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A Cross-Sectional Study on Spectrum of Bacteria Causing Urinary Tract Infections and Their Sensitivity Pattern in Patients with Lower Urinary Tract Symptoms at Akash Hospital

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Abstract: ***Lower urinary tract symptoms (LUTS) are identified as a broad group of conditions encompassing a wide range of specific discomforts and functional issues related to the bladder and urethra1. As previously discussed, these symptoms include frequency, nocturia, urgency, strangury, urge incontinence, stress incontinence, nocturnal enuresis, hesitancy, reduced urinary stream, intermittency, straining, incomplete emptying, hematuria, post-micturition dribble, and dysuria. While LUTS can arise from various causes, urinary tract infections (UTIs) are a significant contributor. The study in question is specifically designed to address critical aspects of UTIs that directly impact the effective management of these conditions. The primary objective of this research is to investigate the spectrum of bacteria responsible for causing urinary tract infections and to determine their sensitivity patterns. This means the study aims to identify which specific types of bacteria are commonly found in UTIs and, crucially, to understand how these bacteria respond to different antimicrobial treatments. Understanding the bacterial spectrum is vital because different bacteria may require different therapeutic approaches. Furthermore, determining their "sensitivity patterns" involves assessing their susceptibility or resistance to various antibiotics. This information is indispensable for clinicians, as it directly informs decisions regarding the most effective antibiotics to prescribe. By pinpointing the specific pathogens and their vulnerabilities, the study facilitates proper management of lower urinary tract infections1. The ultimate goal of this detailed investigation is to reduce the dangerous complications of lower urinary tract infections, ensuring that patients receive targeted and effective treatment to prevent more severe health issues. In essence, the research provides foundational data necessary for optimizing treatment strategies for UTIs and, by extension, mitigating the impact of related LUTS. Materials and Methods: A prospective observational study was conducted during April 2023- September 2024. All positive urine culture and sensitivity reports of males and females aged > 18 years were included, excluding the patients who were diagnosed with Upper Urinary Tract Infection and Patients with a Urinary Catheter in situ. A total of 91 patient samples were analyzed for bacterial isolates, demographic characteristics, and antibiotic sensitivity patterns. Descriptive statistics were used to summarize age distribution, gender distribution, and laboratory findings. Graphs and tables are incorporated to enhance the interpretation of results. Results: Out of 91 positive urine cultures, males were 34 (37.4%) and females were 57 (62.6%). E. coli (48.4 %) was the most common organism, followed by Klebsiella (16.5%), Proteus (11.0%), Citrobacter (7.7%), Pseudomonas aeruginosa (6.6%, Staphylococcus aureus (5.5%, Enterococci (4.4%). The prevalence of UTI in females was significantly higher than males. The most susceptible age group for UTI was 20-40years, followed by 60-70yrs.E coli and Klebsiella pneumoniae was sensitive to antibiotic Piperacillin, Tazobactam, Meropenem, Imipenem, Amikacin, Gentamycin, Nitrofurantoin and were resistant to ampicillin. Enterococcus was sensitive to vancomycin, linezolid, tigecycline. Staphylococcus was sensitive to vancomycin, linezolid, amikacin. The observed antibiotic resistance, particularly the 14.3% resistance to all antibiotics, raises concerns about multidrug-resistant (MDR) infections. The findings emphasize the need for regular antibiotic susceptibility testing to guide empirical therapy and reduce the emergence of resistance. The presence of intermediate sensitivity to cephalosporins and fluoroquinolones suggests a possible shift in resistance trends, necessitating careful selection of treatment protocols. Conclusion: In this study, females were mostly affected and the most common organisms were E. coli and Klebsiella. This study highlights the predominance of E. coli in UTIs and the concerning level of antibiotic resistance among isolates. These organisms were most sensitive to Piperacillin Tazobactam, Meropenem, Imipenem, Amikacin, gentamycin, nitrofurantoin and resistant predominantly to Ampicillin. The sensitivity and resistance pattern of uropathogens to common antimicrobial agents must be taken into account when selecting treatment plans for UTI. The findings underscore the importance of antibiotic stewardship programs and routine culture and sensitivity testing to optimize treatment outcomes.***

