



Diagnostic and Therapeutic Approaches in the Management of Genital and Urinary Tract Infections

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ABSTRACT:

Background: Genitourinary tract infections (GUTIs) are a significant cause of morbidity in women and have adverse consequences for reproductive and maternal health. Data on the diagnostic and therapeutic management of urogenital infections in Bangladesh are limited. This study aimed to evaluate the diagnostic methods, etiological agents, and antimicrobial sensitivity patterns in women with GUTIs attending a tertiary hospital in Bangladesh.

Methods: This cross-sectional study was conducted at the Department of Obstetrics & Gynecology, Bangladesh Medical University (BMU), Dhaka, Bangladesh, from January to December 2024. A total of 350 women with GUTI symptoms were enrolled. Sociodemographic and clinical data were also collected. Laboratory investigations included urine culture, microscopy, Gram staining, dipstick tests, and PCR, where available. Antimicrobial susceptibility was assessed using the Kirby-Bauer disk diffusion method, following CLSI guidelines. Data were analyzed using SPSS version 25.0.

Results: Most participants were aged 25–34 years (40.0%), pregnant (60.0%), and urban residents (51.4%). Urine culture was the most frequently used diagnostic method (77.1%), followed by gram staining (60.0%). *Escherichia coli* was the most common pathogen (40.0%), followed by *Klebsiella pneumoniae* (16.6%) and *Candida albicans* (12.9%). Antimicrobial resistance was high, with ciprofloxacin sensitivity ranging from 35% to 52%, while nitrofurantoin (74–81%) and imipenem (>87%) showed better activity.



Conclusion: GUTIs among Bangladeshi women are predominantly caused by *E. coli* and *K. pneumoniae*, with concerning levels of antibiotic resistance in the latter. Strengthening diagnostic capacity and antibiotic stewardship is urgently needed.

Introduction

Genitourinary tract infections (GUTIs), encompassing both urinary tract infections (UTIs) and genital tract infections (GTIs), are among the most common infectious diseases affecting women globally. They contribute substantially to morbidity, impaired reproductive health, and adverse pregnancy outcomes [1,2]. Women are disproportionately affected due to anatomical and hormonal factors, with prevalence particularly high in low- and middle-income countries like Bangladesh [3].

Urinary tract infections represent one of the most frequent bacterial infections in women, accounting for millions of outpatient visits annually [4]. They are especially concerning in pregnant women, as untreated infections can lead to preterm birth, low birth weight and maternal complications [5]. Genital tract infections, including bacterial vaginosis, vulvovaginal candidiasis and trichomoniasis, also remain significant public health challenges due to their association with infertility, pelvic inflammatory disease and increased risk of HIV transmission [6,7].

Bangladesh faces a dual burden of high prevalence of infectious diseases and limited diagnostic capacity. Studies from rural and urban hospitals reveal that women frequently present with symptoms of abnormal vaginal discharge, dysuria, and pelvic discomfort, yet diagnostic confirmation is often hindered by a lack of laboratory resources [8]. Syndromic management remains common but is associated with both under- and over-treatment [9]. A study in Matlab, Bangladesh, demonstrated that syndromic approaches had low specificity, underscoring the need for more accurate diagnostic methods [10].

Pathogen distribution varies across settings, but *Escherichia coli* remains the predominant cause of UTIs, while *Candida albicans* and anaerobic bacteria are leading causes of genital infections [11]. Alarming, antimicrobial resistance (AMR) is increasingly reported in Bangladesh, with high resistance rates to commonly prescribed antibiotics such as fluoroquinolones and third-generation cephalosporins [12]. This threatens

treatment effectiveness and highlights the importance of local surveillance data.

Despite the high burden, limited research in Bangladesh. Previous studies have either assessed reproductive tract infections in community-based settings or evaluated AMR patterns in tertiary hospitals without focusing on female patients [10,12]. There remains a gap in systematically examining diagnostic practices, etiological agents, and therapeutic patterns in women attending gynecology and obstetrics services, where the impact on maternal health is most pronounced.

This study was therefore undertaken to investigate diagnostic and therapeutic approaches in the management of genitourinary tract infections among women attending the Department of Gynecology and Obstetrics, BSMMU, Dhaka. By analyzing diagnostic utilization, pathogen distribution, and antimicrobial susceptibility patterns, this study aims to provide evidence to guide rational management and inform clinical practice guidelines in Bangladesh.

Methodology & Materials

This cross-sectional study was conducted at the Department of Obstetrics & Gynecology, Bangladesh Medical University (BMU), Dhaka, Bangladesh. The study was carried out over one year, from January to December 2024. A total of 350 women presenting with symptoms of genitourinary tract infections (GUTIs) were enrolled.

Inclusion criteria:

1. Women aged ≥ 18 years.
2. Patients presenting with symptoms suggestive of urinary tract infection or genital tract infection.
3. Both pregnant and non-pregnant women are attending the department.
4. Willingness to provide informed consent.

