

# Evaluation of endoscopic ureteral stone treatments in the period of decreasing severity of COVID-19 pandemic

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**Abstract.** – **OBJECTIVE:** During the COVID-19 pandemic, people's admissions to the hospital for their current illness were delayed. We aimed to reveal how this situation has affected the endoscopic treatment of ureteral stones.

**PATIENTS AND METHODS:** Patients who were treated for 59 endoscopic ureteral stones in the pre-pandemic period between September 2019 and December 2019, and patients who were treated for 60 endoscopic ureteral stones between January 2022 and April 2022, when the effectiveness of the COVID-19 pandemic decreased, were evaluated in two groups. Pre-pandemic patients were classified as group 1, and patients treated during the period when the effectiveness of the pandemic decreased as group 2. The patients' ages, preoperative laboratory examinations and radiological findings, localization and size of the stones in the ureter, time until the operation, duration of the operation, length of hospital stay, preoperative ES-WL history, complication rates according to the Modified Clavien classification were evaluated. The problems observed in the ureter during the operation were examined separately as edema, polyp formation in the ureter, distal ureteral stenosis, and adhesion of the stone to the mucosa.

**RESULTS:** In group 1, 9 patients were female and 50 were male, with a mean age of  $42.19 \pm 14.06$  years; in group 2, 17 patients were female and 43 were male, with a mean age of  $45.23 \pm 12.20$  years. The stone size was found to be higher in group 2. Group 1 had more patients who did not develop complications in the Modified Clavien classification, and the proportion of group 2 patients in the grade I-II-III A-III B classification was higher. Considering the waiting time before hospitalization, it was determined that the rate of group 2 patients was higher in those with a waiting period of 31-60 days (33.9-48.3%) and  $\geq 60$  days (10.2-21.7%). Except for the development of ureteral polyps, all other problems rate were found to be higher in group 2 patients compared to group 1.

**CONCLUSIONS:** During the COVID-19 pandemic, there was a delay in the treatment of ure-

teral stones in patients. In the next period, as a result of this delay, negative effects on the ureteral mucosa were detected and, accordingly, an increase in the complication rates of the operation was observed.

*Key Words:*

COVID-19 pandemic, Complication rates, Ureteral stones, Endoscopic treatment.

## Introduction

The COVID-19 pandemic, which causes many health problems such as acute respiratory syndrome, has seriously affected the whole world<sup>1</sup>. In addition to treating patients infected with COVID-19, all health institutions have tried to prevent transmission and simultaneously treat other non-COVID-19 non-deferrable health problems. Along with all these difficulties, patients were reluctant to go to hospitals for their other existing diseases due to the pandemic. For patients admitted to the hospital, the European Association of Urology (EAU) has made recommendations on patient priorities during the COVID-19 pandemic. Accordingly, the patient group that may suffer if delayed for more than 6 weeks is included in the 'high priority' patient group, while the patient group with a life-threatening risk is classified as 'urgent'<sup>2</sup>. Life-threatening conditions include kidney failure, severe infection, or solitary kidney obstruction<sup>3</sup>. In patients presenting with renal colic, after pain control is achieved, stone-related obstruction should be removed to prevent possible acute renal failure. In the guidelines, it is recommended to postpone surgical procedures as much as possible during the pandemic, and to provide urinary drainage with a double-J catheter or percutaneous nephrostomy in case of obstruction and/or serious infection<sup>2,4</sup>. We think that as a

result of the patients' hesitation in applying to the hospital, some problems related to stones occur in the ureters over time, making stone surgery difficult and increasing the complication rates in surgery.

## Patients and Methods

Patients who were treated for 59 endoscopic ureteral stones between September and December 2019 before the COVID-19 pandemic and patients who were treated for 60 endoscopic ureteral stones between January and April 2022, the late and more stable period of the pandemic, were evaluated in 2 groups. The patients were evaluated retrospectively. Patients under the age of 17 and patients with a congenital pathology of the ureter and kidney or who had previously undergone endoscopic ureteral stone treatment were not included in the study. The pre-pandemic patients were classified as group 1 and the other group as group 2. In group 1, 9 patients were female and 50 were male, with a mean age of  $42.19 \pm 14.06$  years; in group 2, 17 patients were female and 43 were male, with a mean age of  $45.23 \pm 12.20$  years. Routine blood tests, urine tests and urine cultures were performed before the procedure, direct urinary system graphies and urinary system ultrasonography and, if necessary, computed tomography were applied to the patients.

