Original Research Paper Medical Science

A Study Of E. Coli Drug Resistance and Socio-Economic Profile of Urinary Tract Infection Among Rural Females of Andhra Pradesh"

Narasimha Murty.S	Assistant Professor, Department of General Medicine, Rajiv Gandhi Institute of Medical Sciences (RIMS), Srikakulam - 532001, Andhra Pradesh, India
Anil kumar Hanumanthu	Assistant Professor, Department of General Medicine, Rajiv Gandhi Institute of Medical Sciences (RIMS), Srikakulam - 532001, Andhra Pradesh, India
Srinivas. Budati	Tutor, Department of Microbiology, Rajiv Gandhi Institute of Medical Sciences (RIMS), Srikakulam - 532001, Andhra Pradesh, India
Mokshanand. K	Lecturer cum statistician, Department of SPM, Rajiv Gandhi Institute of Medical Sciences (RIMS), Srikakulam - 532001
Appalanaidu. Bch	CSRMO, Rajiv Gandhi Institute of Medical Sciences and General Hospital (RIMS&GH), Srikakulam - 532001

ABSTRACT

Background: in rural area more young females have been reporting for recurrent UT infections they were low socio-economic profile in all aspects. Present study establishing associations of UT infections and SE classes (SEC) and its treatment. Method: A total of 100 E. coli spp obtained from female UTI patients. The study conducted in rural teaching hospital, Srikakulam, Andhra Pradesh. Urine samples were aseptically handled, processed and confirmed E. coli and an open-ended questionnaire was prepared which collected information on education, occupation and income as per latest Kuppuswamy's SEC scale. Results: UT infected females age between 20yrs to 29yrs were 24%, middle school were 28%, unemployed and clerical and shop owners were 23% and 24% were more. In upper (I) class patients antimicrobials; norfloxacin, cefadroxil, nalidixic acid, cefaclor and cefoperazones showed 100% resistance. In upper middle (II) class; norfloxacin, ciprofloxacin, cefaclor and cefoperazones showed 90% antimicrobial resistance. In lower middle (III) class; norfloxacin and cefoperazones showed more antimicrobial resistance were compared with remaining drugs. In upper lower (IV) class; norfloxacin and gentamicin showed 92% and 80% antimicrobial resistance. In lower (V) class; norfloxacin, gentamicin, netilmicin, ciprofloxacin, cefaclor and cefoperazones showed 100% antimicrobial resistance. Conclusion: A better understanding of these issues will be key to helping prevent and treat these infections in the future. The data suggest that amikacin is useful for all SE class, cefuroxime suggest for upper lower (IV) people and oxcillin is best drug in upper middle (II), lower middle (III), upper lower (IV) patients.

KEYWORDS : female, E. coli, UTI, socio-economic status, drug resistance

Introduction

Urinary tract infection (UTI) is one of the leading infections in females. It causes morbidity and mortality worldwide, despite ongoing progress in our basic understanding of its relation between socio economic class (SEC) and drug resistance relations. Escherichia coli (E. coli) are major causes of UTI in females in the developing world and are associated with high resistance levels to antibiotics1,2,3,4,5. Normal intestinal flora is a reservoir for resistance genes; the prevalence of resistance in commensal E. coli is a useful indicator of antibiotic resistance in bacteria in community6, 7. Studies with E. coli are of particular relevance because this species can occupy multiple niches, including human and animal hosts8. In addition, E. coli strains efficiently exchange genetic material with pathogens such as Salmonella, Shigella, Yersinia, and Vibrio species, as well as adjacent pathogenic E. coli8, 9.

Antimicrobial resistance is common in isolates from healthy persons and from patients with community-acquired infections in developing countries like India. The selection and spread of multi-resistant organisms in developing countries, which can often be traced to complex socio-economic and behavioral factors, contribute to the escalating problem of antibiotic resistance worldwide. In developing countries, include the irrational use of antibiotics by health professionals, unskilled practitioners, laypersons, poor drug quality, unhygienic conditions and inadequate surveillance accounting for the spread of resistant bacteria. Nevertheless, misuse of antibiotics is one of the reasons for the increasing rates of resistance, especially in rural areas10.

