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RESEARCH ARTICLE

Inpatient Profile Evaluations Regarding a Pediatric Nephrology Unit Pre-Covid-19 and During

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ABSTRACT

Objective: The COVID-19 pandemic has caused a routine non-clinical course due to primary COVID-19 infection and affected non-COVID patients' access to healthcare services. This study aims to evaluate the changes in hospitalization diagnoses of patients admitted to a nephrology unit before and during the COVID-19 pandemic.

Methods: The study evaluates the inpatients admitted between March 2018- 2020 and March 2020-2022 in the Nephrology Unit of Izmir Behçet Uz Pediatrics and Surgery Training and Research Hospital, University of Health Sciences.

Results: This study includes a total of 1,453 patients. Of these patients, 882 were hospitalized in the pre-COVID period, and 571 were hospitalized during the pandemic. Although a significant difference occurs between genders, no significant differences were found in terms of age and length of stay. The most common diagnoses pre-COVID were urinary tract infections (UTI; 40.1%), nephrotic syndrome (NS; 12.9%), chronic kidney diseases (CKDs; 10.3%), and hypertension (HT; 10%). This order after the pandemic was UTI (35.7%), CKDs (20.8%), NS (10.7%), and HT (10.2%). A significant increase occurred regarding the frequency of CKDs post-pandemic ($p = 0.000$) and the frequency of hematuria pre-pandemic ($p = 0.025$).

Conclusions: The study is important for being the only study conducted in the field of pediatric nephrology regarding the changes in pandemic hospitalizations. During the pandemic, hospitalizations of chronic patients increased, and hospitalizations of examination patients decreased due to the postponement of elective conditions. What is noteworthy is the decreased incidence of upper respiratory tract infections (URTI) and Henoch-Schönlein purpura (HSP), which are known to trigger nephrotic syndrome and glomerulonephritis. Another remarkable result is the decreased number of patients with recurrent UTIs. Although a decrease did occur in this group, the frequency of UTIs actually increased in general pediatric applications, which led to the emergence of missed diagnoses pre-pandemic.

Keywords: Pediatric nephrology, COVID-19 pandemic, inpatient profile

INTRODUCTION

A global struggle began during the COVID-19 pandemic that was recognized as a public health emergency. A mild clinical course was generally observed in children, while rare cases were described as exhibiting a serious complication of inflammatory syndrome with multisystem involvement (1).

The COVID-19 pandemic caused a routine non-clinical course in pediatric nephrology patients, both due to the primary COVID-19 infection as well as by affecting non-COVID patients' access to healthcare. Families also postponed bringing their children in for check-ups when necessary. Few studies are found in the literature to have evaluated the effects of the pandemic in this respect. This study aims to evaluate the change in hospitalization diagnoses of patients admitted to a nephrology unit prior to and during the COVID-19 pandemic.

The first case in Türkiye was detected in March 2020, and measures such as closing schools and public places, canceling mass meetings, and physical distance rules were taken to reduce the spread of the disease. Elective health services were postponed in order to prevent transmission and to use the health services capacity efficiently (2,3). The vast majority of healthcare facilities and staff in many countries were dedicated to the care of COVID-19 patients, and available resources were channeled to increase their capacity to isolate and treat patients affected by the pandemic (4,5). Planned works were disrupted among the pediatric population for evaluating and treating the symptoms, treatment modalities, and transitional

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processes of various nephrological diseases (6). Among the planned elective examinations, ultrasonography is commonly needed for evaluating kidneys and the lower urinary tract, as well as for interventional procedures (7). Kidney scintigraphy can be used to obtain comprehensive anatomical and functional information about the kidneys in a minimally invasive manner (8). Many important nephrological examinations affecting the diagnosis and treatment, such as urinary ultrasonography, kidney scintigraphy, and voiding cystourethrography, were postponed. As seen in studies, kidneys form one of the primary target organs of SARS-CoV-2 after the lungs (9). Few studies are found in the literature to have evaluated how patients with nephrological diseases who needed to be admitted to a nephrology unit were affected, the changes in follow-up procedures, and the hospital admission requirements during the pandemic. The experiences, information needs, decision-making, and support needs of pediatric and young adult patients and their parents during this period are also not well known (5).

MATERIALS AND METHOD

The study is a hospital-based retrospective cross-sectional study that evaluates the patients who were hospitalized in the Nephrology Unit of Izmir Dr. Behçet Uz Pediatrics and Surgery Training and Research Hospital of the Health Sciences University. This study includes the patients between the ages of one month and 18 years who were hospitalized in the pediatric nephrology unit, for a total of 1,453 patients. The cases are divided into two groups: Group 1 and Group 2. Group 1 is defined as those hospitalized before the COVID-19 pandemic and Group 2 as those hospitalized during the pandemic. Both groups are compared in terms of age, gender, diagnosis groups, length of stay, and need for additional intervention. The data were accessed from the inpatient files in the medical records; with the cases whose data could not be accessed or were missing being excluded from the study.