Stone size was evaluated as the longest dimension in direct urinary system graphy (DUSG). According to the localization of the stone, those located above the sacroiliac joint were considered as upper ureteral stones, those located at the level of the sacroiliac joint were considered as middle ureteral stones, and those between the sacroiliac and ureteral orifice were considered as lower ureteral stones. Patients' age, gender, waiting time until the operation after the stone fell into the ureter, and whether extra Corporeal Shock Wave Lithotripsy (ESWL) was applied before the operation were evaluated. The number, size and localization of ureteral stones, the degree of hydronephrosis formed by the stone in the kidney, the duration of the operation, the length of hospital stay, and the creatinine values before and after the operation were compared. In addition, endoscopic findings of stones in the ureter were evaluated separately as presence of edema in the ureter, presence of polyps, adhesion of the stone to the ureter, and distal ureteral stenosis.

Edema status was evaluated in 3 different classes as normal ureteral mucosa, mild edema where normal irrigation is not sufficient to obtain a clear stone image, and severe edema requiring pressure irrigation for a clear stone image. Stone adhesion to the mucosa can be classified into 3 types as no adhesion, mild adhesion and severe adhesion, and distal ureteral stenosis can be classified as easy passage of the rigid ureterorenoscope (r-URS) into the ureter, distal ureteral stenosis that causes mild resistance, and distal ureteral stenosis that creates severe resistance to the passage of r-URS evaluated in class. Complication rates were made according to the Modified Clavien classification.

## Statistical Analysis

SPSS 25.0 program (IBM Corp., Armonk, NY, USA) was used in the analysis of the data collected within the scope of the research. Mann-Whitney U analysis was used to compare the data of the patients in group 1 and 2, since the data were not suitable for the normal distribution according to the results of the Shapiro-Wilk test applied to the quantitative data. Chi-square analysis was used to compare categorical data between group 1 and 2 patients. In all statistical analyses, a  $p$ -value  $<0.05$  was accepted as the significant level.

## Results

No statistically significant difference was found between group 1 and group 2 patients' in pre- and post-operative creatinine, operative time, hospital stay, pre-operative ESWL values ( $p>0.05$ ), but the stone size of group 2 patients ( $x=8.52$ ) was significantly higher than the stone size of group 1 patients ( $x=7.83$ ;  $p<0.05$ ) (Table I).

In the comparison of edema, polyps, stone adhesion to mucosal and distal ureteral stenosis in group 1 and group 2 patients, it was determined that the presence of polyps in group 1 and 2 patients did not differ statistically ( $p>0.05$ ).

However, there was a statistically significant difference between group 1 and 2 patients ( $p<0.05$ ) in edema, stone adhesion to the mucosa and distal ureteral stenosis (Table II). In case of edema, the rate of group 1 patients without endoscopic findings and mild edema is higher, and the rate of group 2 patients is higher in terms of severe edema requiring pressure irrigation (Figure 1). In case of mucosal stone adhesion, the rate

**Table I.** Comparison of pre- and post-operative creatinine, pre-operative ESWL, stone size, duration of operation, duration of hospitalization values of patients in the pre-pandemic period (Group 1) and the period of reduction of the effect of the pandemic (Group 2).

Variable	Group	N	X	SS	Mean rank	Sum of ranks	U	p
Preoperative creatinine	Group 1	59	0.95	0.26	56.57	3,337.5	1,567.5	.281
	Group 2	60	1.07	0.40	63.38	3,802.5		
Preoperative creatinine	Group 1	59	0.85	0.19	56.34	3,324.0	1,554.0	.250
	Group 2	60	0.91	0.25	63.60	3,816.0		
Stone size	Group 1	59	7.83	4.13	52.96	3,124.5	1,354.5	.026
	Group 2	60	8.52	2.89	66.93	4,015.5		
Surgery time	Group 1	59	37.41	14.00	58.27	3,438.0	1,668.0	.587
	Group 2	60	39.48	16.19	61.70	3,702.0		
Length of hospital stay	Group 1	59	1.61	0.72	58.40	3,445.5	1,675.5	.578
	Group 2	60	1.68	0.75	61.58	3,694.5		
Preoperative ESWL	Group 1	59	0.19	0.39	58.91	3,475.5	1,705.5	.623
	Group 2	60	0.27	0.58	61.08	3,664.5		

**Table II.** Comparison of edema, polyps, mucosal stone adhesion and distal ureteral stenosis in Group 1 and Group 2 patients.