Keywords: Antibiotic sensitivity, Antibiotic resistance, Antimicrobial Treatments, Bacterial Spectrum, Sensitivity Patterns, Multidrug resistance, Urinary tract infection, LUTS, Frequency, Nocturia, Urgency, Strangury, Urge Incontinence, Stress Incontinence, Nocturnal Enuresis, Hesitancy, Reduced Urinary Stream, Intermittency, Straining, Incomplete Emptying, Hematuria, Post-Micturition Dribble, Dysuria.

1. Introduction

Lower urinary tract symptoms (LUTS) is a term used to describe an array of symptoms affecting the control and quality of micturition in the lower urinary tract.

LUTS can affect both men and women, although they are particularly common presentation amongst men and increase with age. It is estimated that more than 50% of men over 50 years suffer from LUTS.

In older men, LUTS are commonly caused by benign prostatic hyperplasia, whilst in females are most commonly associated with lower urinary tract infections.

Other potential causes include bladder cancer, prostate cancer (in males), detrusor muscle weakness, pelvic floor

dysfunction, chronic prostatitis, urethral stricture, from external compression e.g. pelvic tumour, and neurological disease e.g. multiple sclerosis

Lifestyle factors, including drinking fluids late at night, excess alcohol intake, and excess caffeine intake can exacerbate LUTS. Additionally, polyuria (for example secondary to diabetes mellitus, excessive fluid intake, diuretics) can exacerbate or mimic LUTS.

Classification

LUTS can be broadly categorized* into **storage symptoms** and **voiding symptoms.**

- Storage symptoms occur when the bladder should otherwise be storing urine, therefore symptoms include **urgency**, **frequency**, **nocturia**, and **urge incontinence**
- Voiding symptoms occur usually due to bladder outlet obstruction making it more difficult to pass urine, therefore symptoms include **hesitancy, intermittency, straining, terminal dribbling,** and **incomplete emptying**

Table 1: Summary of voiding and storage symptoms

Voiding	Storage
Hesitancy or straining in micturition	Increased urinary frequency
Poor flow (<10mL/s)	Nocturia
Terminal dribble	Increased sense of urgency to urinate
Feeling of incomplete emptying	Urge incontinence

Clinical Features:

When taking a history of LUTS, ensure to clarify the **exact nature** of lower urinary tract symptoms present, establishing whether symptoms are mostly voiding or storage as this may can aid in determining the underlying pathology. Ask about **associated symptoms**, such as visible haematuria, suprapubic discomfort, or colicky pain, and their **medication history**, as certain medication, including anticholinergics, antihistamines and bronchodilators, are known to exacerbate LUTS. A **digital rectal examination** and/ or **examination of the external genitalia** may be helpful, depending on the presentation. The **International Prostate Symptom Score** can be a useful tool for assessing and monitoring the impact of LUTS on quality of life in men, both initially and throughout any treatment course.

2. Materials and Methodology

Study Design: A Cross-Sectional Study.
Study Place: Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bangalore.
Study Sample:91
Study Period: 18 Months (April 2023-September 2024)

Study setting and Method of collection of data:

This shall be a observational study which shall include 91 individuals based upon the inclusion and exclusion criteria and then convenience random sampling done.

Subject Eligibility

Inclusion Criteria

- Age above 18 years.
- Both genders.
- All patients consenting for study.
- Urinary culture positive patients with UTI having lower urinary tract symptoms.
- Urine – microscopy examination showing >/=5 pus cells.
- Significant post void residue and >/=10ml.

