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ASSESSMENT OF LABORATORY PARAMETERS IN PATIENTS WITH UNCOMPLICATED PYELONEPHRITIS

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Abstract

Background: During a woman's lifetime, the incidence of experiencing at least one episode of uncomplicated urinary tract infection (UTI) is approximately 30–40%, and in the majority of cases antibiotics are prescribed by physicians during treatment [1]. Routine urinalysis and biochemical testing remain essential for confirming the diagnosis and assessing disease severity.

Methods

Sixty-four patients diagnosed with uncomplicated pyelonephritis were divided into three age groups (21–40, 41–59, and 60–89 years). All underwent standard urinalysis (urine color, specific gravity, epithelial cells, leukocytes, urinary protein) and biochemical testing (alanine aminotransferase, glucose, urea, creatinine, total protein). Urinalysis was evaluated descriptively, while biochemical parameters were compared using one-way ANOVA with Tukey's HSD post-hoc testing.

Results

Urinalysis was predominantly normal in color, and trace-to-mild proteinuria (0.033–0.33 g/L) was identified across all age groups, while renal epithelial cells were not detected. Leukocyturia was present in all patients Leukocyturia was present in all patients. Normal urine specific gravity was observed in 4, 13, and 4 patients across the three age groups, with low values predominating. Alanine aminotransferase, creatinine, and total protein did not differ significantly

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($p>0.05$). Glucose ($p=0.00186$) and urea ($p=0.0301$) varied significantly between groups but remained within normal ranges.

Conclusion

Routine urinalysis and biochemical markers remain stable in uncomplicated pyelonephritis. Age-related differences appeared only in glucose and urea, though all values stayed within physiological limits, confirming that uncomplicated pyelonephritis does not cause significant renal or metabolic dysfunction.

Keywords: urinary tract infection; leukocyturia; urine specific gravity; urea; glucose; creatinine; total protein

Introduction

Uncomplicated UTIs are described as the most common community-acquired infection in the United States [1].

Pyelonephritis occurring in non-pregnant, premenopausal women without urological abnormalities or significant comorbidities corresponds to the definition of uncomplicated pyelonephritis. In uncomplicated pyelonephritis, routine diagnostic evaluation includes urinalysis assessing white blood cells (WBCs), red blood cells (RBCs), and nitrites. In all cases of pyelonephritis, urine culture and antimicrobial susceptibility testing are required [2].

Although this study addresses uncomplicated urinary tract infections as a general category, all enrolled patients had uncomplicated pyelonephritis, representing the upper-tract form of uncomplicated UTI. The aim of this study was to assess urinalysis findings and biochemical blood parameters in 64 patients diagnosed with uncomplicated pyelonephritis and to identify age-related differences across three age groups.

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Materials and Methods

This study included 64 patients diagnosed with uncomplicated pyelonephritis who were divided into three age groups (21–40, 41–59, and 60–89 years). All participants underwent standard urinalysis assessing urine color, specific gravity, squamous and renal epithelial cells, leukocytes per high-power field (HPF), and urinary protein. In addition, biochemical blood testing included alanine aminotransferase (ALT), glucose, urea, creatinine, and total protein. Urinalysis parameters, being categorical or semi-quantitative, were analyzed descriptively. Quantitative biochemical indicators were expressed as mean ± standard error of the mean (SEM) and compared across the three age groups using one-way ANOVA. Tukey's HSD post-hoc test was applied to parameters showing statistical significance, with a p-value <0.05 considered statistically significant.

Results

The results of urinalysis are presented in Table 1.

Table 1

	Age Distribution of Patients and Number in Each Group	21-40 years n=21	41-59 years n=25	60-89 years n=18
Urine color	Yellow	20	20	16
	Dark yellow	1	3	1
	Light yellow	0	1	0
	Grayish	0	1	1
Urine Specific Gravity	Normal specific gravity (1008-1030g/ml)	4	13	4
	Low specific gravity (<1008g/ml)	17	12	14
Squamous epithelium (detected in all patients)		(1–5 per HPF)	(1–5 per HPF)	(1–5 per HPF)
Leukocytes (detected in all patients)		(2–15 per HPF)	(2–15 per HPF)	(3–15 per HPF)
Protein		14 (0.033-0.33g/ml)	14 (0,033-0.33g/ml)	12 (0.033-0.33g/ml)
Renal epithelium		Not detected	Not detected	Not detected

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HPF - high-power field.

The analysis of urinalysis parameters demonstrated that urine color was predominantly yellow in the majority of patients across all age groups. In the 21–40-year age group, 20 patients had yellow urine and 1 patient had dark yellow urine. In the 41–59-year group, yellow urine was observed in 20 patients, light yellow in 1 patient, and dark yellow in 3 patients. In the 60–89-year group, 16 patients had yellow urine and 1 patient had light yellow urine. Urine specific gravity showed an age-associated pattern. Normal specific gravity was recorded in 4 patients in the 21–40 age group, 13 patients in the 41–59 group, and 4 patients in the 60–89 group, while low specific gravity values were observed in 17, 12, and 14 patients, respectively. Squamous epithelial cells were present in all patients, ranging from 1 to 5 per high-power field (HPF). Leukocytes ranged from 2 to 15 per HPF in the 21–40 and 41–59-year groups, and from 3 to 15 per HPF in the 60–89-year group. Urinary protein ranged from 0.033 to 0.33 g/L, corresponding to trace-to-mild proteinuria across all age groups. Urinary protein was identified in 14 patients in the 21–40-year group, 14 patients in the 41–59-year group, and 12 patients in the 60–89-year group. Renal epithelial cells were not detected in any of the study groups.