Variable			Group 1	Group 2	Total	Significance
Edema	No endoscopic findings	f %	5 8.5%	2 3.3%	7 5.9%	$\chi^2 = 3.1675$ $p = .000$
	Mild edema with insufficient normal irrigation	f %	47 79.7%	21 35.0%	68 57.1%	
	Severe edema requiring pressure irrigation	f %	7 11.9%	37 61.7%	44 37.0%	
Polyp	No polyps	f %	37 62.7%	28 46.7%	65 54.6%	$\chi^2 = 3.090$ $p = .079$
	Have polyps	f %	22 37.3%	32 53.3%	54 45.4%	
Stone adhesion to the mucosa	No adhesion between stone and ureteral mucosa	f %	21 35.6%	6 10.0%	27 22.7%	$\chi^2 = 16.675$ $p = .000$
	Light adhesion	f %	32 54.2%	33 55.0%	65 54.6%	
	Severe adhesion	f %	6 10.2%	21 35.0%	27 22.7%	
Distal ureteral stenosis	Easy r-URS embed	f %	22 37.3%	2 3.3%	24 20.2%	$\chi^2 = 28.186$ $p = .000$
	Slight resistance to r-URS	f %	35 59.3%	42 70.0%	77 64.7%	
	Strong resistor to place r-URS	f %	2 3.4%	16 26.7%	18 15.1%	

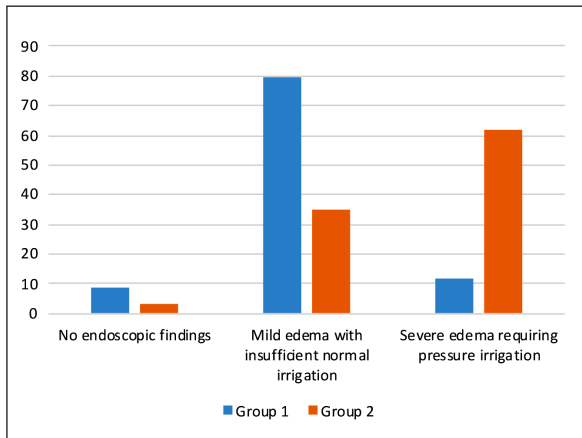


Figure 1. Edema.

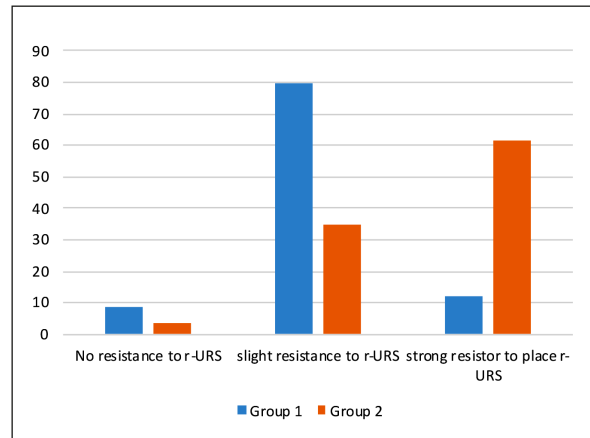


Figure 3. Distal ureteral stenosis.

of non-adhesive and mild adhesions is higher in group 1 patients, and the rate of group 2 is higher in patients with severe adhesions (Figure 2). In case of distal ureteral stenosis, group 1 patients had a higher rate of endoscopy with easy r-URS insertion, and group 2 patients had a higher rate of mild resistance to r-URS and strong resistance to r-URS insertion (Figure 3).

When the stone number, localization, stone side, hydronephrosis grade, pre-hospital waiting time, modified Clavien classification of group 1 and group 2 patients were compared, it was seen that they did not differ statistically ( $p>0.05$ ) (Table III). However, there was a statistically significant difference between group 1 and 2 patients in the Modified Clavien classification in the waiting time before hospitalization ( $p<0.05$ ). It was seen that the rate of patients who did not develop complications in the Modified Clavien

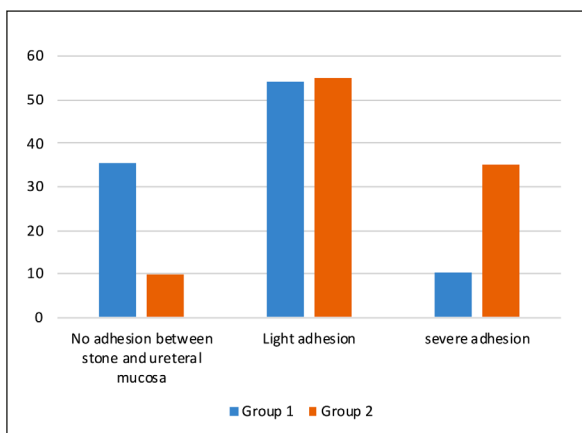


Figure 2. Mucosal stone adhesion.

classification was higher in group 1, (group 1: 37.3%; group 2: 11.7%) and the rate of the grade I-II-III A-III B classification (Figure 4) was higher in group 2.