However, specific etiologic diagnosis, as well as the knowledge of the local antibiotic susceptibility patterns, is necessary if treatment interventions are to be considered. Our hypothesis was that because of frequent inappropriate empiric antibiotic use, there should be a high prevalence of antimicrobial drug resistance in strains of E. coli isolated from rural females. The objective of this study was to determine the prevalence of E. coli among UTI of females, antimicrobial drug susceptibility patterns, and associations of their socio-economic profile. Such information might be useful both in discouraging inappropriate use and guiding physicians to more appropriate choices when therapy is necessary.

Materials and Methods

Participants: A total of 100 E. coli positive obtained from 189 total urine samples. Urine samples collected from females among UT infection, the study conducted in rural teaching hospital, Srikakulam, Andhra Pradesh. Who provided informed consent, all age groups were included. An open-ended questionnaire was prepared which collected information on education, occupation and income and applied latest Kuppuswamy's SEC scale. The score of kuppuswamy's scale for education levels; professors or honors(7), graduate or post graduate(6), intermediate or post high school diploma(5), high school certificate(4), middle school certificate(3), primary school certificate(2), illiterate(1). For occupation levels; profession(10), semi-profession(6), clerical or shop-owner(5), skilled worker(4), semi-skilled worker(3), unskilled worker(2), unemployed(1) For income range; ≤1802(1), 1803–5386(2), 5387– 8988(3), 8989–13494(4), 13495–17999(5), 18000– 36016(10), ≥36017(12), the sum of total come under up-

per (I) 26-29, upper middle (II) 16-25, lower middle (III) 11-15, upper lower (IV) 5-10, lower (V) <5 respectively shows the socio-economic class10,11. Exclusion criteria; duplicate isolates from the same patient and other then E. coli spp wasn't considered. This study was approved by the Institutional Ethical Committee (IEC) of Rajiv Gandhi Institute of Medical Sciences (RIMS), Srikakulam, Andhra Pradesh.

Confirmation E. coli isolates: All urine samples were aseptically handled and processed from apparently UT infected patients. The specimens were collected into Stuart's transport medium and sub cultured onto MacConkey agar plates. Colonies with morphologic characteristics of E. coli were sub cultured onto fresh plates. Identity was confirmed by conventional biochemical tests. The standard disk diffusion method was used for susceptibility testing. The standard CLSI antibiotic discs were used; norfloxacin (NR), cefadroxil (CD), gentamicin (G), nalidixic acid (NA), amikacin (AK), netilmicin (NT), ciprofloxacin (CIP), cefaclor (CFC), ceftriaxone (CTX), cefuroxime (CXM), cefoperazone (CPZ), and oxacillin (OX) provided by Hi-media, Mumbai. E. coli NCTC -10418 was used as control. The goal of this study was to define the current prevalence and phenotypes of multidrug-resistant (MDR) E. coli among UTI rural female and to investigate associations between patient socio-economic parameters and it's multidrug resistance.

Statistical analysis: used SPSS 16.0 version software, were applied by pie diagram and chi-square ($\chi 2$) test a probability of 0.05 is taken as statically significant.

