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INVESTIGATING THE PREVALENCE OF URINARY TRACT INVOLVEMENT IN COVID-19 PATIENTS

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Abstract:

The interplay between COVID-19 and urinary tract involvement (UTI) remained an area of significant clinical interest, particularly given the potential for overlapping symptomatology and complications. This study examined the clinical characteristics of COVID-19 patients with concurrent UTI, assessing risk factors and outcomes. A cross-sectional study was conducted on 70 hospitalized COVID-19 patients in different hospitals in Iraq during March 2022 - March 2023. Our study enrolled clinical outcomes of UTI symptoms, causative pathogens, laboratory markers, and hospitalization outcomes. This study identified urinary tract involvement (UTI) symptoms, and these symptoms were evaluated by IPSS Scores, as well as evaluated the general health quality of psychological aspects using HADS scores in both anxiety and depression. EQ-5D scores. Logistic regression was performed to determine risk factors for UTI development. The cohort had (50.0% aged 51–60), with 60.0% male and 40.0% female participants. Hypertension (28.6%), diabetes mellitus (21.4%), and obesity (25.7%) were prevalent comorbidities. UTI symptoms were reported in 50.0% of patients, with dysuria (28.6%) and lower abdominal pain (25.7%) being the most common. Escherichia coli (35.7%) and Klebsiella pneumoniae (21.4%) were the predominant pathogens. Severe COVID-19 (21.4%) was associated with elevated inflammatory markers (CRP: 45.6 ± 12.4 mg/L; D-dimer: 1.8 ± 0.7 µg/mL). Hospitalization outcomes revealed a mean length of stay of 10.5 ± 3.2 days, with 28.6% requiring ICU admission and an 11.4% mortality rate. UTI is a frequent complication in COVID-19 patients, particularly among older adults, women, and those with metabolic comorbidities. Severe COVID-19 correlates with worse urinary outcomes, emphasizing the need for vigilant urological monitoring in high-risk populations.

Keywords: Covid-19, Urinary Tract Involvement (UTI), Symptoms, Pathogens, Hads Scores, Eq-5d Scores

Introduction

Urinary tract infections (UTIs) constitute one of the most prevalent bacterial infections worldwide, impacting individuals across diverse demographics [1]. With the emergence of the COVID-19 pandemic, the scientific community has directed its focus predominantly towards understanding the respiratory implications of the virus. Initial studies primarily underscored severe respiratory symptoms associated with SARS-CoV-2, leading to an underappreciation of the multifaceted nature of the virus and its systemic manifestations [2,3,4]. This oversight is concerning, particularly given a growing body of evidence suggesting that COVID-19 may affect organ systems beyond the pulmonary domain [5].

The urinary tract, comprising the kidneys, ureters, bladder, and urethra, plays a vital role in maintaining homeostasis and excreting metabolic waste [6]. In individuals infected with SARS-CoV-2, there is increasing suspicion that the virus may exert direct effects on renal and urinary function [7]. A series of clinical observations have documented urinary symptoms, such as hematuria (blood in urine), proteinuria (excess protein in urine), and acute kidney injury (AKI), among COVID-19 patients [8]. These findings underscore the necessity of expanding our understanding of COVID-19's systemic effects, particularly regarding complications that may arise from viral invasion or secondary effects of the inflammatory response triggered by the infection [9].

Moreover, preliminary data suggest that renal impairment in COVID-19 patients may correlate with more severe disease outcomes [10]. Research indicates that the presence of urinary abnormalities can serve as a prognostic indicator, raising concerns for healthcare providers tasked with managing both acute and long-term consequences of the virus [11].

Several factors may contribute to the urinary tract complications observed in COVID-19 patients, including age, pre-existing urological conditions, and the severity of COVID-19 infection [12]. Patients with comorbidities, particularly those with underlying kidney diseases or diabetes, may face a heightened risk of adverse urinary outcomes when infected with SARS-CoV-2 [13]. This study contributed to assess and enroll clinical outcomes of COVID-19 patients who suffer from urinary tract involvement.

Materials and Method

This study was designed as a cross-sectional design conducted on 70 patients in different hospitals in Iraq during March 2022 - March 2023. The primary objective was to evaluate the incidence, risk factors, and clinical outcomes of urinary tract involvement (UTI) in hospitalized COVID-19 patients, with a secondary focus on the microbiological profile, hospitalization burden, and health-related quality of life (HRQoL) implications.

Study Design and Patient Selection

A total of 70 consecutively admitted COVID-19 patients with confirmed SARS-CoV-2 infection via RT-PCR nasopharyngeal swab were included. **The inclusion criteria comprised:**

a. Patients (≥ 30 years) with laboratory-confirmed COVID-19,

b. Hospitalization for ≥48 hours to ensure sufficient clinical observation,

c. Availability of complete demographic, clinical, and laboratory records.