## Discussion

With the COVID-19 pandemic, there have been delays in the health system all over the world, and the health burden of the pandemic has increased. It has been experienced that the approach in the treatment of obstructive stones is different in patients' behaviors during the pandemic and during the regression of the epidemic. According to this, it was observed that patients with ureteral stones were reluctant to come to the hospital during the pandemic and the centers for treatment decreased. With the decrease in the effectiveness of the coronavirus, the number of patients who applied to the hospital for treatment increased. Urologists also detect some pathologies in the ureter due to this delay in operations and experience some complications during the operation. In this study, we showed the increased complication rate and increased ureteral pathologies due to delays in treatment.

The pandemic is still ongoing, nevertheless the coronavirus is less deadly and people are less worried than before. In previous periods, people were increasingly worried about the fear of being infected, and therefore they were trying to keep themselves away from hospitals even if they had serious conditions, but in this period, they can now apply to hospitals without fear for treatment<sup>5</sup>.

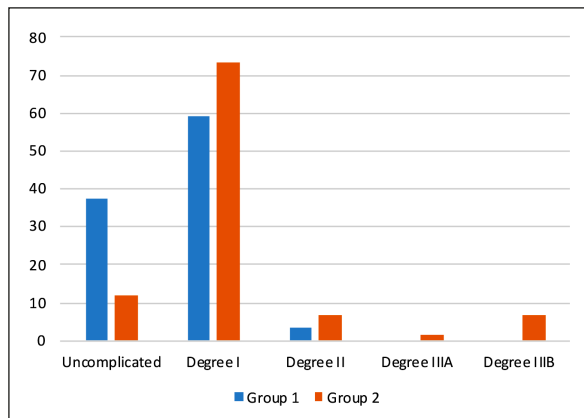
In a recent study<sup>6</sup> on this subject, according to

**Table III.** Comparison of stone number, localization, stone side, hydronephrosis grade, waiting time before hospitalization, modified clavien classification in Group 1 and Group 2 period patients.

Variable			Group 1	Group 2	Total	Significance
Number of stones	1 piece	f %	55 93.2%	50 83.3%	105 88.2%	$\chi^2 = 2.801$ $p = .094$
	2 piece	f %	4 6.8%	10 16.7%	14 11.8%	
Localization	Distal	f %	32 54.2%	34 56.7%	66 55.5%	$\chi^2 = 266$ $p = .875$
	Proximal	f %	15 25.4%	16 26.7%	31 26.1%	
	Medial	f %	12 20.3%	10 16.7%	22 18.5%	
Stone side	Right	f %	27 45.8%	22 36.7%	49 41.2%	$\chi^2 = 2.440$ $p = .295$
	Left	f %	31 52.5%	34 56.7%	65 54.6%	
	Bilateral	f %	1 1.7%	4 6.7%	5 4.2%	
Hydronephrosis grade	Grade 0	f %	15 25.4%	16 26.7%	31 26.1%	$\chi^2 = 2.869$ $p = .412$
	Grade 1	f %	37 62.7%	31 51.7%	68 57.1%	
	Grade 2	f %	7 11.9%	12 20.0%	19 16.0%	
	Grade 3	f %	0 0.0%	1 1.7%	1 0.8%	
Waiting time before admission	0-30 days	f %	33 55.9%	18 30.0%	51 42.9%	$\chi^2 = 8.639$ $p = .013$
	31-60 days	f %	20 33.9%	29 48.3%	49 41.2%	
	≥ 60 days	f %	6 10.2%	13 21.7%	19 16.0%	
Modified clavien classification	Uncomplicated	f %	22 37.3%	7 11.7%	29 24.4%	$\chi^2 = 14.443$ $p = .006$
	Grade 1	f %	35 59.3%	44 73.3%	79 66.4%	
	Grade 2	f %	2 3.4%	4 6.7%	6 5.0%	
	Grade 3A	f %	0 0.0%	1 1.7%	1 0.8%	
	Grade 3D	f %	0 0.0%	4 6.7%	4 3.4%	

the reports of 2 different hospitals, it was determined that the number of patients who underwent URS in the pandemic decreased significantly compared to the same time period one year ago.