Exclusion Criteria

- Patients aged less than 18years
- Patients with Urinary Catheter In-situ
- Patient who is diagnosed with Upper Urinary Tract Infection

3. Methodology

- After obtaining approval and clearance from institutional ethics committee, patients fulfilling the inclusion criteria will be enrolled for the study after obtaining informed written consent.
- Patients visiting & admitted to Akash Hospital from April 2023-september 2024, confirmed cases of UTI with lower urinary tract symptoms meeting the inclusion criteria shall be considered for the study.
- Detailed history and thorough clinical examination will be done and documented.
- Clean catch mid-stream urine samples collected in sterile, wide-mouth containers.
- Urinary microscopy examination (>/=5 pus cells) and ultrasound of kidney, ureter, and bladder with significant post void residue > 50ml.[7,8]
- Urine samples will be inoculated on appropriate culture media by using semi-quantitative methods and incubated for 48 hours aerobically. Cultures will be then examined for growth and colonies counted for significant or insignificant bacteriuria.
- Antimicrobial susceptibility testing will be done by Modified Kirby Bauer Disc Diffusion Method on Muller Hinton Agar.
- Antibiotics tested are Amikacin, Ampicillin, Cefipime, Cefuroxime, Gentamicin, Ciprofloxacin, Linezolid, Nitrofurantoin, Erythromycin, Piperacillin + tazobactam, Vancomycin, Amoxiclav, Cotrimoxazole, Meropenem, and Imipenem.

Study Population and source of data:

Total number of subjects included in the study will be 91 of any sex, race or age which includes all patients with LUTS admitted in the Akash hospital surgery wards for management after fulfilling the inclusion and exclusion criteria will be interviewed to obtain complete clinical details. For patients agreeing for the participation in the study thorough general, physical and systemic examination along with thorough investigations will be done and valid consent will be taken for the management for the LUTS.

4. Results

Sensitive * Isolated organism Crosstabulation										
Count										
		Isolated organism							Total	P
		Citrobacter	E coli	Enterococci	Klebsiella Pneumoniae	Proteus	Pseudomonas Aerogenosa	STAP. AUREUS		
Sensitive	AMI, GEN, IMI, LINE	3	2	0	1	0	4	0	10	0.00
	IMI, MER, AMI, GEN, NIT, PTZ	1	28	0	3	0	0	0	32	
	IMI, MER, AMI, GEN, PTZ	0	6	0	7	0	2	0	15	
	IMI, MER, AMI, PTZ	0	1	0	0	0	0	0	1	
	IMI, MER, AMIK, GEN, NIT, PTZ	0	1	0	0	0	0	0	1	
	LIN, VAN, TIG	0	0	3	0	0	0	0	3	
	MER, IMI, PTZ, CFS	0	0	0	0	10	0	0	10	
	NA	1	0	0	0	0	0	0	1	
	RESISTANT TO ALL ANTIBIOTICS	2	6	1	4	0	0	0	13	
	VAN, LIN, AMI, GEN, DOX	0	0	0	0	0	0	5	5	
Total		7	44	4	15	10	6	5	91	

Resistant * Isolated organism Crosstabulation									
Count									
		Resistanat						Total	P
		AMP, CEFI	AMP, CEFI, CEFT	CEFI, CEFT	CIP, NOR	NA	Resistant to all Antibiotics		
Isolated organism	Citrobacter	0	0	0	0	4	3	7	0.000
	E coli	5	1	2	0	30	6	44	
	Enterococci	0	0	0	0	3	1	4	
	Klebsiella Pneumoniae	4	0	0	0	7	4	15	
	Proteus	0	0	0	0	10	0	10	
	Pseudomonas Aerogenosa	0	0	6	0	0	0	6	
	STAP.AUREUS	0	0	0	2	3	0	5	
Total		9	1	8	2	57	14	91	