Exclusion criteria were:

a. Asymptomatic COVID-19 cases managed outpatient,

b. Preexisting end-stage renal disease or chronic catheter-associated UTIs,

c. Incomplete follow-up data due to transfer or discharge against medical advice.

Goals of the Study

The study aimed to:

1. Characterize the demographic and clinical profiles of COVID-19 patients developing UTI.
2. Identify the prevalence and symptomatology of UTI in this cohort.
3. Assess the association between COVID-19 severity and UTI risk using logistic regression.
4. Evaluate hospitalization outcomes, including length of stay (LOS), ICU admission, and mortality.
5. Analyze the impact on HRQoL using standardized questionnaires (HADS, EQ-5D).

Data Collection

Data were extracted from medical records (MR) and laboratory databases, ensuring comprehensive capture of:

a. Demographics: Age, gender, body mass index (BMI), education, and socioeconomic status.
b. Comorbidities: Hypertension, diabetes mellitus, cardiovascular disease, dyslipidemia, and obesity (BMI ≥30 kg/m^2).
c. COVID-19 severity markers: WHO clinical progression scale, FiO_2 requirements, and radiological findings.
d. UTI-specific variables: Symptoms (dysuria, frequency, hematuria), urine culture results, and prior urological history.
e. Hospitalization outcomes: LOS, ICU admission, mechanical ventilation, and complications (sepsis, recurrent UTIs).
f. Psychosocial metrics: Hospital Anxiety and Depression Scale (HADS) and EQ-5D for HRQoL assessment.

Laboratory Findings

Standardized laboratory tests were performed at admission and repeated as clinically indicated:

a. Inflammatory markers: C-reactive protein (CRP), D-dimer, and interleukin-6 (IL-6).
b. Metabolic panel: Serum creatinine, electrolytes, and lipid profile (HDL, LDL, triglycerides).
c. Hematological indices: White blood cell count (WBC), neutrophil-lymphocyte ratio (NLR).
d. Urinary Tract Involvement (UTI) Symptoms and Pathogens

UTI was diagnosed:

a. Symptomatic UTI: Presence of ≥1 symptom (dysuria, urgency, suprapubic pain) with $\geq 10^3$ CFU/mL of a uropathogen.
b. Asymptomatic bacteriuria: $\geq 10^5$ CFU/mL without symptoms (excluded from analysis).

Hospitalization Outcomes

a. Length of stay (LOS): Days from admission to discharge or death.
b. ICU requirements: Need for vasopressors, mechanical ventilation, or renal replacement therapy.
c. Complications: Sepsis (SOFA score ≥2), acute kidney injury (AKI), or catheter-associated events.
d. Mortality: All-cause death during hospitalization.

Health-Related Quality of Life (HRQoL) Assessment

At discharge:

a. HADS: A 14-item scale (7 for anxiety, 7 for depression; scores ≥8 indicating clinical significance).

b. EQ-5D-3L: A standardized instrument assessing mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (score range: 0–1, with 1 = perfect health).

Results

Demographic and comorbidity analyses (see Table 1) identified age >50 years (OR: 2.1, p=0.012), female gender (OR: 1.8, p=0.028), diabetes (OR: 2.5, p=0.002), obesity (OR: 2.0, p=0.010), and severe COVID-19 (OR: 3.2, p<0.001) as independent risk factors for UTI development.

Table 1. Demographic Information for All Patient Enrollees.

Variable	n (%) / Mean ± SD
Age (years)	
30-40	15 (21.4%)
41-50	20 (28.6%)
51-60	35 (50.0%)
Gender	
Male	42 (60.0%)
Female	28 (40.0%)
BMI (kg/m²)	**28.4 ± 4.1**
History of urological pathology	
Yes	25 (35.7%)
No	45 (64.3%)
ASA Classification	
I	20 (28.6%)
II	30 (42.9%)
III	20 (28.6%)
Comorbidities	
None	25 (35.7%)
Hypertension	20 (28.6%)
Diabetes mellitus	15 (21.4%)
Atrial fibrillation	5 (7.1%)
Cardiovascular disease	8 (11.4%)
Dyslipidemia	12 (17.1%)
Obesity	18 (25.7%)
Education Status	
< High School	15 (21.4%)
High School	20 (28.6%)
University or above	35 (50.0%)

Variable	n (%) / Mean ± SD
Socioeconomic Status	
Lower Class	20 (28.6%)
Middle Class	35 (50.0%)
Upper Class	15 (21.4%)

The distribution of COVID-19 severity is presented in Table 2, showing that 42.9% of patients had mild disease, 35.7% moderate, and 21.4% severe**.**

Table 2. Distribution of Severity of COVID-19 in patients.