The results of blood biochemical analysis are presented in Table 2.

Table 2

Age Distribution of Patients and Number in Each Group	21-40 years n=21	41-59 years n=25	60-89 years n=18
ALT	28.1 ±1.08	27.4± 1.41	26.33 ±1.81
Glucose	4.54± 0.15	5.13± 0.14	4.48 ±0.12
Urea	6.73 ±0.34	6.94± 0.28	7.83± 0.21
Creatinine	85.19± 3.85	87.92 ±3.03	93.22 ±3.76
Total Protein	69.38± 1.66	67.76± 1.24	68.44 ±1.62

Biochemical parameters were compared across the three age groups (21–40, 41–59, and 60–89 years). One-way ANOVA showed no statistically significant

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differences in alanine aminotransferase ($p = 0.711$), creatinine ($p = 0.304$), or total protein ($p = 0.730$), indicating that hepatic enzyme activity, renal filtration, and serum protein levels remained stable across age groups. Glucose levels differed significantly among groups ($p = 0.00186$). Tukey's HSD post-hoc test confirmed that the 41–59-year group had significantly higher glucose values compared with the 21–40 and 60–89-year groups; however, all glucose measurements remained within normal physiological limits. Urea levels also showed statistically significant intergroup variation ($p = 0.0301$). Post-hoc analysis identified a significant difference between the 21–40 and 60–89-year groups, with higher mean urea levels in the older group. Despite this variation, all urea values remained within reference ranges, suggesting that the differences likely reflect age-related metabolic variation rather than infection-related impairment.

Overall, although glucose and urea demonstrated statistically significant age-related differences, all biochemical markers remained within physiological limits, supporting the conclusion that uncomplicated pyelonephritis does not cause clinically meaningful metabolic disturbances.

Discussion

The findings of this study show that uncomplicated pyelonephritis is primarily associated with mild laboratory abnormalities and does not indicate renal parenchymal involvement. Urine color remained within physiological ranges across all age groups, with yellow being the most commonly observed. An age-related difference in urine specific gravity was observed, particularly in the 60–89-year group. The lower values in older patients in our cohort reflect variation within the study population and are not suggestive of infection-related impairment. Leukocyturia was present in all patients and served as the most consistent urinalysis marker of uncomplicated pyelonephritis. The presence of squamous epithelial cells, along with the absence of renal epithelial cells, further supported the conclusion that the infection involved the upper urinary tract

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without evidence of renal parenchymal damage. Urinary protein levels ranged from 0.033 to 0.33 g/L, which may reflect a mild tubular response but does not indicate structural renal damage. Biochemical analysis demonstrated no significant differences in alanine aminotransferase, creatinine, or total protein levels among the age groups, suggesting stable hepatic enzyme activity, renal filtration, and serum protein status. Although glucose and urea values showed statistically significant variation between age groups, all values remained within reference ranges. The relatively higher glucose levels observed in the 41–59-year group and the modest increase in urea levels among older patients are consistent with age-related metabolic and renal concentrating changes rather than infection-associated abnormalities.

Overall, these findings indicate that uncomplicated pyelonephritis does not cause clinically meaningful biochemical disturbances. Routine urinalysis and basic biochemical markers adequately reflect the mild inflammatory nature of the condition and remain appropriate for distinguishing uncomplicated pyelonephritis from more severe urinary tract pathology.

Conclusion

This study demonstrates that leukocyturia is the most reliable and consistent laboratory indicator of uncomplicated pyelonephritis. Urine color remained within normal physiological limits across all age groups, and the absence of renal epithelial cells confirmed that the infection involved the upper urinary tract without causing renal parenchymal damage. Trace-to-mild proteinuria (0.033–0.33 g/L) was observed across all age groups, consistent with mild infection-associated excretion without evidence of renal parenchymal involvement Biochemical analysis showed no significant differences in alanine aminotransferase, creatinine, or total protein levels among the age groups, supporting the conclusion that hepatic function, renal filtration, and serum protein status remained stable. Although glucose and urea levels demonstrated

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statistically significant age-related variation, all values remained within normal reference ranges, suggesting that these changes reflect physiological age-dependent metabolic differences rather than infection-related dysfunction.

Overall, the findings confirm that uncomplicated pyelonephritis does not cause clinically meaningful metabolic or renal abnormalities. Routine urinalysis and basic biochemical testing remain sufficient for distinguishing uncomplicated cases from more severe urinary tract conditions that require further diagnostic evaluation.

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