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Original Research Article

Risk Factors and Etiological Analysis of Community Acquired Urinary Tract Infection in Rural Area of Kanpur, UP

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Conflict of interest: Nil

Abstract

Background: This study was undertaken to find out the risk factors and etiological analysis of community acquired urinary tract infection in rural area. Urinary tract infection is the second most common infection in community after respiratory tract infection. UTI is an infection caused by presence and growth of microorganism in urinary tract. To treat UTI broad spectrum antibiotic are used.

Material and Methods: Cross–sectional analytical study has been performed among suspected UTI patients of both genders and all age group visiting outpatient departments. Study participants had been recruited by convenient sampling technique. On CLED agar culture the clean -catch mid -stream urine sample from the suspected patients. Antimicrobial susceptibility test was carried out using the Kirby – Bauer disc diffusion method.

Result: Total of 170sample 91 urine samples was positive for bacteria with significant bacteriuria. Females were predominant (69.2%). Diabetes mellitus was observed as the commonest risk factor followed by History of UTI and kidney disease. The most common Uropathogen isolated was Escherichia coli (62%), followed by Klebsiella sp. (29.1%), In gram negative bacilli GNB), Prevalence of sensitivity was highest for Polymyxin -B and colistin followed by Piperacillin and nitrofurantoin and piperacillin-tazobactam While in gram positive cocci (GPC), Enterococcus spp (57.1%) followed by Staphylococcu aureus (42.8%) isolates were isolated and were highly sensitive to nitrofurantoin and vancomycin followed by, linezolid and teicoplanin.

Conclusion: This study revealed the E. coli was the predominant bacteria pathogen of community acquired UTI in Kanpur, India. Regular monitoring of the antibiotic sensitivity pattern of UTI pathogens for commonly used antimicrobial agents should be carried out in a particular region for optimal empirical therapy.

Keywords: Uropathogen, Urinary Tract Infection (UTI), Escherichia Coli.

Introduction

The second most frequent illness in a population, behind respiratory tract infections, is urinary tract infection (UTI). Each year, over 150 million people are diagnosed with UTIs worldwide, costing the economy more than $6 billion US [1]. Only the lower urinary tract may be affected by UTI, or both the upper and lower tracts may be affected. Lower UTI, which is characterised by a syndrome comprising dysuria, frequency, urgency, and sporadically suprapubic discomfort, has been referred to as cystitis. However, the existence of lower tract symptoms without upper tract symptoms does not rule out an upper urinary tract infection, which can occasionally be present [2].

UTIs are infections brought on by the development and presence of microorganisms in the urinary tract. The natural flora of the digestive system frequently ascends into the urinary tract through the opening of the urethra, producing lower urinary tract infections. A blood stream infection-causing organism can occasionally reach the kidney via the hematogenous pathway (descending route) [3,4]. In comparison to men, women are more likely to get an infection between the ages of 16 and 64 [5]. Absence of prostatic secretion and simple faecal flora contamination of the urinary system are both caused by a small urethra [6]. Females with wider pelvises are more likely to have weak pelvic floors. Age-related hormonal and physiological changes make voiding disorder more likely. All urinary issues are more common, which is also related to socioeconomic position and poor urogenital cleanliness [7,8]. People in some groups, such as expectant mothers, the elderly, or patients with spinal cord injuries, catheters, or diabetes, are more likely to get UTIs [9,10]. Between 20 and 40 percent of women have repeated episodes, and it is anticipated that half of all women have at least one episode of UTI over their lifetime. UTIs vary by gender and age. Benign prostatic hyperplasia (BPH) is the cause of around 20% of all UTI infections in men who are over the age of 50 to 55 [11]. Around 5% of all young children under the age of two develop febrile sickness brought on by UTI. [12]

Escherichia coli is the main bacterium that causes UTIs, followed by Klebsiella pneumoniae, Proteus species, and Staphylococcus. [13] Because of worries about contracting an infection with resistant organisms, UTIs are frequently treated with several broad-spectrum antibiotics when one with a restricted range of activity may be acceptable. In areas where resistance is expected to be a problem, fluoroquinolones are favoured as the first line of treatment for UTI [14,15]. This is due to the fact that they have among the highest rates of bacteriological and clinical cure and the lowest rates of resistance among the most prevalent Ur pathogens [16,17]. Both in nosocomial infections and community infections, the aetiology of UTI and the antibiotic resistance of UTI microorganisms have changed during the past several years. [18,19].