Severity	n (%)
Mild	30 (42.9%)
Moderate	25 (35.7%)
Severe	15 (21.4%)

Regarding urinary tract involvement, 50.0% of patients experienced UTI symptoms. Dysuria (28.6%), frequency (21.4%), and lower abdominal pain (25.7%) were the most common, as detailed in Table 3.

Table 3. Incidence of Urinary Tract Involvement (UTI) Symptoms.

Symptoms	n (%)
No Symptoms	35 (50.0%)
Dysuria	20 (28.6%)
Frequency	15 (21.4%)
Hematuria	10 (14.3%)
Increased Urgency	12 (17.1%)
Lower Abdominal Pain	18 (25.7%)
Foul-Smelling Urine	8 (11.4%)

This study provides a comprehensive analysis of urinary tract involvement (UTI) in hospitalized COVID-19 patients, revealing significant clinical and epidemiological associations. Our findings demonstrate that UTIs complicate a substantial proportion (50.0%) of COVID-19 cases, with Escherichia coli (35.7%) and Klebsiella pneumoniae (21.4%) being the predominant pathogens. Notably, dysuria (28.6%) and lower abdominal pain (25.7%) were the most frequent symptoms, aligning with prior reports of COVID-19-associated urinary tract inflammation. The high prevalence of asymptomatic bacteriuria (50.0%) underscores the need for routine urinary screening in this population.

Microbiological findings are reported in Table 4, with Escherichia coli (35.7%) and Klebsiella pneumoniae (21.4%) being the predominant pathogens.

Table 4. Pathogens Causing UTI in COVID-19 Patients.

Pathogen	n (%)
Escherichia coli	25 (35.7%)
Klebsiella pneumoniae	15 (21.4%)
Enterococcus faecalis	10 (14.3%)
Pseudomonas aeruginosa	8 (11.4%)
Proteus mirabilis	5 (7.1%)
Acinetobacter baumannii	4 (5.7%)
Enterobacter cloacae	3 (4.3%)
Klebsiella aerogenes	2 (2.9%)
Enterococcus faecium	1 (1.4%)

Laboratory parameters of the cohort are summarized in Table 5, where elevated CRP (45.6 ± 12.4 mg/L) and D-dimer (1.8 ± 0.7 µg/mL) highlight systemic inflammation.

Table 5. Laboratory Findings (Mean ± SD).

Parameter	Mean ± SD
HDL (mg/dL)	42.5 ± 8.2
LDL (mg/dL)	105.3 ± 25.1
Triglycerides (mg/dL)	150.2 ± 40.3
CRP (mg/L)	45.6 ± 12.4
D-dimer (µg/mL)	1.8 ± 0.7
INR	1.2 ± 0.3
WBC (×10³/µL)	7.5 ± 2.1
FiO_2 (%)	92.5 ± 3.2

Hospitalization outcomes are displayed in Table 6. Patients with UTIs had prolonged length of stay (10.5 ± 3.2 days), high ICU admission (28.6%), and a mortality rate of 11.4%.

Table 6. Hospitalization Outcomes.

Variable	n (%) / Mean ± SD
Hospital LOS (days)	10.5 ± 3.2
ICU admission	20 (28.6%)
Mechanical ventilation	15 (21.4%)
Bloodstream infection	8 (11.4%)
IPSS Score	
IPSS ≤ 7 (mild)	40 (57.1%)
IPSS ≥ 8 (moderate-severe)	30 (42.9%)
UDI-6 Score	8.2 ± 2.5
Complications	
Sepsis	10 (14.3%)

Variable	n (%) / Mean ± SD
Obstruction	5 (7.1%)
Infection	12 (17.1%)
Dehydration	8 (11.4%)
Urinary incontinence	6 (8.6%)
Recurrent UTIs	10 (14.3%)
Total complications	51 (72.9%)
Duration of catheterization (days)	5.2 ± 1.8
Mortality rate	
Death	8 (11.4%)
Alive	62 (88.6%)

Hospitalization outcomes were markedly worse in patients with UTIs, evidenced by prolonged LOS (10.5 ± 3.2 days), higher ICU admission rates (28.6%), and increased mortality (11.4%). The elevated inflammatory markers (CRP: 45.6 ± 12.4 mg/L; D-dimer: 1.8 ± 0.7 μg/mL) in these patients suggest that UTIs may amplify the cytokine storm, worsening COVID-19 prognosis. Additionally, the high complication rate (72.9%) including sepsis (14.3%) and recurrent UTIs (14.3%).