Results

In present study a total of 100 E. coli spp analysed from 189 total urine samples showed in table - 1. UT infected females is more in age between 20yrs to 29yrs were 24% and least were <9yrs showed in pie diagram in fig -1. UT infected females education status is more in middle school were 28%, occupation status is more in unemployed and clerical and shop owners were 23% and 24% respectively, income status is more people <1802 INR's were 27% explained in table – 3 Associations of education status, occupation and income and E. coli UT infected rural females in rural centre were statically significant ($P<0.05$). Obtained data applied on kuppuswamy's scale that socio-economic class more in lower middle and upper middle 42% and 40% respectively showed in pie diagram in fig - 2. In upper (I) class patients antimicrobials; norfloxacin, cefadroxil, nalidixic acid, cefaclor and cefoperazones showed 100% resistance. In upper middle (II) class; norfloxacin, ciprofloxacin, cefaclor and cefoperazones showed 90% antimicrobial resistance. In lower middle (III) class; norfloxacin and cefoperazones showed more antimicrobial resistance were compared with remaining antibiotics. In upper lower (IV) class; norfloxacin and gentamicin showed 92% and 80% antimicrobial resistance. In lower (V) class; norfloxacin, gentamicin, netilmicin, ciprofloxacin, cefaclor and cefoperazones showed 100% resistance showed in table - 4. Associations of drug resistance i.e. norfloxacin (NR), cefadroxil (CD), gentamicin (G), nalidixic acid (NA), amikacin (AK), netilmicin (NT), ciprofloxacin (CIP), cefaclor (CFC), ceftriaxone (CTX), cefuroxime (CXM), cefoperazone (CPZ), and oxacillin (OX) and socioeconomic class i.e. upper (I), upper middle (II), lower middle (III), upper lower (IV), and lower (V) were statistically not significant ($P>0.05$). in fig – 3, bar diagram depicts the more no. of drug showed resistance above 25%, 50% 75%, at 100% and socio-economic group; lower middle and upper lower class patients exhibited 12 drugs resistance in above 25% resistance group. In above 50% resistance showed in lower class patients were 10 drugs. In above 75% resistance showed in lower class patients were 8 drugs. At 100% resistance showed in lower class patients were 6 drugs. Association between SEC and no. of drug resistance above 25%, 50% 75% and at 100% were statically not significant ($p>0.05$).

Discussion

During the past 10 years, multidrug-resistant Gram-negative Enterobacteriaceae has become a substantial challenge to infection control. It has been suggested by clinicians that the effectiveness of antibiotics is in such rapid decline that, depending on the pathogen concerned, unless the rise in antibiotic resistance can be reversed, we can expect to see a substantial rise in incurable infection and fatality in both developed and developing regions. The antibiotic resistance develops through complex interactions, with resistance arising by de-novo mutation under clinical antibiotic selection or frequently by acquisition of mobile genes that have evolved over time in bacteria in the environment. The reservoir of resistance genes in the environment is due to a mix of naturally occurring resistance and those present in animal and human waste and the selective effects of pollutants, which can co-select for mobile genetic elements carrying multiple resistant genes12. Less attention has been given to how anthropogenic activity might be causing evolution of antibiotic resistance in the environment. Although the economics of the pharmaceutical industry continue to restrict investment in novel biomedical responses, action must be taken to avoid the conjunction of factors that promote evolution and spread of antibiotic resistance. The five drugs for which a considerable rise in resistance was seen from 1986 to 1998 (ampicillin, sulfonamides, streptomycin, chloramphenicol, and tetracycline) are extensively used in Nigeria and other developing countries13, 14. These five inexpensive drugs are widely available without prescription from authorized health institutions and pharmacies, as well as from unauthorized patent medicine shops and other distributors. The selective pressure generated by overuse explains the relatively high prevalence of resistance in E. coli isolates in 1986. However, it is not clear why the trend observed with other widely used drugs was not seen in this case13,14.

The results of our laboratory based investigation must be interpreted in light of the following considerations. The management of acute uncomplicated urinary tract infections has changed dramatically in the past few years. Attempts to manage reimbursable medical costs have led to a decrease in physician orders for routine urine cultures and subsequent susceptibility testing for patients with acute cystitis. Because the treatment of acute cystitis in otherwise healthy adult females is now largely empirical, isolates that are tested in laboratory based studies may be predominantly from patients for whom previous antimicrobial treatment failed or from patients with other underlying risk factors. Therefore, Performing patient-based studies would be an optimal alternative but would be costly and likely not practical for regional and national data assimilation. In upper lower (II) and lower middle (III) increasing prevalence of resistance was marked. Strains that was simultaneously resistant to several drugs. These data sound a warning because the indiscriminate use of antibiotics, along with poor hygiene and infection control in young female between 20-29 years in rural areas.