Material Methods

This was a cross sectional study conducted at the RMCHRC Kanpur between July 2022 and April 2023. Total 170 patients having signs and symptoms of UTI were recruited for this study. Freshly voided midstream urine specimens of suspected UTI patients were submitted to the clinical microbiology laboratory of RMCH&RC, Kanpur for processing. Urine samples were inoculated on CLED agar using a calibrated loop and a semi-quantitative bacterial count and growth. Significant Monomicrobic bacteriuria was defined as the culture of a single bacterial

species from the urine sample at a concentration of >105 CFU/mL, in accordance with the Kass concept criteria for differentiating real illness from contamination. For each patient, the analysis only took into account one positive culture. Standard biochemical methods were used to for identification of bacteria. The antibiotic sensitivity test was performed by Kirby Bauer disc diffusion technique with commercially available Hi-Media antibiotic discs on Mueller Hinton agar plates, the zone size was interpreted as Susceptible (S), Intermediate (I), Resistant (R) according to Central Laboratory Standard Institute (CLSI 2022) guidelines. Urine microscopy was performed for pus cells count. The collected data was analysed using Microsoft excel sheet.

Inclusion criteria: Suspected cases of urinary tract infection of both genders and all age groups were included in this study.

Exclusion criteria: Patients on antibiotics therapy before urine sample collection and critically ill patients were excluded.

Ethical Approval

Permission to collect sample will be obtained from Rama Medical Collage, Hospital & Research Centre, Kanpur, U.P.

Result

Patients coming to department of Medicine and gynaecology OPD. 170 urine samples processed 91(54%) gave significant growth of pathogens. Out of 91 positive cases 63 (69.2%) were female and 28(34.5%) were male. Majority of cases 29 (31.8%) were found in 21-30years of age group followed by 41-50 years of age group (Table 1).

Table 1: Distribution of suspected cases according to age group

Age Group	No of Patient	Percentage (%)
0-10	08	8.7%
11-20	04	4.3%
21-30	29	31.8%
31-40	13	14.2%
41-50	15	16.4%
51-60	06	6.5%
61-70	12	13.1%
71-Above	04	4.3%
Total	91	100

Out of 91 positive cases 79(86.8%) were gram negative organism isolated and 7(7.6%) were gram positive organism isolated and 5(5.4%) were Candida spp. In Gram negative bacilli E. coli 49 (62%), was most common isolated followed by Klebsiella oxytoca 15(18.9%), Klebsiella pneumonia 8(8.7%), Proteus mirabilis 3(3.7%), Proetus vulgaris 2(2.5%), and Citrobacter 2(2.5%). Gram positive cocci Enterococcus faecalis 4(57.1%), was most common isolated followed by Staphylococcus aureus 3(42.8%). Candida krusei 3(60%) was most common followed by the candida tropicalis 1(20%), candida albicans (20%).

