Advances in Precision Medicine, 2026, Volume 11, Issue 8
https://bbwpublisher.com/journal/APM
Online ISSN: 2424-9106
Print ISSN: 2424-8592

Evaluation of the Application of Urine Bacterial Culture Combined with Routine Urine Testing for Urinary Tract Infection

Yaning Cao, Chuangye Wang*

Changzhou Traditional Chinese Medicine Hospital, Changzhou 213016, Jiangsu, China

Author to whom correspondence should be addressed.

Copyright: © 2026 Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), permitting distribution and reproduction in any medium, provided the original work is cited.

Abstract: *Objective:* To explore the practical application value of urine bacterial culture combined with routine urine testing in patients with urinary tract infection, compare the diagnostic performance of single detection method and combined detection, and provide a reference basis for clinical rapid identification, reasonable diagnosis and treatment of urinary tract infection. *Methods:* 82 patients with suspected urinary tract infection admitted to our hospital from January 2025 to January 2026 were selected as the subjects of this study. All subjects completed urine routine and urine bacterial culture examinations simultaneously. Urine bacterial culture results were used as the gold standard for clinical diagnosis, and the sensitivity, specificity, and diagnostic accuracy of single urine routine testing and the combined testing of the two methods were calculated, as well as the distribution of major pathogenic bacteria. *Results:* Among 82 suspected patients, 51 cases were confirmed to have urinary tract infection by urine bacterial culture. The sensitivity of the single urine routine test was 74.51%, the specificity was 70.97%, and the diagnostic accuracy was 73.17%. After the two methods were combined for testing, the sensitivity increased to 94.12%, the specificity was 90.32%, and the diagnostic accuracy was 92.68%. The diagnostic indicators of the combined testing were significantly better than those of urine routine testing alone, and the difference in data between groups was statistically significant ($P<0.05$). Among the pathogenic bacteria isolated, *Escherichia coli* accounted for the highest proportion. *Conclusion:* Routine urinalysis can complete the rapid initial screening of urinary tract infection, but when used alone, there are certain cases of missed diagnosis and misdiagnosis. Combining routine urinalysis and urine bacterial culture for testing can effectively improve the overall diagnostic level. It can not only achieve rapid screening, but also clarify the pathogenic bacteria and drug susceptibility, which has very practical significance in guiding the rational selection of antibacterial drugs in clinical practice.

Keywords: Urinary tract infection; Routine urine; Urine bacterial culture; Diagnostic value

Online publication: August 26, 2026

1. Introduction

Urinary tract infection is a very common clinical urinary system infection, and patients of this type are often encountered in outpatient and inpatient departments [1]. The particularity of women's physiological structure, coupled with the elderly group's reduced resistance, indwelling urinary catheters and other factors, can easily induce urinary tract infections. Most patients will experience frequent urination, urgency and pain in urination, and some severe cases will also be accompanied by fever and low back pain. In severe cases, they may develop into pyelonephritis or even systemic infection, which will cause greater harm to the patient's body [2].

In actual clinical work, it is difficult to completely distinguish urinary tract infections from other urinary system diseases by relying solely on the patient's symptoms. Laboratory testing has become a critical part of diagnosing the disease [3]. The routine urine test is simple to perform and the results are obtained quickly. All departments in the hospital can carry out this test, which is mostly used for preliminary screening of infections. However, in daily clinical work, we can find that some patients with obvious urinary discomfort have no obvious abnormality in urine routine results, and some samples may have false positives. It is easy to make a diagnosis based solely on urine routine, which can easily lead to biased judgment. Urine bacterial culture has always been regarded as the gold standard for diagnosing urinary tract infections. This examination can identify the specific pathogenic bacteria and can also complete a drug susceptibility test, making it easier for doctors to choose appropriate antibiotics. However, bacterial culture requires a relatively long testing period, which cannot meet the practical needs of rapid outpatient screening, and is not suitable as the first-choice screening method for large numbers of patients. How to balance the contradiction between rapid screening and accurate diagnosis is a practical problem that both laboratory departments and clinicians need to face. This study collected specimen data from 82 patients with suspected urinary tract infections in our hospital, and compared and analyzed the actual diagnostic effects of routine urine testing alone and the combined testing of the two methods. Combined with various specimen problems encountered in daily testing work, the advantages and shortcomings of the two testing methods were analyzed, hoping to provide some practical reference for clinical diagnosis and treatment.