Ethics committee approval for this study was obtained from the same hospital under approval number 7650 2022/250 dated 27.10.2022.

Statistical analysis

Statistical analyses were performed using the program IBM SPSS Statistics 21.0 (SPSS, Inc, Chicago, IL, USA). Continuous variables are provided as mean ± standard deviation (*M±SD*) and categorical variables as numbers and percentages. Student's t-test is used for the numerical data, and the chi-square test was used for analyzing the categorical variables to compare pre-pandemic and pandemic patient data. Statistical significance has been set at $p < 0.05$.

RESULTS

Of the 1,453 patients included in this study, 882 (60.7%) were hospitalized pre-COVID (Group 1), and 571 (39.2%) were hospitalized during COVID-19 (Group 2). 48% ($n = 696$) of the patients are female, and 52% ($n = 757$) are male. The distribution of boys and girls is 52% female and 48% male in Group 1 and 41.5% female and 58.5% male in Group 2, which is statistically significant ($p < 0.001$). Age, gender, and length of stay distributions are given in Table 1.

Table 1: Demographic data, length of stay and p values of the patients before and during the pandemic

	Before Pandemic	After Pandemic	P value
Gender (F; female M; male)	459 F (52%) 423 M (48%)	237 F (41.5%) 334 M (58.5%)	P<0.001
Mean age (month)	76.39±66.68	81.32±71.69	P=0.182
Mean length of stay (day)	7.25±7.21	7.26±6.40	P=0.988

The mean age distribution of the patients hospitalized during the pre-pandemic period is 76.39 months ± 66.68 months, and the mean age distribution of the patients hospitalized during the pandemic is 81.32 months ± 71.69 months. No significant difference occurred between patients hospitalized in either period in terms of age distribution ($p = 0.182$).

When looking at the patients' hospitalization stays, the mean hospitalization period for the patients in Group 1 is 7.25 days ± 7.2 days, and the hospitalization period for the patients in Group 2 is 7.26 ± 6.4 days. No difference is found between the patients hospitalized in either periods in terms of length of stay ($p = 0.988$).

Although a significant difference between the two periods did occur with regard to gender, no significant difference was found for age or length of stay.

When looking at the diagnosis distribution for all patients, the pre-pandemic patients were seen to be hospitalized with 17 different diagnoses, and the patients hospitalized during the pandemic were seen to be hospitalized with 16 different diagnoses. Three types of diagnoses occurred in the pre-pandemic period that did not result in hospitalization during the pandemic. These are: hematuria and proteinuria ($n = 4$), Alport syndrome ($n = 3$), and solid lesion in the bladder ($n = 1$).

Urinary tract infections (UTIs) were the most common hospitalization diagnosis in both patient groups. While UTIs constituted 40.1% of the cases in Group 1 ($n = 354$), they constituted 35.7% of the cases in Group 2 ($n = 204$). Although the difference is not significant, a decrease had occurred in the number of UTIs during the pandemic.

After UTIs, the most common pre-COVID hospitalization diagnoses were nephrotic syndrome (NS; 12.9%), chronic kidney diseases (CKDs; 10.3%), and hypertension (HT; 10%). During the pandemic, this ranking was CKDs (20.8%), NS (10.7%), and HT (10.2%).

Two types of diagnoses had significant differences between Groups 1 and 2. CKD diagnoses increased two-fold in Group 2. While hematuria made up 4.8% of the diagnosis in Group 1, it was only 2.5% in Group 2 (Table 2). The number of patients

hospitalized with acute kidney injury was similar in both groups, but the percentage was higher in Group 2, even if the difference is not significant. The percentage of patients with hypertension remained the same, with Group 2 having a slight increase. A 46% decrease was observed in cases of nephrotic syndrome during the pandemic period, while a 75% decrease was detected in cases of acute glomerulonephritis. The number of Henoch-Schönlein purpura (HSP) patients fell by more than half. The number of patients with proteinuria was also reduced by half, while the number of patients with hematuria dropped by 33% . The percentages for tubular patients are similar, but a marked reduction in the number did occur (40%). During the pandemic, the number of patients with stones in the urinary system decreased by 50%. The number of bladder dysfunction cases decreased between 25% to 33% of the number of pre-pandemic cases (Figure 1).

