



Original Research Article

## Diagnostic Discordance Between Urinalysis and Urine Culture in Symptomatic Patients: A Prospective Observational Study

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### ABSTRACT

**Background:** Urinary tract infection (UTI) is one of the most common bacterial infections encountered in outpatient practice. Urinalysis is frequently used as an initial screening tool because of its rapid availability and low cost; however, false-negative results may delay diagnosis and treatment. This study evaluated the correlation between urinalysis and urine culture in symptomatic patients and assessed the proportion of culture-positive cases with negative urinalysis.

**Methods:** This prospective observational study included 250 patients presenting to the outpatient department with symptoms suggestive of UTI. Midstream clean-catch urine samples were collected under aseptic precautions. Each sample underwent urinalysis, including dipstick testing for leukocyte esterase and nitrites and microscopic examination for pyuria, followed by urine culture using standard microbiological techniques. Significant bacteriuria was defined as growth of  $\geq 10^5$  colony-forming units/mL of a single organism. Diagnostic parameters of urinalysis were calculated using urine culture as the gold standard.

**Results:** A total of 250 symptomatic patients were included, with a mean age of  $38.6 \pm 14.2$  years and female predominance (65.6%). Positive urinalysis was seen in 155 (62.0%) patients, while 95 (38.0%) had negative urinalysis. Overall, urine culture was positive in 104 (41.6%) patients. Among those with positive urinalysis, 87/155 (56.1%) had positive cultures, whereas 17/95 (17.9%) patients with negative urinalysis were culture-positive. The commonest organisms in this discordant group were *Escherichia coli*, *Enterococcus faecalis*, and *Klebsiella pneumoniae*. Symptomatic improvement following culture-guided therapy was observed in 15/17 (88.2%) patients. Urinalysis demonstrated sensitivity of 83.7%, specificity of 53.4%, positive predictive value of 56.1%, and negative predictive value of 82.1% ( $p < 0.001$ ).

**Conclusion:** A considerable proportion of symptomatic patients with negative urinalysis were culture-positive. Urinalysis alone may miss clinically significant infections; therefore, urine culture should be strongly considered in symptomatic patients despite negative screening results.

**Keywords:** Urinary Tract Infection (UTI), Urinalysis, Urine Culture, Diagnostic Discordance.

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### INTRODUCTION

Urinary tract infections (UTIs) are among the most common bacterial infections encountered in clinical practice, contributing substantially to outpatient visits, healthcare costs, and antibiotic utilization worldwide [1]. Prompt and accurate diagnosis is essential to alleviate symptoms, prevent complications such as pyelonephritis and sepsis, and reduce inappropriate antimicrobial use. In routine practice, urinalysis—comprising dipstick testing and microscopic examination—serves as the initial screening modality due to its rapidity, low cost, and widespread availability [2]. Commonly assessed parameters include leukocyte esterase, nitrites, and the presence of pyuria, which are considered surrogate markers of infection.

Despite its utility, urinalysis has well-recognized limitations in diagnostic accuracy. Its sensitivity may be reduced in early stages of infection, in cases with low bacterial colony counts, or when the causative organisms do not reduce nitrates to nitrites, such as *Enterococcus* species [3]. Additionally, factors such as frequent voiding, dilute urine, or prior partial antibiotic exposure may further contribute to false-negative results. Recent studies have further highlighted variability in the diagnostic performance of urinalysis, particularly in specific populations such as women and elderly patients, emphasizing the risk of missed infections when relying solely on screening tests [4,5]. Also, the emerging practice of home-based sample collection services has introduced additional challenges in the accurate diagnosis of urinary tract infections (UTIs). It is also important that accurate antibiotics should be prescribed according to urine culture and sensitivity reports due to increasing problem of resistant super bugs.

Urine culture remains the gold standard for the diagnosis of UTI, enabling definitive identification of pathogens and determination of antimicrobial susceptibility[6]. Contemporary evidence continues to support its role, especially in symptomatic patients with inconclusive or negative urinalysis findings, to ensure appropriate diagnosis and targeted therapy[7]. However, in clinical settings, urine cultures are often deferred when urinalysis results are negative, potentially leading to underdiagnosis and persistence of symptoms.

Emerging clinical observations suggest that a subset of symptomatic patients with negative urinalysis may still demonstrate significant infection on culture and subsequently experience symptomatic improvement following culture-directed antibiotic therapy. This diagnostic discordance has important clinical implications in guiding evaluation and management strategies. The present prospective study aims to evaluate the prevalence of culture-positive urinary tract infections among symptomatic patients with negative urinalysis and to assess their clinical response to targeted antimicrobial treatment.