In many rural areas well-trained health workers are scarce and cannot serve the entire population. Patient lending antibiotic drugs from unofficial sources and their financial constraints also affect antibiotic choices15,16,17. Education and hygienic habits have not been successfully implemented and encouraged to purchase from unofficial distributors because drugs often are not available in government hospitals18. Most of the drug sellers usually have minimal or no knowledge of the required dosage regimen, indications, or contraindications19,20,21 especially in rural areas. In general, these studies have found that education is more strongly associated with disease than income and occupation of pateints22. Strict regulations on the use of antibiotics in human medicine as well as in various agriculture productions are required to control the emergence of drug-resistant clones23. Sometimes half knowledge and over confidence in self-medication and lack of microbiology laboratories availablity has been responsible for the emergence of drug resistance strains in rural area.

Antibiotic resistance in E. coli species is only beginning to emerge as a clinical issue, yet the attention it has already received serves to underscore the seriousness of the problem. Although much work has been and is being done on these organisms, much is also yet to be done, especially with respect to determining the true risk factors for infection and the mechanisms of resistance. A better understanding of these issues will be key to helping prevent and treat these infections in the future. The data suggest that amikacin is useful for all SE class, cefuroxime suggest for upper lower (IV) people and oxcillin is best drug in upper middle (II), lower middle (III), upper lower (IV) female patients in rural area.

Funding: Nil, **Conflict of interest:** None initiated.

Table – 1: Latest Kuppuswamy's Socio-Economic status scale.

Sr. No.	Education	Score
1	Professors or honors	7
2	Graduate or post graduate	6
3	Intermediate or post high school	5
4	High school	4
5	Middle school	3
6	Primary school	2
7	Illiterate	1
Sr. No.	Occupation	Score
1	Profession	10
2	Semi-Profession	6
3	Clerical or Shop-owner	5
4	Skilled worker	4
5	Semi-skilled worker	3
6	Unskilled worker	2
7	Unemployed	1
Sr. No.	Family Income Per Months in Rs	Score
	2015	
1	≤1802	1
2	1803–5386	2
3	5387–8988	3
4	8989–13494	4
5	13495–17999	6
6	18000–36016	10
7	≥36017	12
Score	Socio-economic Class (SEC)	
26–29	Upper (I)	
16–25	Upper Middle (II)	
11–15	Lower Middle (III)	
5–10	Upper Lower (IV)	
< 5	Lower (V)	

Table – 1: Isolation of E. coli from female urine (n=189)

Name of The centre	urine samples	other than E. coli and sterile samples	E. coli
Rural teaching hospital - Rajiv Gandhi Institute of Medical Sciences (RIMS) Srikakulam, A.P	189	89	100

Fig – 1: Isolation and distribution of age of UTI patients.

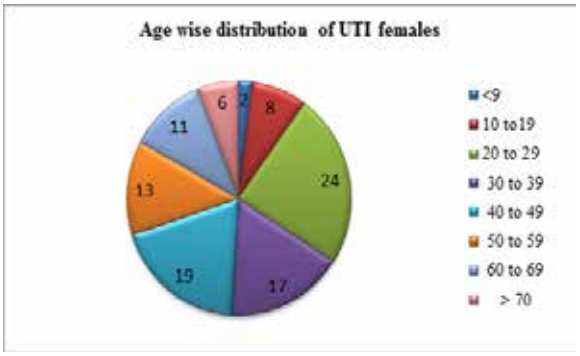


Table – 3: Associations of education status, occupation and income of E. coli UT infected females in rural centre.

Sr. No.	Education (No.)		Occupation (No.)		Income per month in INRs (Latest) (No.)		Chi-square	Df	P value
1	Illiterate	11	Unemployed	23	≤1802	27	24.1	12	0.020
2	Primary school	19	Unskilled worker	15	1803–5386	13			
3	Middle school	28	Semi-skilled worker	13	5387–8988	22			
4	High school	16	Skilled-worker	16	8989–13494	11			
5	Intermediate or post high school	22	Clerical or Shop-owner	24	13495–17999	17			
6	Graduate or post graduate	3	Semi-Profession	3	18000–36016	8			
7	Professors or honours	1	Profession	6	≥36017	2			
Total		100		100		100			

Fig – 2: Associations of Socio-economical class of E. coli UT infected females in rural centre.