Table 2: Clinical Diagnosis of patients before and during the pandemic

Clinical Diagnosis	Before Pandemic	After Pandemic	P value
Acute kidney injury	31 (3.5%)	32 (5.6%)	0.056
Chronic renal disease	91 (10.3%)	119 (20.8%)	0.000
Hypertension	88 (10%)	58 (10.2%)	0.911
Nephrotic syndrome	114 (12.9%)	61 (10.7%)	0.200
Akute glomerulonephritis	16 (1.8%)	4 (0.7%)	0.075
Hemolytic uremic syndrome(HUS)	11 (1.2%)	12 (2.1%)	0.203
Henoch-Schonlein purpura (HSP)	47 (5.3%)	20 (3.5%)	0.105
Systemic lupus erythematosus (SLE)	-	2 (0.4%)	0.079
Proteinuria	26 (2.9%)	13 (2.3%)	0.439
Hematuria	42 (4.8%)	14 (2.5%)	0.025
Proteinuria+Hematuria	4 (0.5%)	-	0.107
Alport syndrome	3 (0.3%)	-	0.163
Tubulary diseases	32 (3.6%)	19 (3.3%)	0.761
Cystic renal diseases	-	2 (0.4%)	0.079
Ureteropelvic junction obstruction (UPJO)	2 (0.2%)	4 (0.7%)	0.169
Nefrolithiasis	8 (0.9%)	4 (0.7%)	0.671
Bladder dysfunctions	12 (1.4%)	3 (0.5%)	0.124
Urinary tract disease (UTIs)	354 (40.1%)	204 (35.7%)	0.091
Solid lesion of bladder	1 (0.1%)	-	0.421

DISCUSSION

Coronaviruses (CoV) can cause mild clinical infections that are common in the community, self-limiting, and from which people rapidly recover, such as the common cold. However, they also lead to more serious clinical manifestations such as

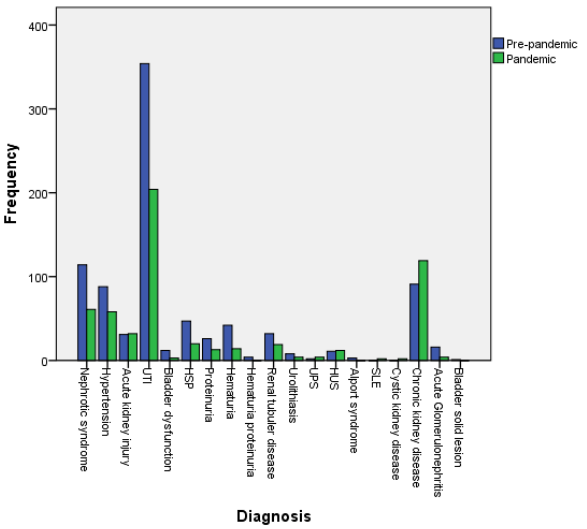

Figure 1: Variation of diagnosis before and during the pandemic

Middle East respiratory syndrome (MERS) and severe acute respiratory syndrome, (SARS) (10).

The COVID-19 pandemic has affected both the number and the inpatient profiles of patients applying to hospitals and who've been monitored in wards all over the world. Various studies have been published globally on this subject (11).

A significant decrease was observed in acute gastroenteritis (AGE), thanks to the reduction of external nutrition, more careful washing and storage of food, and more attention to cleaning rules, especially hand washing. Also, another significant decrease was observed in upper respiratory tract infections (URTIs) transmitted by droplets as a result of mask use, individuals' observance of social distance rules, and online education (12).

A study conducted in Spain observed that during the first wave of the COVID-19 pandemic, a 68% decrease had occurred in the total number of patients admitted to emergency services. In addition, a significant decrease of 33% was observed in the total number of hospitalized patients (13). Similarly, the current study and its total of 1,453 patients in the Health Sciences University Izmir Dr. Behçet Uz Pediatrics and Surgery Nephrology Clinic found the number of inpatients pre-COVID to have been 882, while this number decreased by 35% to 571 during the pandemic.

Dann et al.'s study reported that, during the epidemic, parents did not go to the hospital immediately due to the increased surveillance of their children and the fear of being contaminated by COVID, thus a significant decrease was observed in admissions to emergency services (14).

Another study reported the numerical and distributional changes in the hospitalization diagnoses of patients admitted to general pediatric services before and during the COVID-19 pandemic. That study is unique to Türkiye with regard to pediatrics. While the number of patients hospitalized with a

diagnosis of pneumonia, HSP, arthritis, seizures, or abdominal pain decreased during the COVID-19 pandemic, an increase was reported regarding the number of patients hospitalized with the diagnosis of a urinary tract infection (15).