2. Materials and methods

2.1. General information

This study selected 82 patients with clinical suspicion of urinary tract infection who visited our hospital from January 2025 to January 2026 as the research subjects. Among the patients, there were 30 males and 52 females, with an age range of 21-78 years and an average age of (48.62 ± 11.37) years. Most of the included patients had related symptoms such as frequent urination, urgency, tingling during urination, lower abdominal distension, or waist soreness, and some patients were accompanied by varying degrees of fever. All selected subjects are aware of the relevant procedures of this inspection and voluntarily cooperate to complete specimen collection.

Situations that need to be excluded include patients who have taken antibiotics by themselves before sampling, patients with severe urinary system tumors and severe kidney disease, cases where specimen collection was unqualified, where there was obvious contamination, and cases where data are incompletely recorded. Comparing the basic data of the 82 study subjects in terms of age, gender and clinical symptoms, there is no obvious statistical difference, and a controlled study can be carried out.

2.2. Specimen collection methods

Clean mid-stream urine specimens were collected from all patients. Before collection, medical staff will give patients a brief education, telling female patients that they need to clean their vulva in advance to avoid menstrual blood, and male patients to clean their urethra. During the urination process, discard the first phase of urine, keep the urine in the middle phase, and put it into a sterile special urine cup. After the specimen collection is completed, send it to the laboratory for testing within two hours to avoid leaving the specimen for too long, bacterial reproduction, or cell damage, which will interfere with the final test results.

2.3. Detection method

All specimens submitted for inspection will undergo routine urine testing and urine bacterial culture testing at the same time. Routine urine testing is completed using a fully automatic urine analyzer, equipped with original reagents, and the testing is carried out in strict accordance with the instrument operating instructions, focusing on observing core indicators such as leukocytes, leukocyte esterase, nitrite, and urine sediment leukocyte count. The reference standard for clinical determination of a positive urine routine test is positive leukocyte esterase, or the urine sediment white blood cells are greater than 5 per high-power field, and the nitrite result is positive. If any one of these is met, the urine routine test result is determined to be positive.

The entire urine bacterial culture operation follows the microbiology laboratory operating standards. The quantitative urine specimen is inoculated into the blood agar plate culture medium and placed in a 35°C constant temperature incubator for 24–48 hours. Observe the growth of bacterial colonies on the plate. The colony count is $\geq 10^5$ CFU/mL. Combined with the patient's clinical symptoms, the urine bacterial culture result is determined to be positive for urinary tract infection. The urine bacterial culture result is regarded as the diagnostic gold standard for this study. After the positive strains are cultured, bacterial species identification and drug susceptibility testing are further carried out to record the various pathogenic bacteria isolated.

2.4. Observation indicators

Using the urine bacterial culture results as a reference, we calculated the sensitivity, specificity, and diagnostic accuracy of the two modes of urine routine testing alone and urine routine testing combined with urine bacterial culture testing. We also counted the distribution proportions of various pathogenic bacteria in positive specimens.

2.5. Statistical processing

All data were statistically processed using SPSS 22.0 software. The count data were expressed as the number of cases and percentages. The comparison between groups was performed by the χ^2 test. $P < 0.05$ means that the difference results are statistically significant.

3. Result

3.1. Comparison of diagnostic performance of different detection methods

Among 82 patients with suspected urinary tract infection, 51 cases were confirmed to have urinary tract infection through urine bacterial culture, and 31 cases were negative. The diagnostic results of the urine routine single test and combined test were counted, respectively. The specific data are shown in **Table 1**.

Table 1. Comparison of diagnostic results of different detection methods (n)

Detection method	Gold standard positive	Gold standard negative	Sensitivity (%)	Specificity (%)	Diagnostic accuracy (%)
Urine routine single item	38	9	74.51	70.97	73.17
Joint testing	48	3	94.12	90.32	92.68

The sensitivity, specificity, and diagnostic accuracy of the combined test were significantly higher than those of the urine routine test alone. Comparing the two sets of data, $\chi^2 = 8.637$, $P < 0.05$, the difference was statistically significant.

