



Prevalence of Urinary Tract Infection among Women in Virudhunagar, Tamil Nadu: Treatment Approach and Perspectives

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Urinary tract infections (UTIs) represent a significant health burden, particularly among women worldwide. Understanding the prevalence and associated risk factors of UTIs is crucial for effective management and treatment. This research focuses on exploring the prevalence of UTIs in women in Virudhunagar, Tamil Nadu, and identifying the microbial agents responsible for these infections.

Aim: The primary objective of this study is to determine the prevalence of urinary tract infections among women in Virudhunagar, Tamil Nadu, and to investigate associated risk factors. Additionally,

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the research aims to evaluate the microbial agents causing UTIs in the region to inform the development of tailored and effective treatment strategies.

Study Design: A Prospective Observational Study was conducted over a period of 6 months at the Outpatient and Obstetric and Gynaecological department of a Tertiary Healthcare Teaching hospital. Female patients presenting with symptoms suggestive of UTIs were recruited for participation in the study after providing informed consent.

Methodology/Methods: Data collection encompassed various parameters including patient demographics, symptoms, urine culture results, prescribed antibiotics, and concurrent medications. A sample size of 480 participants was determined through an extensive review of literature. Statistical analysis was performed to analyze the collected data.

Results: Out of the 480 participants, 117 individuals tested positive for UTIs, indicating a prevalence rate of [24.4%]. The age group 15-24 exhibited the highest incidence of UTIs, with a mean age of 30. Educational and marital status was found to influence infection rates. Common symptoms included increased frequency of urination and painful urination. *E.coli* was identified as the primary pathogen responsible for UTIs. Cephalosporin antibiotics were the most frequently prescribed treatment modality.

Conclusion: Urinary tract infections are prevalent among women in Virudhunagar, Tamil Nadu, as evidenced by the findings of this study. The identification of associated risk factors and microbial agents provides valuable insights for clinical decision-making and the development of tailored treatment approaches. These findings underscore the importance of continued research in UTI management to address the global health burden posed by this infection.

Keywords: Urinary tract infection; urine culture report; prevalent infection; risk factors; management.

1. INTRODUCTION

Urinary tract infection (UTI) represents a highly prevalent bacterial infection that is commonly encountered by both genders, on a frequent basis [1]. UTI can substantially influence both, the overall quality of life and healthcare systems. These infections may also arise as an unfortunate incident and is regarded as a prevalent infection acquired within a hospital setting [2,3,4]. Despite the advancements in medical comprehension and therapeutic approaches, UTIs persist in imposing a significant load on affected individuals and healthcare practitioners. It encompasses a diverse array of clinical syndromes and ailments, each exhibiting its own distinct epidemiology, etiology, and level of severity [5].

Statistical projections suggest that women are likely to experience at least one urinary tract infection in their lifetime [6]. Studies in India have shown that women have higher rates of UTIs compared to men [7]. Younger females aged 18-37% have a higher prevalence of UTIs [8]. In a particular district, 48% of women in different slums reported experiencing an UTI episode [9]. The level of education, socio-economic status, and UTI are significantly associated. Various factors such as sexual intercourse, age, duration of diabetes, glycemic control, and diabetes complications contribute to UTI risks [10]. UTI is

a significant medical complication during pregnancy, affecting 3% - 24% of women in India. Half of the UTI cases during pregnancy occur in the second trimester [11].

UTI in females occurs when bacteria invade the epithelial lining of the system, leading to colonization of the vagina and urethra [12-14,15,16]. This resulting in inflammatory events causing tissue reactions followed by disrupts the normal system and leads to an increase in white blood cells, pus formation, and a change in urine colour. The immune system responds by releasing cytokines and prostaglandins, causing inflammation and fever. The urinary tract lining becomes inflamed, narrowing the passage and causing frequent urination. [17,18,11]. Research has extensively characterized urinary tract infections as the most common manifestation of bacterial infections, with viral or parasitic infections being rare [19,20]. The main bacteria causing UTIs in women are *Escherichia coli* and *Staphylococcus saprophyticus*, with other uropathogens also potentially causing UTIs which includes *Klebsiella*, *Enterobacter*, *Serratia*, *Proteus*, *Pseudomonas*, and *Enterococcus* [15,7,21,22]. UTIs are common during pregnancy, with a significant number of pregnant women experiencing bacteriuria. Similar manifestations of bacteriuria can occur in non-pregnant women with UTIs [23,24,25,26]. The infection starts with bacteria invading the

urinary tract and multiplying, causing an infection.