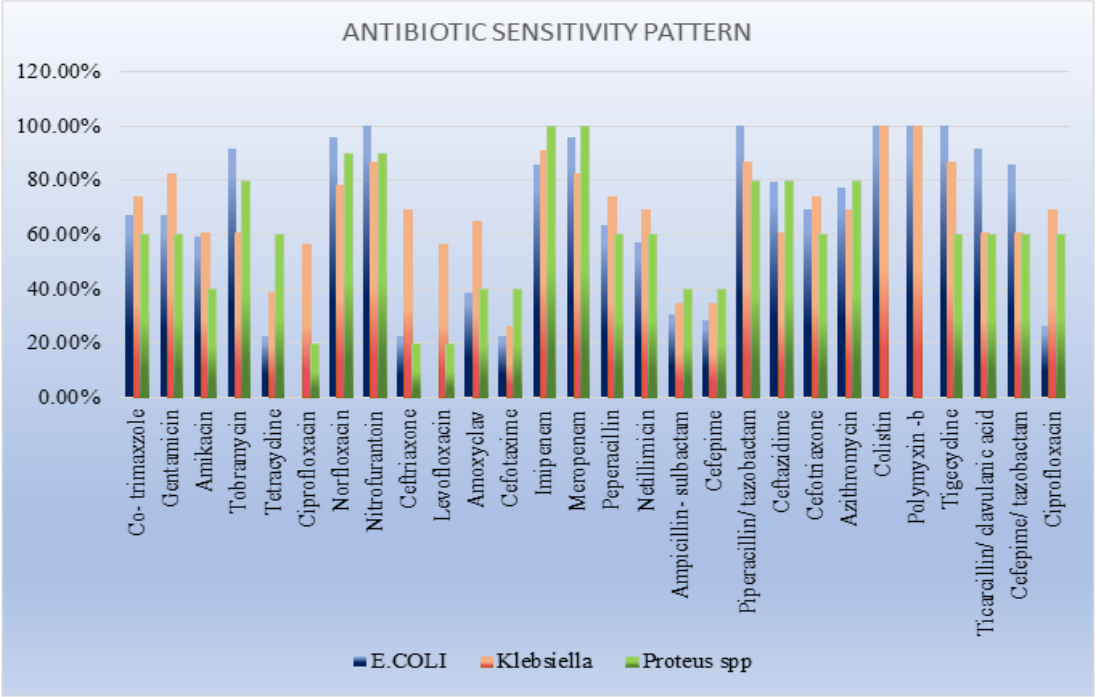
Burning micturition was observed as the commonest symptom (28.57%) followed by frequency (23%), urgency (8.79%), abdominal pain (7.69%), flank pain (7.69%) followed by dysuria (5.49%), fever (4.39%), other (4.39%), and haematuria (3.29%) (Table 2). Diabetes mellitus was the most common risk factor (28.5%) followed by kidney disease (23%), History of UTI (19.7%), Haematuria (8.7%) Pregnancy (5.4%), Menopause (4.3%), history of

catheterization (3.2%), Prophylaxis of Drugs (4.3%), Pre-mature Birth (2.19%) (Graph 1).

