



THE IMPORTANCE OF CLINICAL LABORATORY DIAGNOSTICS IN THE DIAGNOSIS OF UNCOMPLICATED PYELONEPHRITIS

Farhodov Kamaladdin Mansurovich

Master's Student at Urgench State Medical Institute

Article history:

Received: December 11th 2025

Accepted: February 10th 2026

Abstract:

Urinary tract infections (UTIs) are among the most common infectious diseases encountered in general medical practice, and 80% of them are classified as uncomplicated urinary tract infections. According to current clinical guidelines, the use of antibiotics is considered the first-line therapeutic option in the treatment of the acute phase of UTIs [1].

This study evaluated routine laboratory parameters—including urinalysis, hematological indices, biochemical markers, and coagulation profiles—in 63 patients diagnosed with uncomplicated pyelonephritis, stratified into four age–sex groups. Urinalysis revealed mild leukocyturia in all patients, consistent with lower urinary tract inflammation. Low-level urinary protein (0.033–0.33 g/L) was detected in a proportion of patients across all groups, while renal epithelial cells were not observed in any case, indicating preserved renal parenchymal integrity. Squamous epithelial cells were more common in women, reflecting physiological anatomical differences. Biochemical parameters (ALT, glucose, urea, creatinine, and total protein) remained within normal reference ranges, with no statistically significant intergroup differences ($p > 0.05$). Hematological evaluation demonstrated reduced hemoglobin and erythrocyte levels in all groups, with significant intergroup variation in hemoglobin concentration ($p = 0.006$). ESR was mildly elevated and showed statistically significant differences between specific subgroups ($p = 0.0023$), whereas leukocyte counts remained within normal limits. Coagulation parameters—including prothrombin time, INR, APTT, thrombin time, and fibrinogen—were within physiological ranges, and no significant differences were present between the groups (all $p > 0.05$).

These findings demonstrate that uncomplicated pyelonephritis is associated with minimal systemic laboratory abnormalities. Mild leukocyturia and low-grade proteinuria represent the most consistent urinary findings, while the absence of renal epithelial cells confirms the non-complicated nature of the infection. Routine laboratory diagnostics therefore remain essential for accurately distinguishing uncomplicated pyelonephritis from more severe renal or systemic infectious processes.

Keywords: Uncomplicated pyelonephritis; urinalysis; leukocyturia; complete blood count; biochemical analysis; coagulation parameters; erythrocyte sedimentation rate.

INTRODUCTION

The prevalence of uncomplicated urinary tract infection in women is reported to be around 11%. The disease typically occurs in individuals of sexually active age, most commonly between 18 and 39 years. Gram-negative *Escherichia coli* (*E. coli*) is the most frequent causative agent of uncomplicated UTIs, and is estimated to account for approximately 85% of all cases. The remaining cases are mainly attributed to *Staphylococcus saprophyticus*, *Klebsiella* species, and *Proteus* species. For this reason, antimicrobial agents play a central role in the management of uncomplicated urinary tract infections [2].

Routine laboratory studies—including urinalysis, complete blood count (CBC), biochemical testing, and

coagulation analysis—play a key role in assessing the extent of inflammation, identifying early signs of renal involvement, and distinguishing uncomplicated cases from more severe presentations. Despite the clinical relevance of these laboratory markers, age- and sex-related differences in routine diagnostic parameters have not been fully characterized in patients with uncomplicated pyelonephritis. Understanding these variations may improve diagnostic accuracy and contribute to more individualized patient assessment. The aim of this study was to evaluate urinalysis, hematological, biochemical, and coagulation parameters in patients with uncomplicated pyelonephritis across four age–sex groups, and to



determine the diagnostic significance of these routine laboratory findings.

MATERIALS AND METHODS

This study included a total of 63 patients diagnosed with uncomplicated pyelonephritis. The patients were divided into four groups based on age and sex:

1. women ≤40 years,
2. men ≤40 years,
3. women >40 years,
4. men >40 years.