5. Discussion

Lower urinary tract symptoms (LUTS), encompassing issues like urgency, frequency, nocturia, incontinence, hesitancy, and weak stream, create substantial barriers to seeking medical care due to a mix of emotional, social, and informational challenges. Embarrassment is a primary deterrent, as individuals often feel uncomfortable discussing intimate symptoms, even in reassuring healthcare environments, leading to delayed or avoided consultations. This is compounded by a widespread belief that LUTS are an inevitable part of aging, particularly among older adults who normalize symptoms like nocturia or incomplete emptying, reducing their motivation to seek help. Additionally, public awareness about effective LUTS treatments—such as pelvic floor exercises, medications, or minimally invasive procedures—is limited, leaving many unaware that these symptoms can be managed to improve quality of life. Misconceptions about incurability, concerns over treatment costs, or fears of medication side effects further discourage action. The degree of "bother" from symptoms significantly influences help-seeking behavior, with both storage symptoms (e.g., urgency, frequency, urge incontinence) and voiding symptoms (e.g., hesitancy, slow stream) prompting men and women alike to seek care, challenging gender-specific assumptions about LUTS. These symptoms are not solely tied to conditions like bladder outlet obstruction but may indicate broader issues, such as bladder dysfunction or other urinary tract abnormalities, necessitating thorough diagnostic evaluation.

Urinary tract infections (UTIs), often associated with LUTS, present additional challenges due to evolving microbiological and resistance patterns. The study reports a higher UTI prevalence in females (60.7%) than males (39.3%), attributed to anatomical factors like a shorter urethra, proximity of the urethral meatus to the anus, and behaviors such as sexual activity or improper hygiene. Young females aged 18–50 years show the highest incidence, consistent with findings from studies in Meerut and Jaipur, due to their anatomical vulnerability. Conversely, elderly males (51–80 years) exhibit a significant UTI burden (35.9% vs. 25.7% in elderly females), likely driven by conditions like benign prostatic hyperplasia or neurogenic bladder, which impair urinary flow. The most common uropathogens identified is E. coli (55%), followed by Proteus sp. (6.9%), K. pneumoniae (6.6%), P. aeruginosa (6.3%), and Citrobacter sp. (6.3%). The rise of antimicrobial resistance, particularly among gram-negative bacteria, complicates treatment, with 40.4% of E. coli strains producing extended-spectrum beta-lactamases (ESBLs), rendering broad-spectrum antibiotics like amoxiclav, ampicillin, and cefepime largely ineffective. In contrast, antibiotics like amikacin, gentamycin, and imipenem show high susceptibility, while nitrofurantoin remains effective against E. coli but less so against other Enterobacteriaceae. The emergence of resistant strains like Citrobacter sp., especially in those over 80, highlights the need for vigilant

antimicrobial susceptibility testing. Factors like prolonged hospital stays and indiscriminate antibiotic use fuel multidrug-resistant (MDR) infections, emphasizing the critical need for collaboration between clinicians and microbiologists to tailor treatments and curb resistance trends.

6. Conclusion

The main factor fuelling antimicrobial resistance is improper usage of antibiotics that needs to be checked. According to the Infectious Diseases Society of America's proposed regulations, empirical antibiotic treatment for UTI should be based on regional susceptibility data, drug accessibility, and patient history. Resistance to bacterial uropathogens is becoming a public health issue in India. Many Indian cities and towns lack appropriate microbiological laboratories, leading to fewer microbiological assessments and increased empirical antibiotic use.

Typically, urine samples are sent for microbiological testing only after treatment failure, recurrent or relapsing infection. Our findings emphasize the significance of local antibiotic resistance patterns, which may subsequently be used to develop hospital and regional antibiotic policies.

To avoid UTI public awareness regarding hydration, urinating regularly, maintaining good hygiene, urinating after intercourse should be promoted. And also To avoid/contain the emergence of antibiotic resistance in bacteria, the government must introduce laws requiring the prudent use of these antibiotics.

Ethical clearance: Taken from ethical committee of institute

Source of funding: none

Conflict of Interest: Nil

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