3.2. Distribution of pathogenic bacteria

Among the 51 specimens that tested positive by urine bacterial culture, we isolated a variety of pathogenic strains, and there were obvious differences in the proportions of different strains. Based on the accumulation of daily work in the laboratory department, it can be found that the pathogenic bacteria of urinary tract infections are not completely fixed, and will fluctuate to a certain extent depending on the patient‘s age and basic physical condition. The strain results collected in this study can also reflect the general prevalence characteristics of the recent pathogenic bacteria in our hospital. The specific statistical results are shown in the table below.

Table 2. Distribution of pathogenic bacteria in positive urinary tract infection samples (n=51)

Pathogenic bacteria	Number of strains	Proportion (%)
Escherichia coli	29	56.86
Klebsiella pneumoniae	7	13.73
Proteus	4	7.84
Staphylococcus aureus	6	11.76
Other pathogenic bacteria	5	9.81

It is not difficult to see from the statistical data in the table that Gram-negative bacteria are still the main group of bacteria causing urinary tract infections, among which *Escherichia coli* is far ahead in the detection ratio. This is corroborated by the cases we usually encounter clinically. The source of most common community-acquired urinary tract infections comes from this type of intestinal resident bacteria. The female urethra is physiologically close to the anus, and it is easy for bacteria to migrate and invade the urethra, thereby inducing inflammation of the urinary system.

In addition to *Escherichia coli*, Klebsiella pneumoniae and Proteus also account for a proportion. This type of bacteria is more common in elderly patients, or people with diabetes or long-term indwelling urinary catheters. Gram-positive bacteria such as Staphylococcus aureus cannot be ignored. Although the overall proportion is not the highest, these strains often show resistance. If antibiotics are selected based on experience alone, it is easy for the treatment effect to fail to meet expectations. The remaining pathogenic bacteria include a small number of enterococci and other bacterial species, which are scattered among a small number of cases.

Precisely because there is no single type of pathogenic bacteria, the sensitivity of different strains to antibacterial drugs varies greatly. This can also explain why some patients do not get better with urinary discomfort after taking anti-inflammatory drugs directly after their urine routine shows infection. Relying only on a urine routine can determine the existence of an inflammatory reaction, but there is no way to

distinguish which kind of bacteria is responsible. This also reflects the irreplaceable practical significance of urine bacterial culture in actual diagnosis and treatment.

4. Discussion

Urinary tract infection is a very common type of infection in clinical practice. Many patients have atypical symptoms. If the test judgment is biased, antibiotic abuse may easily occur. In daily outpatient work, it is not uncommon for doctors to receive routine urine reports and directly prescribe antibiotics when they see an increase in white blood cells. However, in actual practice, we can encounter many situations. Female patients' leucorrhea is mixed with urine specimens, and urinary white blood cells will increase. However, the patients themselves do not have urinary tract infections. In this case, blind medication will bring unnecessary drug burden to the patients. On the contrary, some patients who have taken a small amount of antibiotics in advance have obvious symptoms of clinical urinary discomfort, but all the indicators of urine routine are close to normal. Relying only on urine routine can easily lead to missed diagnosis and delay the patient's treatment opportunity [4].

The biggest advantage of routine urine testing is that the test takes a short time, and the report can be obtained in ten minutes. The test cost is not high, and it is suitable for preliminary screening of a large number of suspected patients. As the gold standard for diagnosing urinary tract infections, urine bacterial culture can identify specific pathogenic bacteria. At the same time, accompanied by drug susceptibility results, it can guide the accurate selection of antibiotics in clinical practice and reduce the occurrence of drug resistance. However, the shortcomings of this test are also very prominent. The entire culture cycle takes one to two days, and there is no way to meet the needs of outpatient clinics for quick reports. It is impossible for some patients with mild symptoms to wait two days before treatment. Combining the two detection methods can just make up for each other's shortcomings. When clinically treating patients with suspected urinary tract infection, rapid urine routine screening can be completed first. If all urine routine indicators are negative, and based on the patient's actual situation, unnecessary urine bacterial culture can be reduced as appropriate, reducing the patient's financial burden and reducing the workload of the laboratory. When the urine routine result is positive, or the patient's clinical symptoms are obvious, even if the urine routine result is not typical, the urine bacterial culture must be completed in time. This working mode can not only take advantage of rapid urine routine screening, but also obtain etiological evidence through bacterial culture, effectively reducing the probability of missed diagnosis and misdiagnosis. After joint testing in this study, the diagnostic accuracy increased to 92.68%, which also confirms this [5].