All patients underwent a comprehensive laboratory evaluation, including urinalysis, complete blood count (CBC), biochemical analysis, and coagulation testing. Urinalysis parameters assessed included urine color, specific gravity, squamous epithelial cells, renal epithelial cells, leukocytes per high-power field (HPF), and urinary protein. These indicators represent categorical or semi-quantitative variables, and therefore were analyzed descriptively. CBC parameters included hemoglobin, erythrocytes, leukocytes, differential leukocyte counts, hematocrit, and platelet levels.

Biochemical testing consisted of alanine aminotransferase (ALT), glucose, urea, creatinine, and total protein. Coagulation studies included prothrombin time (PT), activated partial thromboplastin time (APTT), thrombin time, the international normalized ratio (INR), and fibrinogen. For quantitative laboratory indicators (CBC, biochemistry, coagulation parameters), mean values and standard error of the mean (SEM) were calculated. Intergroup comparisons were performed using one-way analysis of variance (ANOVA) followed by Tukey’s HSD post-hoc test to identify statistically significant differences between specific groups. A p-value <0.05 was accepted as statistically significant.

All laboratory tests were performed using standard clinical protocols in accordance with routine diagnostic procedures. The study design and analytical approach ensured accurate comparison of laboratory findings across the four predefined patient groups.

RESULTS

The results of the urinalysis are presented in Table 1

Table 1

Laboratory Indicators	Detection Rate	Age ≤ 40 years		Age > 40 years	
		Women n=11	Men n=9	Women n=31	Men n=12
Urine Color	Yellow	10	9	26	10
	Dark yellow	1	0	3	1
	Light yellow	0	0	1	0
	Straw-colored	0	0	1	1
Urine Specific Gravity	Normal specific gravity (1008–1030 g/mL)	3	1	12	5
	Low specific gravity (<1008 g/mL)	8	8	19	7
Squamous epithelium (detected in all patients)		(0–5 per HPF)	(0–2 per HPF)	(0–5 per HPF)	(0–2 per HPF)
Leukocytes (detected in all patients)		(2–15 per HPF)	(3–10 per HPF)	(3–14 per HPF)	(2–12 per HPF)
Protein		9 (0.033-0.33 g/L)	4 (0.033-0.33 g/L)	8 (0.033-0.33 g/L)	18 (0.033-0.33 g/L)
Renal epithelium		Not detected	Not detected	Not detected	Not detected

HPF - high-power field.

Urinalysis findings across all four age–sex groups demonstrated patterns consistent with uncomplicated pyelonephritis. Yellow urine was the predominant color in all groups, with occasional cases of dark yellow, light

yellow, or straw-colored urine. A noticeable shift toward lower urine specific gravity was observed among patients older than 40 years, whereas individuals ≤40 years exhibited a higher proportion of normal specific



gravity values. Squamous epithelial cells were detected in all women and in smaller quantities in men, consistent with anatomical characteristics of the lower urinary tract. Leukocyturia of mild to moderate degree (2–15/HPF) was present in all patients. Urinary protein was detected in the range of 0.033–0.33 g/L across all

groups, corresponding to trace-to-mild proteinuria. No renal epithelial cells were detected in any age–sex group, indicating preserved renal parenchymal integrity and absence of infection-related tubular injury. The results of the biochemical blood analysis are presented in Table 2.

Table 2

	Age ≤ 40 years		Age > 40 years	
	Women n=11	Men n=9	Women n=31	Men n=12
ALT	26.09±1.11	32.22±1.67	27.93±1.29	24.17±1.52
Glucose	4.63±0.23	4.37±0.19	4.94±0.15	4.89±0.22
Urea	6.68±0.5	6.78±0.44	7.14±0.24	7.77±0.528
Creatinine	82.25±4.45	91±5.66	87.1±2.1	99.25±5.24
Total Protein	69±2.43	70.22±2.20	68±1.1	66.5±1.27

The evaluation of biochemical parameters, including ALT, glucose, urea, creatinine, and total protein, demonstrated that all indicators remained within normal physiological ranges. Intergroup comparison using one-way ANOVA revealed no statistically significant

differences between age- or sex-based subgroups (all p > 0.05). These findings indicate preserved renal function and absence of metabolic imbalance in uncomplicated pyelonephritis.