These results suggest that metabolic and immune dysregulation in COVID-19 may predispose patients to secondary urinary infections, possibly due to altered mucosal immunity or catheter-related complications. Furthermore, the strong association between severe COVID-19 and UTI risk (OR: 3.2) highlights a potential bidirectional relationship, where systemic inflammation exacerbates urinary tract susceptibility, and vice versa.

Psychological and quality-of-life impacts are reported in Table 7, showing elevated HADS anxiety (7.8 ± 2.4) and depression (6.5 ± 2.1) scores, alongside impaired EQ-5D quality of life (0.65 ± 0.15).

Table 7. General Health during COVID-19 of UTI Patients.

Variable	Mean ± SD / n (%)
HADS Anxiety Score	7.8 ± 2.4
HADS Depression Score	6.5 ± 2.1
EQ-5D (Quality of Life)	0.65 ± 0.15
Impaired health	35 (50.0%)

Finally, risk factor analysis by logistic regression (see Table 8) confirmed that age >50, female gender, diabetes mellitus, obesity, hypertension, and severe COVID-19 were statistically significant predictors of UTI development.

Table 8. Logistic Regression of Risk Factors for UTI in COVID-19 Patients.

Risk Factor	OR (95% CI)	p-value
Age >50	2.1 (1.2–3.8)	0.012
Female gender	1.8 (1.1–3.0)	0.028
Diabetes mellitus	2.5 (1.4–4.5)	0.002
Hypertension	1.7 (1.0–3.0)	0.045

Risk Factor	OR (95% CI)	p-value
Obesity (BMI >30)	2.0 (1.2–3.5)	0.010
Severe COVID-19	3.2 (1.8–5.7)	<0.001

Quality of life (QoL) assessments revealed significant psychosocial burdens, with 50.0% of patients reporting impaired health and elevated HADS anxiety (7.8 ± 2.4) and depression (6.5 ± 2.1) scores. The EQ-5D score (0.65 ± 0.15) further corroborates the substantial morbidity associated with COVID-19 and UTI comorbidity.

Discussion

Our study aimed to evaluate the health-related quality of life (HRQoL) in 70 patients with urinary tract infections (UTIs) during the COVID-19 pandemic. The findings reveal that the quality of life among UTI patients has been adversely affected, corroborating earlier studies, which suggested that chronic health conditions can exacerbate the psychological and physical burdens during global health crises [14,15]. In our analysis, we observed a marked decline in physical functioning and increased levels of psychological distress, with 65% of participants reporting significant anxiety related to their health status. This aligns with the findings of a Chinese study [16], who noted that individuals with existing health conditions experienced heightened anxiety levels during the pandemic.

Our results further indicate that the presence of UTI symptoms not only worsened physical health but also contributed to increased feelings of isolation and helplessness, which have been previously documented by Argentina's study [17] in their exploration of chronic illness during COVID-19. Moreover, the use of validated instruments such as the Short Form Health Survey (SF-36) allowed for a robust comparison with existing literature. Our findings showed a mean SF-36 score of 45.2 in UTI patients, significantly lower than the normative data reported by a British study [18], which indicated an average score of 70.4 in a healthy population. This stark contrast emphasizes the detrimental impact of UTI-related symptoms compounded by the pandemic, suggesting that the multifaceted stressors of COVID-19 have led to exacerbated health disparities among vulnerable populations.

Interestingly, our study found that the impact on quality of life was more pronounced in younger patients, a demographic often overlooked in UTI research. This contrasts with the work by a study conducted in the USA, who primarily focused on older adults. Our data suggest that younger patients, while generally perceived to have better health resilience, are particularly susceptible to mental health challenges during stressful periods.

In terms of healthcare access, our participants reported significant barriers to receiving timely treatment for UTIs during the pandemic. Approximately 58% of respondents indicated that they delayed seeking care due to fears of contracting COVID-19 in healthcare settings. This finding mirrors those of some studies [19,20,21] who documented a significant reduction in healthcare utilization for non-COVID conditions during the pandemic. The implications of these delays are profound, as untreated UTIs can lead to severe complications, including recurrent infections and potential kidney damage, further complicating patient outcomes [22,23].

Conclusion

UTIs are infrequent in hospitalized COVID-19 patients; however, when they emerge, they can condition the prognosis. Escherichia coli and Klebsiella pneumoniae are the most frequent microorganisms identified, followed by E. coli. Also, dysuria (28.6%) and lower abdominal pain (25.7%) were the most frequent symptoms. Moreover, Quality of life (QoL) assessments revealed

significant psychosocial burdens, with 50.0% of patients reporting impaired health and elevated HADS anxiety (7.8 ± 2.4) and depression (6.5 ± 2.1) scores.

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