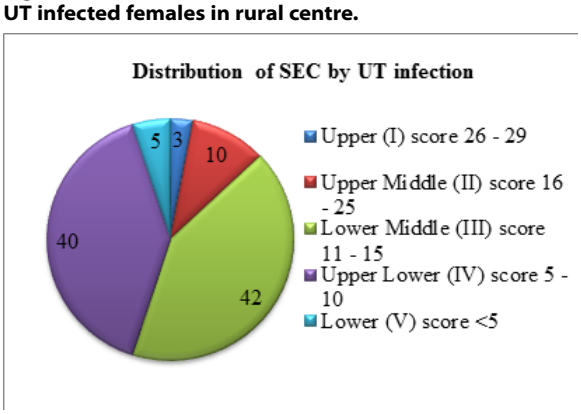
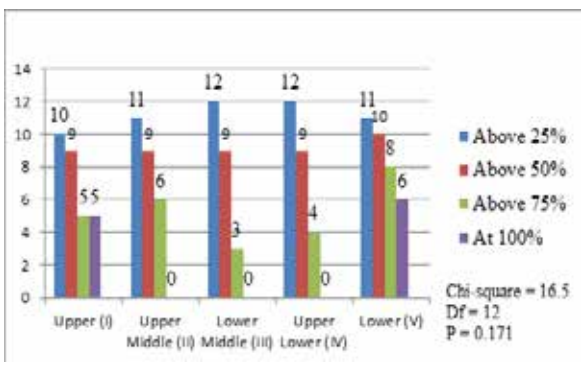


Table – 4: Associations of Drug resistance rate in percentages in various SEC.

SEC profile	Upper (I)		Upper Middle (II)		Lower Middle (III)		Upper Lower (IV)		Lower (V)		Chi-square	Df	P value
Name of the Drug	No	%	No	%	No	%	No	%	No	%			
	(n=3)		(n=10)		(n=42)		(n=40)		(n=5)				
Norfloxacin (NR)	3	100	9	90	38	90.48	37	92.5	5	100	12.26	44	1
Cefadroxil (CD)	3	100	6	60	25	59.52	24	60	4	80			
Gentamicin (G)	2	66.67	8	80	31	73.81	32	80	5	100			
Nalidixic acid (NA)	3	100	6	60	25	59.52	22	55	3	60			
Amikacin (AK)	1	33.33	4	40	12	28.57	17	42.5	1	20			
Netilmicin (NT)	2	66.67	7	70	19	45.24	23	57.5	5	100			
Ciprofloxacin (CIP)	2	66.67	9	90	32	76.19	27	67.5	5	100			
Cefaclor (CFC)	3	100	9	90	25	59.52	31	77.5	5	100			
Ceftriaxone (CTX)	2	66.67	8	80	28	66.67	23	57.5	4	80			
Cefuroxime (CXM)	0	0	5	50	28	66.67	16	40	3	60			
Cefoperazone (CPZ)	3	100	9	90	36	85.71	31	77.5	5	100			
Oxacillin (OX)	0	0	2	20	12	28.57	11	27.5	3	60			

Fig – 3: Associations of socio-economic status and no. of drug showing resistance above 25%, 50% 75% and at 100%.