The results of the complete blood count are presented in Table 3.

Table 3

	Age ≤ 40 years		Age > 40 years	
	Women n=11	Men n=9	Women n=31	Men n=12
Hemoglobin (Hb)	76±1.32	78.11±1.86	80.1±2.5	83.33±4.93
Erythrocytes (RBC)	2.83±0.078	2.92±0.13	2.96±0.08	3.15±0.23
Platelets	184.6±9.01	182.78±8.16	187.42±6.16	187±9.14
Leukocytes	6.08±0.53	6.33±0.58	5.88±0.35	5.53±0.51
Band Neutrophils	2.33±0.51	2.22±0.37	2.9±0.39	3.17±0.57
Segmented Neutrophils	65.92±3.94	65.33±3.06	67.30±2.23	69.42±3.18
Lymphocytes	26.08±3.49	25.22±3.66	24.03±2.23	21.5±3.32
Monocytes	4.5±1.09	4.67±0.74	5.5±0.46	5.25±0.88
ESR (Erythrocyte Sedimentation Rate)	14.42±1.46	9.56±1.02	15.65±1.02	10.67±0.89



Hemoglobin and erythrocyte values were below the physiological reference range in all four groups. ANOVA demonstrated statistically significant intergroup differences in hemoglobin levels ($p = 0.006$). Post-hoc Tukey HSD analysis showed that hemoglobin values in the ≤ 40 -year female group were significantly higher than those of the remaining groups ($p < 0.05$). Leukocyte counts remained within physiological limits across all groups, and no statistically significant differences were detected ($p > 0.05$). Although neutrophils were relatively higher in certain groups, this finding did not reach statistical significance ($p > 0.05$).

A mild elevation in ESR was observed. ANOVA indicated a significant difference in ESR between the groups ($p = 0.0023$). Tukey HSD confirmed a significant pairwise difference only between the ≤ 40 -year male group and the > 40 -year female group ($p < 0.01$). All remaining hematological parameters—including platelets, hematocrit, lymphocytes, monocytes, eosinophils, and basophils—remained within normal reference limits without statistically significant differences (all $p > 0.05$). The results of the coagulation test (coagulogram) are presented in Table 4.

Table 4

	Age ≤ 40 years		Age > 40 years	
	Women n=11	Men n=9	Women n=31	Men n=12
Prothrombin	97.58 \pm 1.43	95.67 \pm 2.42	93.52 \pm 1.66	94.92 \pm 1.47
INR	0.96 \pm 0.02	0.97 \pm 0.03	0.98 \pm 0.02	0.99 \pm 0.023
APTT	26.82 \pm 0.58	27.56 \pm 0.73	27.43 \pm 0.46	27.7 \pm 0.82
TT	20.67 \pm 0.45	20.78 \pm 0.39	20.63 \pm 0.24	20.53 \pm 0.36
Fibrinogen	3.16 \pm 0.18	3.11 \pm 0.15	3.11 \pm 0.13	3.14 \pm 0.24

The coagulation parameters of the patients remained within normal physiological ranges. No statistically significant differences were found between the groups for prothrombin time ($p = 0.470$), APTT ($p = 0.862$), thrombin time ($p = 0.246$), INR ($p = 0.330$), or fibrinogen levels ($p = 0.586$). This indicates that uncomplicated pyelonephritis does not influence intrinsic or extrinsic coagulation pathways.

Discussion

The findings of this study demonstrate that uncomplicated pyelonephritis is characterized by mild inflammatory laboratory changes with preserved renal, hematological, and coagulation function. Urinalysis showed consistently mild leukocyturia across all patient groups, which corresponds to the expected inflammatory response in uncomplicated pyelonephritis. The presence of squamous epithelial cells predominantly in female patients reflects normal anatomical differences of the lower urinary tract and does not indicate pathology.