Table 2: Distribution of Suspected Cases According to Sign & Symptom

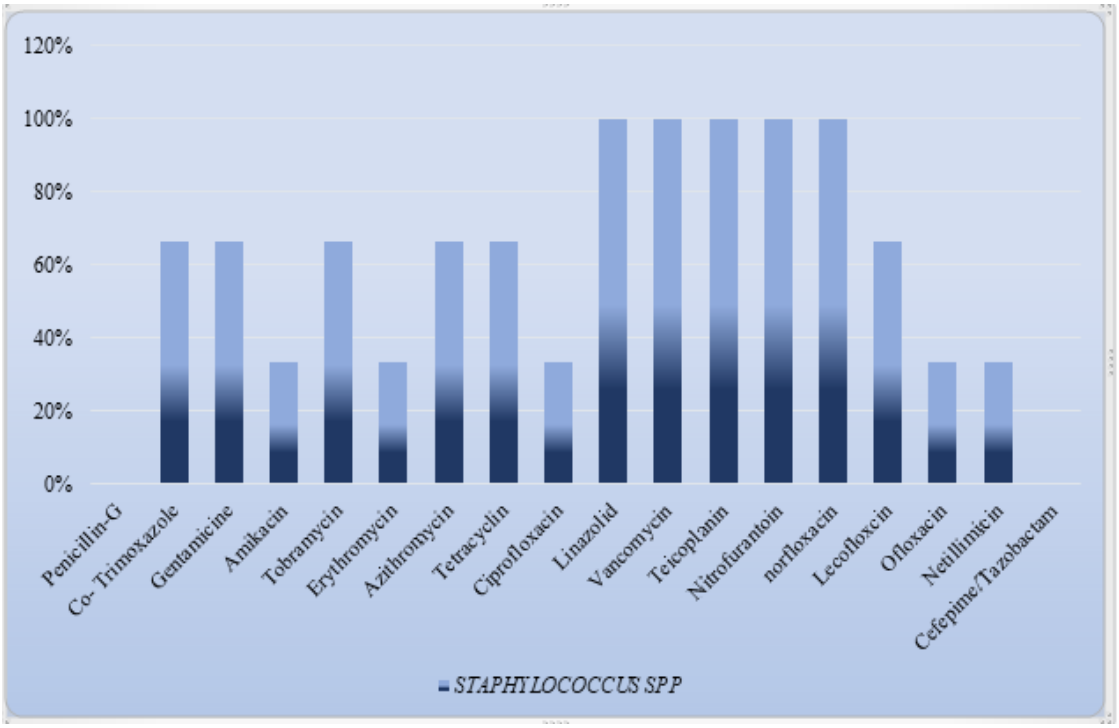
Sign & Symptoms	Number	Percentage%
Fever	04	4.39
Nausea	02	2.19
Abdominal pain	07	7.69
Dysuria	05	5.49
Urgency	08	8.79
Frequency	21	23
Flank pain	07	7.69
Urinary incontinences	04	4.39
Burning micturition	26	28.57
Haematuria	03	3.29
Other	04	4.39
TOTAL	**91**	**100**

In case of E. coli was most common isolate in patient. E. coli (49) isolates were most sensitive to nitrofurantoin (100%), piperacillin–tazobactam (100%), tigecycline (100%), polymyxin -B (100%), and colistin (100%), followed by Norfloxacin (95.9%), Meropenem (95.9%) Imipenem (85.7%), Tobramycin (91.3%), & most resistant to ampicillin (77.5%), cefotaxime (77.5%) followed by ceftriaxone (77.5%) and Ciprofloxacin (73.9%). Klebsiella spp. [23] is second most common isolates in patients. Klebsiella spp. were most sensitive to polymyxin-B (100%), colistin (100%) followed by imipenem (91.3%) and piperacillin–tazobactam (86.9%) and most resistant to ampicillin (92,9%) and ampicillin–sulbactam (82.6%) followed by cefotaxime (73.5%) and ceftriaxone (73.5%). Proteus spp. (05) was most sensitive to imipenem (100%), meropenem (100%), followed by nitrofurantoin (90%), and norfloxacin (90%) & most resistant to polymyxin-B (100%), colistin (100%), and ceftriaxone (90%). Citrobacterkrusari (02) was most sensitive topolymyxin -B (100%), and colistin (100%), followed by Meropenem (100%) Imipenem (100%), and most resistance to cefotaxime (100%), cefepime (100%) (Table-2).