References

1. Vila J, Vargas M, Casals C, Urassa H, Mshinda H, Schellemberg D, Gascon J, 1999. Antimicrobial resistance of diarrheagenic Escherichia coli isolated from children under the age of 5 years from Ifakara, Tanzania. Antimicrob Agents Chemother 43: 3022–3024.
2. Franzolin MR, Alves RC, Keller R, Gomes TA, Beutin L, Barreto ML, Milroy C, Strina A, Ribeiro H, Trabulsi LR, 2005. Prevalence of diarrheagenic Escherichia coli in children with diarrhea in Salvador, Bahia, Brazil. Mem Inst Oswaldo Cruz 100: 359–363.
3. Nguyen TV, Le PV, Le CH, Weintraub A, 2005. Antibiotic resis-tance in diarrheagenic Escherichia coli and Shigella strains iso-lated from children in Hanoi, Vietnam. Antimicrob Agents Chemother 49: 816–819.
4. Estrada-García T, Cerna JF, Pacheco-Gil L, Velázquez RF, Ochoa TJ, Torres J, DuPont HL, 2005. Drug-resistant diarrheogenic Escherichia coli, Mexico. Emerg Infect Dis 11: 1306–1308.
5. Levy S, Marshall B, Schleuderberg S, Rowe B, Davis J. High frequency of antibiotic resistance in human fecal flora. Antimicrob Agents Chemother 1988;32:1801-6.
6. Levin B, Lipsitch M, Perrot V, Schrag S, Antia R, Simonsen L, et al. The population genetics of antibiotic resistance. Clin Infect Dis 1997;24:S9-16.
7. Levy SB. Antibiotic resistance: an ecological imbalance. Ciba Found Symp 1997;207:1-9.
8. auxe RV, Cavanagh TR, Cohen ML. Interspecies transfer in vivo producing an outbreak of multiply resistant Shigellosis. J Infect Dis 1989;160:1067-70.
9. Iruka N. Okeke, Adebayo Lamikanra, and Robert Edelman Socioeconomic and Behavioral Factors Leading to Acquired Bacterial Resistance to Antibiotics in Developing Countries Emerging Infectious Diseases, 1999; 5(1).
10. Kuppuswamy's Socio-Economic Status Scale – A Revision of Income Parameter For 2014 Gururaj, Maheshwaran International Journal of Recent Trends in Science And Technology, ISSN 2277-2812 E-ISSN 2249-8109, 2014 ; 11(1): pp 01-02.
11. Kuppuswamy B. Manual of Socioeconomic Status (urban), Manasayan, Delhi, 1981.
12. Hart CA, Kariuki S. Antimicrobial resistance in developing countries. Br Med J 1998;317:647-50.
13. Okeke IN, Lamikanra A, Edelman R. Socioeconomic and behavorial factors leading to acquired bacterial resistance to antibiotics in developing countries. Emerg Infect Dis 1999;5:18-27.
14. Munishi GK. The development of the Essential Drugs Program and implications for self-reliance in Tanzania. J Clin Epidemiol 1991;44 Suppl 2:7S-14S.
15. Hogerzeil HV, Bimo, Ross-Degnan D, Laing RO, Ofori-Adjei D, Santoso B, et al. Field tests for rational drug use in twelve developing countries. Lancet 1993;342:1408-10.
16. Salako LA. Drug supply in Nigeria. J Clin Epidemiol 1991;44 Suppl 2:15S-9S.
17. Robles Y, Polack A. Continuing professional education in pharmacy in the Philippines 2. A current perspective. J Soc Admin Pharm 1997;14:24-132
18. Goel P, Ross-Degnan D, Berman P, Soumerai S. Retail pharmacies in developing countries: a behavior and intervention framework. Soc Sci Med 1996;42:1155-61.
19. Dua V, Kunin CM, White LV. The use of antimicrobial drugs in Nagpur, India. A window on medical care in a developing country. Soc Sci Med 1994;38:717-24.
20. Haak H. Pharmaceuticals in two Brazilian villages: lay practices and perceptions. Soc Sci Med 1988;27:1415-27.
21. Catalano M, Almiron MA, Romeo AM, Caruso E, Murtagh P, Harisiadi J. Comparison between parental report and results of microbiologic agar assay for presence of antibiotic in urine of rgentinian children with acute lower respiratory tract infection. Reviews of Infectious Diseases 1990;12 Suppl 8:S998-1000.
22. Implementation of the global strategy for health for all by the year 2000, second evaluation; and eighth report on the world health situation. Geneva: World Health Organization; 1992.
23. Woolfson A, Huebner R, Wasas A, Chola S, Godfrey-Faussett P, Klugman K. Nasopharyngeal carriage of community-acquired, antibiotic-resistant Streptococcus pneumoniae in a Zambian paediatric population. Bull World Health Organ 1997;75:453-62.