A key diagnostic feature was the absence of renal epithelial cells, indicating that the infection did not extend to the renal parenchyma. Low-level urinary protein (0.033–0.33 g/L) was detected in a proportion of patients across all age–sex groups, which reflects mucosal inflammation rather than renal tissue damage. Because renal epithelial cells were not observed, the detected proteinuria can be interpreted as mild,

inflammation-related excretion rather than a sign of parenchymal involvement. These findings align with existing clinical evidence suggesting that uncomplicated pyelonephritis rarely causes structural renal injury and is typically limited to mild upper urinary tract inflammation.

Biochemical indicators—including ALT, glucose, urea, creatinine, and total protein—remained within normal physiological ranges for all groups, and no statistically significant differences were observed. This suggests that renal filtration and metabolic processes remain functionally preserved in uncomplicated cases, consistent with earlier research indicating that biochemical abnormalities are uncommon in non-complicated infections.

Hematological evaluation revealed reductions in hemoglobin and erythrocyte levels across all age–sex groups. Although the decrease reached statistical significance between certain groups, leukocyte counts remained within normal reference limits, supporting the notion that uncomplicated pyelonephritis does not normally trigger systemic inflammatory leukocytosis. ESR showed mild elevation, with significant intergroup variation, reflecting a low-grade inflammatory response typical of uncomplicated urinary tract infections.

Coagulation parameters—including PT, INR, APTT, thrombin time, and fibrinogen—were within normal limits in all groups, and intergroup differences were not



statistically significant. These results indicate that uncomplicated pyelonephritis does not influence intrinsic or extrinsic coagulation pathways, which differentiates it from severe infections or septic conditions where coagulation abnormalities are more prevalent.

Overall, the findings support the understanding that uncomplicated pyelonephritis presents with limited systemic involvement. Routine laboratory diagnostics—particularly urinalysis—remain essential tools for confirming the benign nature of the condition and distinguishing it from more severe renal and systemic infections requiring intensive management.

CONCLUSION

This study shows that uncomplicated pyelonephritis is characterized by mild inflammatory changes and preserved renal, hematological, and coagulation function. Urinalysis findings—including mild leukocyturia, low-level urinary protein (0.033–0.33 g/L), and the absence of renal epithelial cells—indicate intact renal parenchymal structure and confirm that the infection does not involve renal parenchymal damage. Biochemical parameters remained within normal physiological limits across all groups, demonstrating that renal metabolic and filtration processes were not impaired. Hematological assessment revealed moderate reductions in hemoglobin and erythrocyte levels, whereas leukocyte counts generally remained within the reference range and ESR exhibited only mild elevation, reflecting a low-grade inflammatory response. Coagulation parameters were stable and within normal limits, indicating preserved hemostatic function.

Overall, the findings confirm that uncomplicated pyelonephritis progresses as a clinically mild condition without significant systemic laboratory disturbances. Routine laboratory evaluation—particularly urinalysis, complete blood count, biochemical testing, and coagulation profiling—plays a critical role in verifying its non-complicated nature and differentiating it from more severe infectious processes requiring more intensive diagnostic and therapeutic approaches.

REFERENCES

1. Wagenlehner FM, Abramov-Sommariva D, Höller M, Steindl H, Naber KG. Non-antibiotic herbal therapy (BNO 1045) versus antibiotic therapy (fosfomycin trometamol) for the treatment of acute lower uncomplicated urinary tract infections in women: a double-blind, parallel-group, randomized, multicentre, non-inferiority phase III trial. *Urol Int.* 2018;101(3):327-336. doi:10.1159/000493368
2. Gautam S, Shrestha R, Ghani MR, Ali MM, Kc M, Elferty YA, Chong V, Adegbite BR. Efficacy and

safety of different therapies of non-steroidal anti-inflammatory drugs against antibiotic monotherapy in the treatment of uncomplicated lower urinary tract infection: a systematic review. *SAGE Open Med.* 2022;10:20503121221122392. doi:10.1177/20503121221122392