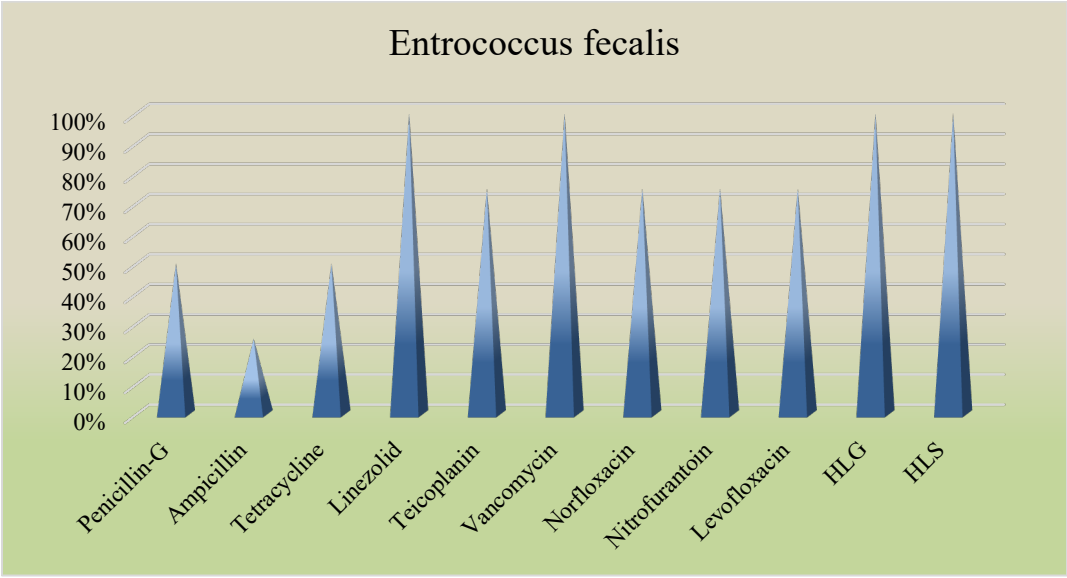
Graph-1: Antibiotic sensitivity pattern for GNB

Staphylococcus aureus. (03) was most sensitive to vancomycin (100%), linezolid (100%) followed by teicoplanin (100%), and most resistant to penicillin (100%) and Cefepime /Tazobactam (100%).(Graph 3).



Graph 3: Antibiotic sensitivity pattern of Staphylococcus

Enterococcus faecalis (04) was susceptibility pattern of E. faecalis showed highly sensitive to vancomycin (100%), followed by linezolid (100%) & High – level gentamycin (100%) and most resistant to penicillin (100%) followed by Cefepime/Tazobactam (100%).(Graph 4)



Graph4: Antibiotic sensitivity pattern of Enterococcus.

Discussion

This study shows the bacteriological profile and antibiotic susceptibility pattern community acquired UTI. A total of 170 urine samples collected from CA-UTI patients 91 (54%) showed significant pathogens. The culture positive rate for CA-UTI was higher than the study conducted by Shivani Gupta et.al (2014) and Mohammed Akram et.al (2007) in which CA-UTI rates were 10.1% and 10.86% respectively [20,21]. In this study, community-acquired urinary tract infections were more in females (69.2%) than the males (34.5%). According to Mohapatra et.al (2022), females were predominantly infected (72.5%), followed by males (27.5%) [22].

In our study, the age group commonly affected were 21-30 years (31.8%). In the study of Sarita Mohapatra et.al (2022) the highest cases was observed from 19–35 years (56.9%) [22]. In the study of Christy VR et.al (2019) the women in the age group 21-30 years are more prone to UTI as compared to other age groups. In other studies the rate of UTI was similar to our study [23].

In our study, Burning micturition was observed as the commonest symptom (28.57%) followed by frequency (23%), urgency (8.79%), abdominal pain (7.69%), flank pain (7.69%) followed by dysuria (5.49%), fever (4.39%), other (4.39%), and haematuria (3.29%). In the study of Sarita Mohapatra et.al (2022), burning micturition was observed as the commonest symptom (37.6%) followed by frequency (30.4%), urgency (29.1%), suprapubic pain (23%) and dribbling of urine (6.5%). Flank pain (27.8%) [22]. In the study of Sheng-Wen Wu (2013) The clinical symptoms of UTIs included fever (71%), dysuria/ frequency (25%) and others (4%) [24]. In other studies, the UTI symptoms of frequency and urgency was similar to our study.