Judging from the results of the pathogenic bacteria isolated this time, *Escherichia coli* is still the main pathogenic bacterium of urinary tract infections, which is basically consistent with the situation reported in much of the clinical literature. However, it should also be noted that the proportion of pathogenic bacteria such as Staphylococcus and Klebsiella is not low, and the resistance of different bacteria to antibiotics varies greatly. If you do not refer to the bacterial culture susceptibility results and directly use empiric drugs, it is easy for the drug to be inappropriate, and the patient's symptoms will not improve after taking the drug. Especially for elderly patients with recurrent urinary tract infections and inpatients with indwelling urinary catheters, it is even more necessary to improve bacterial culture and not rely solely on urine routine results for long-term antibiotic use.

At the same time, we must also pay attention to the impact of the specimen collection process. In clinical practice, many false-positive urine cultures are caused not by the patient's own infection, but by the specimen being contaminated by vulvar secretions when collecting urine [6]. This requires clinical nurses to educate patients well, standardize the mid-stream urine collection process, and return unqualified specimens for re-collection as much as possible. Otherwise, no matter how good the detection method is, reliable test results will not be obtained.

5. Conclusion

For laboratory diagnosis of urinary tract infection, both routine urine examination and urine bacterial culture have irreplaceable value, but at the same time, they also have certain limitations. Routine urine testing is fast and suitable for preliminary screening of a large number of cases. However, if used alone, there is a risk of missed diagnosis and misdiagnosis, and it cannot be used as the only basis for the diagnosis of urinary tract infection. Urine bacterial culture can clarify the pathogenic bacteria and drug susceptibility results and is an important basis for diagnosing urinary tract infection. However, the detection cycle is long and is not suitable for rapid primary screening. The combined testing of urine routine and urine bacterial culture can give full play to the complementary effects of the two detection methods and significantly improve the overall diagnostic sensitivity and accuracy. In clinical practice, it is recommended that, based on the patient's urinary symptoms, the urine routine should be used first to complete the preliminary screening. For patients with abnormal urine routine, typical symptoms, and recurrent symptoms, urine bacterial culture should be carried out in a timely manner, and the etiological results should be combined to guide the selection of antibacterial drugs. This can not only improve the reliability of urinary tract infection diagnosis, but also avoid the unreasonable use of antibiotics to a certain extent, bringing better diagnosis and treatment results to patients.

About the author

Cao Yaning (1996.04—), female, Han, native of Xuzhou, Jiangsu, graduate student, junior laboratory technician, research direction is metabolomic analysis of infectious diseases and optimization of clinical diagnostic strategies.

Wang Chuangye (1997.12—), male, Han, from Huai'an, Jiangsu Province, bachelor's degree, junior laboratory technician, research direction is clinical microbiology and infection immunodiagnosis.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Qiu LZ, 2026, Analysis of the Value of Routine Urine Testing in the Diagnosis of Urinary Tract Infection. In Proceedings of the First Academic Symposium on Digital Intelligence Education Research, 669–672.

[2] Yang SL, 2022, Observation on the Diagnostic Value of Routine Urine Examination for Urinary Tract Infection. Chinese Medical Guide, 20(12): 96–98.

[3] Sun Y, 2022, Analysis of the Application Value of Routine Urine Testing in the Clinical Diagnosis of Urinary Tract Infection. Chinese Practical Medicine, 17(7): 114–116.

[4] Wei GQ, 2020, Diagnostic Value of Routine Urine Testing in Patients with Urinary Tract Infection. Chinese Medical Guide, 18(29): 125–126, 129.

[5] Wang YQ, 2020, Evaluation of the Application Effect of Routine Urine Dry Chemistry Method and Urine Sediment Examination in the Diagnosis of Urinary Tract Infection. Capital Food and Medicine, 27(4): 95–96.

[6] Zhong X, 2020, Analysis of the Clinical Diagnostic Significance of Routine Urine Testing for Urinary Tract Infection. Journal of Clinical Laboratory (Electronic Edition), 9(1): 74.

Publisher's note

Bio-Byword Scientific Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.