Although a significant difference was found between genders in the current study, no significant difference was found in terms of age or length of stay between the two groups. In the literature, the mean age of patients admitted to a general pediatric unit was found to be higher before the pandemic (15). This is explained by the fact that families who think that younger children have less developed immune systems and thus don't bring their young children to hospitals unless necessary. Similar studies in the literature have shown risk factors to be present for a more severe course of COVID-19 infection in children who have an underlying lung disease or immunodeficiency (16).

The study conducted by Alataş et al. with 45,857 emergency patients observed an increase in the rate of hospitalization compared to pre-COVID, although a decrease had occurred in the number of patients applying to emergency departments during the COVID-19 pandemic. In 2020 in particular, an increase in COVID-19-related hospitalizations had occurred, but interestingly the increase in hospitalizations matched with an increased diagnosis of acute coronary syndrome. Admissions due to renal failure were found to be 4.6%, and this was said to not constitute a significant rate (17). Meanwhile, the current study found a significant increase in cases where patients were admitted with the diagnoses of both acute failure and chronic kidney disease. This difference between the two studies is thought to be due to the fact that Alataş et al.'s study was conducted with adult patients.

One study reported that hospitalizations with a diagnosis of HSP were observed to have decreased significantly during the pandemic (15). The current study also observed a 57.4% decrease in HSP cases. As for the reason, HSP, being a systemic vasculitic syndrome mostly seen in children, occurs mainly after an upper respiratory tract infection, and children during the pandemic had a lower incidence of upper respiratory tract infections as a result of the precautions taken.

Birkmeyer et al. reported the analysis of 1,056,951 cases from 201 hospitals in 36 states in the USA. At the beginning of pandemic, they found a significant decrease in all non-COVID cases. Then, although they found that admissions for pancreatitis, alcohol-related conditions, and diabetes had returned to baseline levels, admissions for urinary tract infections had remained substantially depressed (-24.3%; $p < 0.05$), (18). While the current study had 354 hospitalizations for UTIs pre-COVID, this number decreased to 204 during the pandemic, a decrease of 42.8%. Because the current study was conducted in a nephrology unit, the inpatient profiles predominantly involve chronic nephrology patients. This group of patients and their families are knowledgeable and experienced with regard to preventing and taking precautions against UTIs. During the pandemic, most patients were at home and under the closer supervision of their parents. Therefore, this study attributes the decrease in UTI cases to this. One study conducted on the General Pediatrics Service of the current study's hospital on the same patient population found the opposite result, with an increase in the number of UTI cases occurring during the pandemic. This situation is explained with the following reasons:

- Most of the UTIs in the General Pediatrics Service are newly diagnosed, and concern about COVID increased the frequency of admissions and diagnoses during the pandemic.

- The fact that children were not using public toilets when outside may have caused urine to accumulate in the bladder and increase the risk of infection.

- The lifestyle changes that occurred with the pandemic, and the long time spans children spend in front of digital screens causes a delay in urination or inability to empty completely as a result of rapid urination.

- The change in eating habits and a more sedentary lifestyle have led to an increase in the frequency of constipation. This in itself is a cause of UTIs.

- The decrease in elective circumcision surgeries during the pandemic may have resulted in an increase in UTIs in boys.

- The reason this study considers to be the most important among the above reasons is that cases with mild fever before the epidemic were monitored and managed by the family without going to a hospital, but during the pandemic, these cases were admitted to the hospital in case the cause of the fever was COVID, as well as causing an increase in the diagnosis of UTIs.

The significant increase in hospitalization regarding patients diagnosed with CKDs during the pandemic in this study can be explained by the fact that chronic patients in the nephrological patient group were more affected by the pandemic than those in other branches. The decrease in cases with a diagnosis of hematuria after the pandemic can be explained by the postponement of patients who were to undergo further examination in terms of the cause of hematuria during the pandemic.

CONCLUSION

This study is important for being the only study conducted in the field of pediatric nephrology regarding changes in pre-pandemic hospitalizations with those during the COVID-19 pandemic. During the pandemic, hospitalizations increased for chronic patients, and hospitalizations for patient examinations decreased due to the postponement of elective conditions. What is noteworthy is the decreased incidence of upper respiratory tract infections (URTI) and HSP, as nephrotic syndrome and glomerulonephritis are known to be triggered by them. Another remarkable result is the decreased number of patients with recurrent UTIs. Although a decrease did occur in this group, the frequency of UTIs increased in general pediatric

applications, which led to the emergence of missed diagnoses pre-pandemic.

Ethics Committee Approval: This study was approved by the ethics committee of Dr. Behcet Uz Pediatric Diseases and Surgery Training and Research Hospital, approval number 7650 2022/250 dated 27.10.2022.

Informed Consent: Written consent was obtained from the participants.

Peer Review: Externally peer-reviewed.

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