In our study, Diabetes mellitus was the most common risk factor (28.5%) followed by Kidney disease (23%), History of UTI (19.7%), Haematuria (8.7%) In the study of Sarita Mohapatra et.al (2022), patients had a history of recent episode of UTI (23.9%), diabetes mellitus (3.2%), renal stone (1.1%) [22]. In the study of E. Stefaniuk (2016) the risk factor of recurrent UTI (58.3 %), urinary/ fecal incontinence (31.0 %), nephritis (23.6 %), kidney stones (21.3 %), prostate hypertrophy (5.56 %), renal insufficiency (3.2 %), diabetes (4.17 %), kidney empyema (1.85 %), polycystic kidneys (1.39 %), and kidney cancer (1.39 %) [25]. In other studies, the risk factors

were commonly from past history of UTI as compared to our study.

In our study, E. coli (62%) was the most common organism followed by the Klebsiella spp (29.1%). In the study of Sarita Mohapatra et.al (2022) E. coli was observed as the commonest uropathogen (68.3%), followed by K. pneumoniae (17.6%) [22]. In the study Yedla Kavita (2016) E.coli (60.40%) was the most commonly isolated organism followed by Klebsiella species (24.87%) [26]. In the study of Ilknur Erdem (2018) most common causative agent was E. coli (66.6% of cases) followed by K. pneumoniae (16.6%) [27]. E.coli was the most common organism isolated in UTI patients.

In our study Antibiotic sensitivity pattern of gram-negative bacilli revealed that maximum sensitivity was seen for (100%) colistin, (100%) polymyxin -B followed by nitrofurantoin (100%), piperacillin-tazobactam (100%), Norfloxacin (95.9%), Meropenem (95.9%) Imipenem (85.7%), Tobramycin (91.3%), tigecycline (100%). most resistant to ampicillin (92,9%) and ampicillin – sulbactam (82.6%) followed by cefotaxime (73.5%) and ceftriaxone (73.5%), cefepime (100%). Antibiotic sensitivity pattern of gram-positive cocci revealed maximum sensitivity to (100%) Vancomycin, Linezolid, Teicoplanin, high level of Gentamycin. Most resistant to (100%) Penicillin, cefepime- tazobactam. In other study Harsha Vijayvergiya et al (2016)Antibiotic sensitivity pattern of gram negative bacilli revealed that maximum sensitivity was seen for nitrofurantoin (68.9%), followed by amikacin (62.2%), gentamycin (51.8%) and maximum resistance was seen against ampicillin (96.3%), cephalexin (92.1%), amoxicillin (90.2%), nalidixic acid (85.4%), ceftazidime (79.8%), cotrimoxazole (77.4%). Antibiotic sensitivity pattern of gram-positive cocci revealed maximum sensitivity to nitrofurantoin (83.5%) followed by vancomycin (79.7%), gentamicin (75.9%), amikacin (73.4%). Maximum resistance was seen against nalidixic acid (93.7%), cotrimoxazole (84.8%), ceftazidime (84.8%) and ampicillin (79.7%) [28]. In the study Sandeep N et al (2021) of sensitivity pattern by all isolated organisms cotrimoxazole (37.5%), nitrofurantoin (95%), norfloxacin (72%), cefixime (58.9%), ceftazidime (34.4%), cefotaxime (4.4%), cefuroxime (34.4%), piperacillin-tazobactom (66.1%), meropenem (97.8%) and imipenem (95%). 100% resistant to ampicillin by all isolated organisms [29].

Conclusion

This study revealed that the E. coli was the predominant bacterial pathogen of community acquired UTI in Kanpur, India. The most effective and safe antibiotics were norfloxacin and nitrofurantoin. Regular monitoring of the antibiotic sensitivity pattern of UTI pathogens for commonly used antimicrobial agents should be carried out in a particular region for optimal empirical therapy.

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