Urinary tract infections (UTIs) are categorized according to the specific site of infection, which include urethritis, cystitis and pyelonephritis. Urethritis refers to the inflammation of the urethra, Cystitis refers to inflammation of the urinary bladder, while pyelonephritis denotes an infection in the renal pelvis and parenchyma. UTIs are further classified as either symptomatic or asymptomatic, depending on the presence or absence of symptoms [27,28]. The majority of UTIs are symptomatic, presenting with suprapubic pain, fever, burning during urination, cloudy urine, foul odour, increased frequency of urination, persistent urge to urinate, and discoloured urine. Classifying infection as complicated, uncomplicated and recurrent infection is a widely used method. Uncomplicated infection is caused by common uropathogens and treated with short-term antibiotics [29,28]. Complicated UTIs can lead to functional abnormalities and require hospitalization and thorough investigation. Recurrent infection puts additional responsibility on healthcare professionals, as it can result from bacteria persisting in the urinary tract or external reinfection. It often occurs as asymptomatic UTI following the resolution of a previous UTI.

Associations have been observed between urinary tract infections (UTIs) and various factors such as age, pregnancy, gender, diaphragm and spermicide use, delayed urination after sex, menopause, and previous UTI occurrence. Toll-like receptors trigger immune responses that release cytokines like interleukins (e.g., IL-6, 8) and tumor necrosis factors, promoting infection expansion. Physical factors and anatomical changes significantly influence UTI progression in females due to the close proximity of the urethra and anus, as well as the short length of the urethra, facilitating bacteria ascent. Vaginal microbiota variations, genetic factors, pregnancy, diabetes, and impaired voiding function may also correlate with UTI occurrence. Understanding the complex interplay of these factors is crucial for implementing effective preventive measures.

Taking a thorough history is the first step in diagnosing Urinary Tract Infection. A physical examination is also conducted to identify symptoms. The gold standard method for diagnosis is a urine culture examination. Other tests can detect bacteria in the urine. Imaging

studies are used to identify anatomical abnormalities. The assessment also considers the influence on indigenous communities, frequency of consequences, extent of damage, complicating circumstances, and degree of risk. The medical management of UTIs aims to strike a delicate balance between treating the infection appropriately with the right antibacterial agent to prevent adverse outcomes and excessive antimicrobial management resulting in antimicrobial resistance. Empirical treatment of UTIs employs ceftriaxone and Gentamicin as a first line agents and drugs such as Nitrofurantoin, Trimethoprim/sulfamethoxazole, cephalexin, fosfomycin as second line agents.

This research article delves into the intricate realm of urinary tract infections in females, with the objective of clarifying the underlying predisposing factors, causative microorganisms, and contemporary therapeutic strategies that could be employed in the clinical setting for an effective management of these infection

2. METHODS

This is a prospective observational study. The estimated sample size for the present study was 480, who were attending female medical ward, Obstetrical & Gynaecology department at Tertiary healthcare Teaching Hospital. The patients were selected according to the criteria which were included for this study. The inclusion criteria for the study are, the women should be within the age group of 18 – 70, Pregnant women population, Patients with other medical conditions, Patients with recurrent and under treatment. The exclusion criteria for the study are, the patients should not be below the age of 18, the women population who are having renal failure.

