10 (100)
Cefixime	10 (27.8)	26 (72.2)	0 (0)	48 (100)	3 (50)	3 (50)	0 (0)	10 (100)
Ceftazidime	10 (27.8)	26 (72.2)	0 (0)	48 (100)	3 (50)	3 (50)	0 (0)	10 (100)
Ceftriaxone	10 (27.8)	26 (72.2)	0 (0)	48 (100)	3 (50)	3 (50)	0 (0)	10 (100)
Cefuroxime	10 (27.8)	26 (72.2)	0 (0)	48 (100)	3 (50)	3 (50)	0 (0)	10 (100)
Ciprofloxacin	10 (27.8)	26 (72.2)	0 (0)	48 (100)	3 (50)	3 (50)	0 (0)	10 (100)
Colistin	-	-	-	-	2 (100)	0 (0)	-	-

Antibiotic sensitivity and resistance patterns of *E. coli* (n=84) and *K. pneumoniae* (n=16)

Bacterial organism	E.coli (non-ESBL)		E. coli (ESBL positive)		K. sp (non-ESBL)		K. sp. (ESBL positive)	
	n=36	(%)	n=48	(%)	n=6	(%)	n=10	(%)
Antibiotic	sen	res	sen	res	sen	res	sen	res
Co-trimox	10 (27.8)	26 (72.2)	22 (45.8)	26 (54.2)	3 (50)	3 (50)	0 (0)	16 (100)
Gentamicin	22 (61.1)	14 (38.9)	20 (41.7)	28 (58.3)	3 (50)	3 (50)	10 (100)	0 (0)
Imipenem	36 (100)	0 (0)	48 (100)	0 (0)	6 (100)	0 (0)	10 (100)	0 (0)
Mecillinam	24 (66.7)	12 (33.3)	18 (37.5)	30 (62.5)	3 (50)	3 (50)	10 (100)	0 (0)
Netilmicin	36 (100)	0 (0)	44 (91.7)	4 (8.3)	6 (100)	0 (0)	10 (100)	0 (0)
Nitrofurantoin	34 (94.4)	2 (5.6)	43 (89.6)	5 (10.4)	6 (100)	0 (0)	0 (0)	10 (100)
Vancomycin	-	-	-	-	-	-	-	-
Piperacilin	-	-	-	-	-	-	-	-
PPC+Tazobac	-	-	-	-	0 (0)	2 (100)	-	-

*Not all specimens were tested against all antibiotics listed; sen=sensitive; res=resistant; PPC=piperacilin.

Discussion

- In one study from Nepal ESBL positivity of *E. coli* and *K. pneumoniae* were found to be 13.51% and 16.55% respectively.*
- In North India 48.27% organisms were confirmed to be ESBL producers, among whom 55.69% were *E. coli* and 44.31% were *K. pneumoniae*.**

*Chander A et al. Prevalence of extended spectrum beta lactamase producing *Escherichia coli* and *Klebsiella pneumoniae* urinary isolates in a tertiary care hospital in Kathmandu, Nepal. BMC Research Notes 2013, 6:487.

**Shaikh S et al. Risk factors for acquisition of extended spectrum beta lactamase producing *Escherichia coli* and *Klebsiella pneumoniae* in North-Indian hospitals. Saudi J Biol Sci;2015:37-41.

Discussion

- In Korea, over a six-year period, the proportion of ESBL-EC responsible for causing community-onset bacteremia had increased significantly from 3.6% in 2006 to 14.3% in 2011.*
- In Central Africa, proportion of ESBL producing Enterobacteriaceae was 15.4% and 49.4% of all *K. pneumoniae* were ESBL-producer.**

*Kang C et al. Clinical and Molecular Epidemiology of Community-Onset Bacteremia Caused by Extended-Spectrum β -Lactamase- Producing *Escherichia coli* over a 6-Year Period. J Korean Med Sci 2013; 28: 998-1004 .

**Alabi et al. Retrospective analysis of antimicrobial resistance and bacterial spectrum of infection in Gabon, Central Africa. BMC Infectious Diseases 2013, 13:455.

Discussion

- Length of hospital stay (>3 days) and previous exposure to antibiotics were found as significant risk factors in India. Imipenem and meropenem were suggested as drugs of choice.*
- Advanced age, diabetes, use of catheters, previous hospitalization and previous antibiotic treatment were some of the risk factors found among patients in Spain.**

*Shaikh S et al. Risk factors for acquisition of extended spectrum beta lactamase producing *Escherichia coli* and *Klebsiella pneumoniae* in North-Indian hospitals. *Saudi Journal of Biological Sciences* 2015;22: 37–41.

**Ines Rubio-Perez. Extended-spectrum beta-lactamase-producing bacteria in a tertiary care hospital in Madrid: epidemiology, risk factors and antimicrobial susceptibility Patterns. *COACTION 2012; Emerg Health Threats J* 2012, 5: 11589 - <http://dx.doi.org/10.3402/ehth.v5i0.11589>

Limitations

- Study period and sample size was small
- Most patients were diabetic
- Single center study

Conclusion

- Two-thirds of the *E. coli* and *K. pneumoniae* in this study were ESBL positive
- Female patients, DM, long history and poor control of DM, past history of UTI, CKD and catheterization were important risk factors for ESBL positivity
- Aminoglycosides, carbapenems and nitrofurantoin remain the drug of choice
- All laboratories should routinely screen for ESBL positivity

Thank You All