Exclusion criteria:

1. Women have been on antibiotic therapy for the last two weeks.



2. Patients with known congenital urogenital anomalies.
3. Critically ill patients are unable to provide samples.

Data Collection and Study Procedure

Data were collected using a structured case record form. Sociodemographic information, obstetric status, and comorbidities were documented. Laboratory investigations included urine culture and microscopy, dipstick testing for nitrite and leukocyte esterase, vaginal swab with Gram stain, and PCR, where available. Syndromic diagnosis was recorded based on clinical findings following national and WHO guidelines. All

samples were processed in the BMU microbiology laboratory using standardized protocols. Positive isolates were identified by conventional microbiological techniques, and antimicrobial susceptibility testing was performed using the Kirby-Bauer disk diffusion method. Quality control was ensured by following CLSI guidelines. Data were entered and analyzed using SPSS version 25.0. Descriptive statistics, including frequencies and percentages, were used to summarize categorical data. Means and standard deviations were calculated for continuous variables. Informed consent was obtained from all participants, and confidentiality was strictly maintained.

Results

Table 1. Baseline Characteristics of Study Participants (N = 350)

Variable	Frequency (n)	Percentage (%)	
Age Groups	18–24 years	85	24.3
	25–34 years	140	40
	35–44 years	80	22.9
	≥45 years	45	12.8
Residence	Urban	180	51.4
	Rural	170	48.6
Obstetric Status	Pregnant	210	60
	Non-pregnant	140	40
	Diabetes mellitus	45	12.9
Comorbidities	Hypertension	60	17.1
	No major comorbidity	245	70

Table 1 presents the baseline characteristics of participants. The majority of women were aged 25–34 years (40.0%), followed by 18–24 years (24.3%). Urban residents accounted for 51.4% of participants, while

48.6% were from rural areas. Pregnant women represented 60.0% of the cohort. Hypertension (17.1%) and diabetes mellitus (12.9%) were the most common comorbidities.

Table 2. Diagnostic Approaches Used for Genitourinary Infections (N = 350)

Diagnostic Method	Utilization (n, %)	Positive Cases (n)	Detected	Positivity Rate (%)
Urine culture & microscopy	270 (77.1)	125		46.2
Vaginal swab + Gram stain	210 (60.0)	85		40.5
Dipstick test (nitrite/leukocyte esterase)	182 (52.0)	70		38.5
PCR-based pathogen detection	42 (12.0)	30		71.4
Syndromic approach (clinical only)	98 (28.0)	40		40.8



Table 2 shows the diagnostic approaches used for detecting genitourinary infections. Urine culture and microscopy were the most frequently utilized (270 cases, 77.1%), yielding 125 positive cases (46.2%). Vaginal swab with Gram stain was performed in 210 women (60.0%) with 85 positives (40.5%). Dipstick tests were

used in 182 cases (52.0%) and detected 70 positives (38.5%). PCR testing was limited (42 cases, 12.0%) but showed a high positivity rate (71.4%). Syndromic diagnosis was applied in 98 women (28.0%) with 40 positives (40.8%).

Table 3. Etiological Agents Identified in Female Genitourinary Infections

Pathogen	Isolated Cases (n)	Percentage (%)
<i>Escherichia coli</i>	140	40
<i>Klebsiella pneumoniae</i>	58	16.6
<i>Enterococcus faecalis</i>	32	9.1
<i>Staphylococcus saprophyticus</i>	25	7.1
<i>Candida albicans</i>	45	12.9
Mixed infections (bacterial + fungal)	20	5.7
Others (<i>Proteus</i> , <i>Pseudomonas</i>)	30	8.6

Table 3 describes the distribution of etiological agents. *Escherichia coli* was the most frequently isolated pathogen (40.0%), followed by *Klebsiella pneumoniae* (16.6%) and *Candida albicans* (12.9%). Other isolates included *Enterococcus faecalis* (9.1%) and

Staphylococcus saprophyticus (7.1%). Mixed infections were observed in 5.7% of cases, while 8.6% were attributed to less common organisms such as *Proteus* and *Pseudomonas*.

Table 4. Antimicrobial Sensitivity Patterns of Major Uropathogens

Pathogen / Antibiotic	Ciprofloxacin (%)	Nitrofurantoin (%)	Ceftriaxone (%)	Imipenem (%)
<i>Escherichia coli</i>	50	81	66	93
<i>Klebsiella pneumoniae</i>	44	58	60	91
<i>Enterococcus faecalis</i>	38	74	42	87
<i>Staphylococcus saprophyticus</i>	52	77	59	90

Table 4 outlines the antimicrobial sensitivity patterns. High resistance to ciprofloxacin was observed, with sensitivities of only 50.0% for *E. coli* and 44.0% for *K. pneumoniae*. Nitrofurantoin showed better activity across most pathogens (74–81%), while ceftriaxone displayed moderate sensitivity (42–66%). Imipenem

demonstrated the highest sensitivity, exceeding 87% across all isolates.

Discussion

This study provides insight into the diagnostic and therapeutic management practices of genitourinary tract infections (GUTIs) among women attending at



Department of Obstetrics & Gynecology, Bangladesh Medical University (BMU), Dhaka, Bangladesh. By focusing on baseline characteristics, diagnostic practices, pathogen distribution, and antimicrobial sensitivity patterns, the findings contribute to the limited body of evidence on the management of urogenital infection.