## **AIMS AND OBJECTIVES**

### **Aims:**

To evaluate the diagnostic discordance between urinalysis and urine culture in all patients and to determine the clinical significance of culture-positive urinary tract infections in cases with negative urinalysis.

### **Objectives:**

#### **Primary Objective:**

- To determine the proportion of symptomatic patients with negative urinalysis who demonstrate positive urine culture.

#### **Secondary Objectives:**

- To identify the spectrum of microorganisms isolated in patients with negative urinalysis but positive urine culture.
- To assess the clinical response (symptom resolution) following culture-guided antimicrobial therapy in these patients.
- To evaluate the diagnostic reliability of urinalysis in detecting urinary tract infections in symptomatic individuals.
- To analyze potential factors contributing to false-negative urinalysis (e.g., organism type, colony count, patient-related factors).

## **MATERIALS AND METHODS**

### **Study Design and Setting:**

This prospective observational study was conducted in the Department of Urology over a period of 18 months (October 2024 to March 2026). Informed consent was obtained from all participants prior to inclusion. Adult patients ( $\geq 18$  years) presenting to the urology OPD with urinary symptoms, including dysuria, increased frequency of micturition, urgency, lower abdominal discomfort, suprapubic pain, burning micturition, hematuria, nocturia, and other lower urinary tract complaints, were included in the study.

### **Inclusion Criteria:**

- 1) Patients presenting to the outpatient department with dysuria.
- 2) Patients presenting with increased frequency of micturition and/or urgency.
- 3) Patients presenting with lower abdominal discomfort or burning micturition.
- 4) Patients presenting with hematuria and/or nocturia.
- 5) Patients presenting with other lower urinary tract symptoms/complaints suggestive of urinary pathology.
- 6) patients willing to provide informed consent.

### **Exclusion Criteria**

- 1) Antibiotic use within the preceding 72 hours
- 2) Patients with indwelling urinary catheters
- 3) Pregnant women

- 4) Patients with known structural urinary tract abnormalities
- 5) Contaminated urine samples (as per standard microbiological criteria)

#### Sample Size Calculation:

The sample size was calculated based on an expected prevalence of 20% of culture positivity among patients with negative urinalysis, derived from prior literature. Using the formula for estimation of proportion:

$$n = \frac{Z^2 \times p \times (1-p)}{d^2}$$

Z = 1.96 (for 95% confidence interval),

p = 0.20,

d = 0.05 (absolute precision),

the calculated minimum sample size was 246. Considering a 10% attrition rate, a total of 250 patients were enrolled.

#### Data Collection Procedure

A detailed clinical history and physical examination were performed for all eligible patients. Midstream clean-catch urine samples were collected under aseptic precautions.

#### Each sample was subjected to:

1. Urinalysis: Including dipstick (leukocyte esterase, nitrites) and microscopic examination (pyuria defined as >5 pus cells/high power field).
2. Urine Culture: Performed using standard microbiological techniques. Significant bacteriuria was defined as growth of  $\geq 10^5$  colony-forming units (CFU)/mL of a single organism.

Patients with negative urinalysis but positive urine culture were identified and treated with culture-guided antibiotics.

#### Outcome Measures:

- Primary outcomes: Proportion of patients with negative urinalysis but positive urine culture
- Secondary outcomes:
  - Type of organisms isolated
  - Clinical response to treatment (defined as resolution of symptoms within 5–7 days of appropriate antibiotic therapy)

#### Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics were used to summarize demographic and clinical characteristics. Categorical variables were expressed as frequencies and percentages, while continuous variables were expressed as mean  $\pm$  standard deviation.

The diagnostic performance of urinalysis was assessed by calculating sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), using urine culture as the gold standard. The association between categorical variables was analyzed using the Chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

### RESULTS:

#### A) Baseline characteristics

A total of 250 patients presenting with symptoms suggestive of urinary tract infection were included in the study. The mean age of the study population was  $38.6 \pm 14.2$  years, with a female predominance (164/250, 65.6%).

**Table 1. Baseline Characteristics of Study Population (N = 250)**

Variable	Value
Total patients included	250
Mean age (years)	$38.6 \pm 14.2$
Female sex, n (%)	164 (65.6%)
Male sex, n (%)	86 (34.4%)

#### B) Urinalysis and Urine Culture Findings

Out of 250 patients, 155 (62.0%) had a positive urinalysis, while 95 (38.0%) had a negative urinalysis.

**Table 2. Urinalysis and Urine Culture Findings**

Parameter	Number (%)
Positive urinalysis	155 (62.0%)
Negative urinalysis	95 (38.0%)
Positive urine culture overall	104 (41.6%)

Negative urine culture overall	146 (58.4%)
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Urine culture was positive in 104 patients overall. Among these:

- 1) 87/155 (56.1%) patients with positive urinalysis had positive urine cultures
- 2) 17/95 (17.9%) patients with negative urinalysis had positive urine cultures

Thus, a significant proportion of symptomatic patients with negative urinalysis were found to have culture-positive urinary tract infections.