2.1 Sample Size Calculation

$$\begin{aligned}
 n &= \frac{N * [z^2 * P * (1 - P) / e^2]}{[N - 1 + (z^2 * p * (1 - p))e^2]} \\
 &= \frac{648 * (1.96)^2 * 0.5 * (1 - 0.5) / (0.05)^2}{(70 - 1) + (1.96)^2 * 0.5 * (1 - 0.5) / 0.05^2} \\
 &= \frac{648 * 384.16}{518.1} \\
 n &= 480
 \end{aligned}$$

2.2 Data Collection

The subjects selected according to inclusion/exclusion criteria must sign an informed consent form to participate in the study. The form is provided in the patient's native language for clarity. It contains study details and the purpose of collecting patient information. Data is collected using a specially designed proforma. This includes patient demographics, symptoms, affected organism, differential diagnosis, urine culture report, prescribed antibiotics, and other medications for medical conditions.

2.3 Data Analysis

The data was analyzed using Microsoft Excel. The selected population was analyzed based on their area of living and marital status to determine the recurrence of urinary tract infection. The study's average results were calculated by using mean, median, and mode.

3. RESULTS

This study was conducted with the sample size of about 480 females who were selected for the study according to the selection criteria and who presented with the symptoms of urinary tract infection.

First the analysis (Table 1) was carried out to determine the age group of people who are more affected with the urinary tract infection. From the analysis made patient of age between 15-24 were about 220 (46%), and the patient of age 25-34 were about 124 (26%), and the patient of age between 35-44 were about 134 (28%).

Table 1. Age-wise distribution

Age group	No. of Cases	Percentage	Mean age
15-24	221	46%	30
25-34	125	26%	
35-44	134	28%	
Total	480	100	

Out of the 480 patients those who are with the symptomatic infection are 370 (77%) and 110 (23%) patients with asymptomatic infection (Table 2).

Out of the 480 patients (Table 3) urine culture has been made based on the culture positive and negative results 90 patients were tested culture

positive from the symptomatic patients and 27 were tested culture negative for the asymptomatic patients.

Table 2. Presence and absence of uti among the study population

Category	No. of cases	Percentage
UTI Present	117	24.4%
UTI Absent	363	75.6%

Table 3. Symptomatic and asymptomatic distribution among the study population

Category	No. of cases	Percentage
Symptomatic	90	77%
Asymptomatic	27	23%

Table 4. Association between presence of uti symptoms and urine culture

Category	Culture positive	Culture negative	P value
Symptomatic	90	127	0.00
Asymptomatic	27	236	0.00

While analyzing the correlation between culture positivity and patient symptoms (Table 4), we discovered that out of the 480 patients, 90 individuals exhibiting symptoms tested positive for urine culture, while 27 asymptomatic patients yielded positive culture results.

The patients were categorized (Table 5) based on the symptoms of urinary tract infection such as painful micturition was highly prevalent in 302 (63%) of the patients, following it, haematuria in 115 (24%) patients, flank pain in 158 (33%) of patients, fever was among 158 (33%) of patients and 340 (71%) patients were presented with increased frequency of micturition.

The majority of UTI cases were caused by E. coli (64%), followed by Staphylococcus (12%), Proteus mirabilis (22%), and Klebsiella Species (2%).

Upon analyzing the prescription pattern among the study participants, it was observed that (Table 8) cephalosporin antibiotics were the most frequently prescribed medication (65%), followed by fluoroquinolones (22%), other drugs (11%), and Penicillin (2%).

Table 5. Prevalence of symptoms among the study population

Symptoms	No. of Women Experiencing Symptoms	Percentage
Painful Micturition	302	63%
Haematuria	115	24%
Flank pain	158	33%
Fever	192	40%
Frequency of micturition	340	71%

Table 6. Socio-demographic characteristics of the study population

Socio-demographic characters	Frequency (n=480)	Uti present (n=117)	Uti present (%)	p-value
Age				
15-24	221	54	46%	0.48
25-34	125	30	26%	
35-44	134	33	28%	
Education				
Graduate	29	7	6%	0.01
High School	230	56	48%	
Middle school	77	19	16%	
Primary School	58	14	12%	
Illiterate	86	21	18%	
Marital Status				
Married	355	87	74%	0.01
Unmarried	125	30	26%	
Socio-Economic Status				
Class I	43	11	9%	0.39
Class II	67	16	14%	
Class III	173	42	36%	
Class IV	182	44	38%	
Class V	14	4	3%	