The majority of affected women were in the reproductive age group of 25–34 years, consistent with prior studies reporting a peak incidence of urinary tract infections (UTIs) and reproductive tract infections in young to middle-aged women [2,4]. Pregnancy accounted for 60% of the study population, underscoring the clinical relevance of GUTIs in obstetric practice. Similar trends were observed by Lee et al. in Sylhet, where maternal urinary and genital infections were common and strongly associated with adverse pregnancy outcomes, including preterm birth [10]. The nearly equal distribution of rural and urban participants highlights the widespread burden across socioeconomic strata, a finding supported by Hawkes et al., who demonstrated high prevalence in both low- and middle-income communities of Bangladesh [9].

Urine culture and microscopy remained the most frequently employed methods, aligning with global recommendations for UTI diagnosis [13]. However, culture utilization rates were lower than ideal, reflecting resource limitations. Gram stain and dipstick testing, though less sensitive, were frequently used, echoing findings from studies in rural Bangladesh where limited infrastructure constrained diagnostic choices [3]. Syndromic management was still practiced in over one-quarter of cases, a pattern also reported in community-based studies [10,14]. While syndromic diagnosis offers a pragmatic approach in resource-limited settings, its diagnostic accuracy is suboptimal, often leading to overtreatment or missed infections. PCR testing, though more accurate, was underutilized (12%), reflecting challenges in affordability and access, consistent with Moussa et al. who reported similar underuse of molecular diagnostics in gynecological clinics in the Middle East [15].

Etiological findings indicated that *Escherichia coli* (40%) was the predominant pathogen, followed by *Klebsiella pneumoniae* (16.6%) and *Candida albicans* (12.9%). This pathogen profile is consistent with prior Bangladeshi studies conducted by Akter et al. and Majumder et al. [11,12]. The significant proportion of

Candida infections reflects the dual burden of urinary and genital tract infections. Comparable fungal prevalence was also reported by Chowdhury in Bangladeshi women presenting with genital complaints [16]. The detection of mixed infections (5.7%) underscores the complexity of diagnosis and treatment, as multiple pathogens can complicate clinical presentation and therapy selection.

Antimicrobial resistance patterns present a concerning scenario. High resistance to ciprofloxacin was observed, paralleling the findings of Majumder et al., who documented escalating fluoroquinolone resistance in Bangladeshi tertiary hospitals [12]. Resistance to ceftriaxone was also moderate to high, indicating reduced efficacy of third-generation cephalosporins, a trend mirrored by Mahmood et al. [17]. Conversely, nitrofurantoin retained good activity (74–81%), consistent with its global role as a first-line agent for uncomplicated UTIs [13]. Imipenem demonstrated the highest sensitivity (>87%), reaffirming its role as a reserve antibiotic, though its restricted use is critical to avoid further resistance development [18].

The predominance of infections among pregnant women in this study warrants particular attention. Untreated UTIs in pregnancy are associated with preeclampsia, pyelonephritis, and adverse neonatal outcomes [5]. Lee et al. reported that early screening and treatment of maternal GUTIs in Bangladesh significantly reduced preterm birth risk, emphasizing the importance of integrating infection management into antenatal care [10]. Our findings of high positivity rates from culture-based diagnostics suggest that systematic screening could be beneficial in similar populations.

Strengthening diagnostic capacity is crucial. While syndromic approaches remain widespread, they are insufficient in gynecology and obstetrics practice where maternal and neonatal outcomes are at stake. Expansion of low-cost, point-of-care molecular diagnostics could bridge the gap.

From a public health perspective, the study highlights the urgent need for antibiotic stewardship programs in Bangladesh. Inappropriate empirical prescribing has been documented widely and contributes to the alarming resistance trends observed [8,19]. Policies should prioritize rational prescribing, periodic antibiogram updates, and patient education.



In summary, this study aligns with existing literature in demonstrating the dominance of *E. coli* as the primary uropathogen, high resistance rates to fluoroquinolones and cephalosporins, and the continued role of nitrofurantoin and carbapenems. It also emphasizes the diagnostic gap, with heavy reliance on culture but limited molecular testing. Addressing these challenges through improved laboratory capacity, stewardship interventions, and integrated antenatal infection screening could substantially improve outcomes for Bangladeshi women.

Limitations of the study

This study was limited by its single-center design and relatively small sample size, which may reduce generalizability. Advanced molecular diagnostics were not widely available, limiting the detection of fastidious pathogens. Antibiotic sensitivity testing was restricted to commonly available drugs, and follow-up outcomes were not assessed.

Conclusion

This study demonstrates that genitourinary tract infections remain a major health concern. *Escherichia coli* was the predominant pathogen, and antimicrobial resistance against commonly used antibiotics was alarmingly high. Diagnostic practices were variable, with reliance on culture-based methods and limited access to advanced diagnostics. These findings underscore the urgent need for strengthened diagnostic capacity, rational antibiotic stewardship, and continuous surveillance to improve maternal health outcomes in Bangladesh.

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