### C) Microbiological Profile

Among the 17 patients with negative urinalysis but positive culture(n):

- 1) Escherichia coli: 9
- 2) Enterococcus faecalis:4
- 3) Klebsiella pneumoniae:3
- 4) Others:1

**Table 3. Correlation Between Urinalysis and Urine Culture**

Urinalysis Result	Culture Positive n (%)	Culture Negative n (%)	Total
Positive urinalysis	87 (56.1%)	68 (43.9%)	155
Negative urinalysis	17(17.9 %)	78(82.1 %)	95
Total	104	146	250

**Table 4. Microbiological Profile in Patients with Negative Urinalysis but Positive Culture (n = 17)**

Organism isolated	Number (%)
Escherichia coli	9 (52.9%)
Enterococcus faecalis	4 (23.5%)
Klebsiella pneumoniae	3 (17.6%)
Others	1 (5.9%)

Notably, non-nitrite-producing organisms such as Enterococcus contributed to a proportion of false-negative urinalysis results.

### D) Clinical Outcomes

All 17 patients with discordant findings received culture-guided antibiotic therapy.

Symptomatic improvement was observed in 15/17 (88.2 %) patients within 5–7 days of treatment, while 2 patients required modification of antibiotics based on sensitivity reports.

**Table 5. Clinical Outcomes in Discordant Group (Negative Urinalysis, Positive Culture) (n = 17)**

Outcome	Number (%)
Symptomatic improvement within 5–7 days	15(88.2%)
Required antibiotic modification	2 (11.8%)

### E) Diagnostic Performance of Urinalysis

Using urine culture as the gold standard:

- Sensitivity of urinalysis: 83.7%
- Specificity: 53.4 %
- Positive Predictive Value (PPV): 56.1 %
- Negative Predictive Value (NPV): 82.1 %

**Table 6. Diagnostic Performance of Urinalysis (Using Urine Culture as Gold Standard)**

Parameter	Value (%)
Sensitivity	83.7
Specificity	53.4
Positive Predictive Value (PPV)	56.1
Negative Predictive Value (NPV)	82.1

### Statistical Analysis

The association between urinalysis results and urine culture positivity was statistically significant (Chi-square test,  $p < 0.001$ ). However, the moderate sensitivity and negative predictive value indicate that urinalysis alone may miss a substantial number of culture-positive cases.

Approximately 18 % (accurately 17.9 %) of patients with negative urinalysis were culture-positive, and the majority showed clinical resolution with targeted therapy, underscoring the limitation of relying solely on urinalysis.

## DISCUSSION

Urinalysis has long served as the initial diagnostic tool for suspected urinary tract infection (UTI) because of its rapid availability and low cost. However, its diagnostic accuracy remains variable across clinical settings. A recent meta-analysis demonstrated that the sensitivity and specificity of urine dipstick tests vary widely, limiting their reliability as a rule-out test for UTI, particularly in primary care populations<sup>[3]</sup>. Similarly, Simerville et al. emphasized that while the presence of leukocyte esterase and nitrites increases the likelihood of infection, their absence does not reliably exclude it, especially in symptomatic individuals<sup>[2]</sup>. These findings suggest that urinalysis alone may not be sufficient for definitive diagnosis and should be interpreted cautiously in clinical practice. In our study, urinalysis demonstrated only moderate sensitivity (83.7%) and low specificity (53.4%), reinforcing its limited reliability as a standalone diagnostic tool.

Urine culture remains the gold standard for the diagnosis of UTI due to its ability to provide definitive microbial identification and antimicrobial susceptibility. Hooton highlighted that culture is particularly important in cases where clinical suspicion remains high despite inconclusive preliminary tests<sup>[6]</sup>. More recent guidelines from the European Association of Urology (EAU) strongly recommend performing urine culture in symptomatic patients when initial screening tests are negative or equivocal, to avoid missed diagnoses and inappropriate treatment<sup>[7]</sup>. Despite these recommendations, urine culture is often underutilized in routine clinical practice, particularly when urinalysis findings are negative. In our study, 17.9% of patients with negative urinalysis were found to have positive urine cultures, supporting the essential role of culture in symptomatic patients.