Table 7. Distribution of microorganism among the study population

Organism	No. Of cases	Percentage
E.coli	307	64%
Staphylococcus	58	12%
Proteaus mirabilis	106	22%
Klebsiella Species	9	2%

Table 8. Antibiotic usage pattern

Drugs	Percentage of usage
Cephalosporin	65%
Fluoroquinolones	22%
Penicillin	2%
Others	11%

4. DISCUSSION

A total of 480 individuals were studied for urinary tract infection (UTI) symptoms, and 117 were diagnosed with UTI. Initial assessment showed UTI was prevalent in 24.4% of females,

particularly those aged 15-24. Among the 480 patients with UTI symptoms, most were aged 18-24 (221 patients), followed by 25-34 (125 patients) and 35-44 (134 patients). The average age of UTI patients was 30. A study by Ranjani et al. [24] found a similar mean age of 30, but a

study by Salwa H Almkhatar contradicted our findings, showing higher UTI prevalence among those aged 21-30. Vigila et al. [11] reported greater UTI frequency among those aged 21-30. Out of 480 individuals, 117 had UTI, while 363 only displayed UTI symptoms. Of the diagnosed patients, 77% had symptoms and positive urine cultures. Fasalua et al. [30] found only 65 positive urine cultures out of 385, with 342 patients asymptomatic and 43 displaying symptoms. Our study showed significant disparity in symptomatic and asymptomatic cases. Manikandan et al. [31] conducted a study with 2450 samples and found that 1420 patients had UTI. 27.1% of these patients had positive cultures indicating bacterial growth. The study also looked at sociodemographic characteristics of patients, including age, marital status, educational status, and socioeconomic status. The prevalence of UTIs was highest among patients aged 15-24. UTIs were more prevalent among high school attendees, followed by illiterate patients, middle school attendees, primary school students, and graduate patients. Married patients had a higher prevalence of infection compared to unmarried patients. Socioeconomic status also played a role, with higher prevalence rates in certain classes. In another study conducted by Salwa H Almkhatar, the prevalence of UTIs among married and unmarried women was examined and it was found that the prevalence was higher among married women, with illiterate patients having a higher prevalence rate. During the study period, symptoms possibly associated with UTIs were observed in some patients, including painful urination and haematuria. 158 participants experienced flank pain, which accounted for 33% of the sample. Fever was detected in 193 patients, constituting 40% of the group. The frequency of urination was heightened in 340 individuals, representing 71% of the subjects. The study revealed the presence of a microorganism causing urinary tract infections (UTIs). Among the 307 patients, a high prevalence of infection was observed, with *E. Coli* being the cause in 64% of cases. *Proteus mirabilis* and *Staphylococcus* affected 22% and 12% of patients, respectively. *Klebsiella* species caused infection in only 2% of patients. Existing literature supports *E. Coli* as the most common cause of UTIs. Cephalosporin antibiotics were the predominant medication for treating UTIs, followed by fluoroquinolones and penicillin. This aligns with the research conducted by Anu et al. [32], where cephalosporin was commonly used [33,34].

5. CONCLUSION

Urinary Tract Infection continues to be a prevalent concern in medical management. The results derived from this study can provide valuable insights to researchers in order to fortify the management of UTI. The results above demonstrate the importance of enhancing the medical administration of Urinary Tract Infection by implementing empirical antibiotic utilization, while also minimizing reinfection and adopting a prudent approach to antibiotics. Pharmacists are frequently approached by patients seeking guidance on the signs, causes, and prevention of UTI. It is advisable to inform them to promptly consult their healthcare provider for appropriate care. Pharmacists can educate patients on non-prescription options such as UTI home test strips and non-pharmacologic treatments. Pharmacists must ensure that patients taking antibiotics for UTIs are adhering to the prescribed instructions and are knowledgeable about potential side effects, as well as the recommended duration and dosage of over-the-counter urinary tract analgesics. This serves as a pivotal strategy in combating antibiotic resistance throughout the infection treatment process.

CONSENT

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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