Several pathophysiological and technical factors contribute to the observed discordance between urinalysis and urine culture. Devillé et al. noted that dipstick tests depend on surrogate markers such as leukocyte esterase and nitrites, which may not always be present in early or low-grade infections<sup>[3]</sup>. Additionally, organisms that do not reduce nitrates to nitrites, such as *Enterococcus faecalis*, can result in false-negative dipstick results. Vasudevan further highlighted that dilutional effects from increased fluid intake, frequent voiding, and prior partial antibiotic exposure may reduce detectable markers of inflammation in urine<sup>[5]</sup>. These factors collectively contribute to the reduced sensitivity of urinalysis. In our study, a significant proportion of discordant cases involved organisms such as *Enterococcus*, and many patients likely presented in early or low-burden stages of infection.

Clinical implications of this diagnostic discordance are substantial. Chu and Lowder emphasized that reliance on urinalysis alone may lead to underdiagnosis of UTIs, particularly in women and elderly populations where presentation may be atypical<sup>[4]</sup>. Missed or delayed diagnosis can prolong symptoms, increase patient morbidity, and in some cases, lead to complications such as ascending infection or sepsis. Furthermore, empirical treatment without microbiological confirmation may contribute to inappropriate antibiotic use and rising antimicrobial resistance. In our study, patients with negative urinalysis but positive culture who received targeted antibiotic therapy showed a high rate of symptomatic improvement (88.2%), underscoring the clinical significance of these otherwise missed infections.

The diagnostic performance parameters observed in this study further highlight the limitations of urinalysis. While moderate sensitivity suggests that a proportion of true infections are detected, the low specificity indicates a high rate of false positives, and the modest negative predictive value suggests that a negative result cannot reliably exclude infection. These findings are consistent with prior literature demonstrating that urinalysis performs better as a rule-in rather than a rule-out test<sup>[2]</sup>. Therefore, clinical judgment and patient symptoms should play a central role in decision-making, rather than reliance on urinalysis alone. In our study, the negative predictive value of urinalysis was only 82.1%, indicating that a notable proportion of infections may still be missed if culture is not performed.

From a clinical practice perspective, these findings advocate for a more liberal use of urine culture in symptomatic patients, regardless of urinalysis findings. While cost and resource constraints may limit routine use in some settings, the potential benefits of accurate diagnosis, targeted therapy, and prevention of complications outweigh these concerns. Incorporating urine culture into standard evaluation protocols for symptomatic patients may improve patient outcomes and support antimicrobial stewardship efforts. In our study, the substantial proportion of culture-positive cases among urinalysis-negative patients supports revisiting current diagnostic algorithms to include routine culture in symptomatic individuals.

This study has certain limitations that must be acknowledged. Being a single-center study with a relatively modest sample size, the findings may not be generalizable to all populations. Future multicentric studies with larger sample sizes and stratified analysis across different patient populations are needed to validate these findings and further elucidate predictors of diagnostic discordance. In our study, despite these limitations, the consistent pattern of discordance and clinical response strengthens the validity of the observations.

In conclusion, accumulating evidence from prior studies and current guidelines indicates that urinalysis alone is insufficient to exclude UTI in symptomatic patients. Urine culture remains indispensable for accurate diagnosis and appropriate management. In our study, a significant proportion of symptomatic patients with negative urinalysis were

culture-positive and responded to targeted therapy, highlighting the need to integrate urine culture more consistently into clinical practice.

## CONCLUSION

Urinalysis remains a useful and rapid initial screening tool for urinary tract infection; however, its diagnostic accuracy is limited when used alone. Symptomatic patients with negative or inconclusive urinalysis should undergo urine culture. Integrating clinical assessment with microbiological confirmation can improve diagnostic accuracy, guide targeted treatment, reduce unnecessary empirical antibiotic use, and ultimately improve patient outcomes.

## CONFLICTS OF INTEREST

None

## REFERENCES

1. Flores-Mireles AL, Walker JN, Caparon M, Hultgren SJ. Urinary tract infections: epidemiology, mechanisms of infection and treatment options. *Nat Rev Microbiol.* 2015;13(5):269–284.
2. Simerville JA, Maxted WC, Pahira JJ. Urinalysis: a comprehensive review. *Am Fam Physician.* 2005;71(6):1153–1162.
3. Deville WL, Yzermans JC, van Duijn NP, et al. The urine dipstick test useful to rule out infections: a meta-analysis. *BMC Urol.* 2004;4:4.
4. Chu CM, Lowder JL. Diagnosis and treatment of urinary tract infections across age groups. *Am J Obstet Gynecol.* 2018;219(1):40–51.
5. Vasudevan R. Urinary tract infection: an overview of the infection and the associated risk factors. *J Microbiol Exp.* 2020;8(2):50–54.
6. Hooton TM. Clinical practice. Uncomplicated urinary tract infection. *N Engl J Med.* 2012;366(11):1028–1037.
7. Bonkat G, Bartoletti R, Bruyere F, et al. EAU Guidelines on Urological Infections 2023. European Association of Urology.