In the same study, it was determined that there was a decrease in percutaneous nephrolithotripsy procedure compared to the previous year during the pandemic process.



**Figure 4.** Complication (Modified Clavien Classification).

In a different study<sup>7</sup> examining the problems caused by the decrease in the number of cases during the pandemic period, it was thought that the rate of post-renal acute kidney failure was higher than the literature, and the reason for this was that the patients did not come to the hospital for fear of being infected with the coronavirus. In this study, serum creatinine levels were found to be above the limit value in 11 of the patients (21.1%). However, although only 5.8% of the patients had bilateral ureteral obstruction, the rates of development of postrenal acute renal failure were calculated as higher than those in the literature<sup>7</sup>. In our study, no significant difference was found between the postrenal obstruction, hydronephrosis and creatinine levels of the patients in the two groups, but local complications caused by the stone were found to increase significantly.

In the study of Ecer et al<sup>7</sup>, nephrostomy catheter was inserted in 8 (15.3%) patients and DJ stent was placed in 25 (48%) patients. In the later stages of the epidemic, the use of nephrostomy catheters has increased due to the increasing patient load and the increase in the number of complicated patients<sup>7</sup>.

According to the EAU COVID-19 recommendation guide, the method of decompression is left to the preference of the physician<sup>2</sup>. In a study<sup>8</sup> conducted in Italy, it was determined that the number of DJ stent placement for urinary system stones increased numerically during the COVID-19 pandemic compared to 2019.

Flammia et al<sup>9</sup>, in their study, evaluated patient and urinary stone characteristics, symptoms and complications at the time of admission, diagnosis and treatment approaches, hospitalization

time in 2 different time periods. In this study, there was no significant change in the number of first responders for urinary stone emergencies independent of COVID-19 infection (44 cases in the non-COVID-19 period, 36 cases in the COVID-19 period). Significantly higher serum creatinine levels ( $p=0.026$ ) were detected in patients presenting during the COVID-19 period compared to a non-COVID-19 period<sup>9</sup>. These data suggested to the authors that there is a delay in patients' admission to the hospital in relation to the pandemic. However, there was no significant difference in complication rates due to the COVID-19 pandemic, urinary stone diameter, or degree of hydronephrosis<sup>10</sup>. In our study, similar to these studies, stone ratio, diameter and hydronephrosis did not differ significantly and showed similarities with the literature. In the same study<sup>9</sup>, while the higher upper ureter ratio and lower distal region and stone position differed significantly in the COVID-19 period, no significant difference was found in terms of stone location in our study.

Endoscopic findings in the ureter due to ureteral stones were classified by the SMART study by Hamamoto et al<sup>11</sup>. To reveal how long the stone remains in the ureter and its effects in the ureter, mucosa-stone adherence was reported as 98 days with a prediction rate of 78%, and risk factors for distal ureteral stenosis as 34 days with a prediction rate of 72%. It was stated<sup>11</sup> that appropriate intervention should be performed around 34 days from the onset of the symptom, and if it exceeds 98 days, the operation should be planned assuming the presence of mucosa-stone adherence. We reported the endoscopic findings in the ureter due to stones similar to the SMART classification, and a statistically significant difference was found between the two groups in terms of edema, stone adhesion to the mucosa, and distal ureteral stenosis. Group 2 with significantly longer time from symptom onset to operation had a higher proportion of patients with severe edema requiring pressure irrigation, severe stone adhesion to the mucosa, and distal ureteral stricture with strong resistance to r-URS.

In the literature, there are many studies<sup>12-14</sup> showing a lower stone-free rate and higher intraoperative complication rate in the URS procedure for stones embedded in the mucosa than for non-adherent stones. We think that the high complication rate in group 2 in our study is also related to the high rate of ureteral pathologies, such as the adhesion of the stones to the mucosa, in accordance with the literature.

## Conclusions

In a period in which the severity of the pandemic decreased, the effects of the pandemic on patients are still continuing, although not as before. However, in this period, although there are still delays for the existing diseases of the patients, their applications to the hospital are increasing. Depending on these delays, the pathologies caused by ureteral stones in the ureter and the complications experienced in the operation increase. For this reason, anticipating the problems that may be encountered in delayed cases and being prepared for the operation may cause some reduction in the complication rates.

### Conflict of Interest

The Authors declare that they have no conflict of interests.

### Ethics Approval

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethics Committee Approval was obtained from From Malatya Turgut Ozal University Clinical Research Ethics Committee (Approval no. 2022/38).

### Informed Consent

The patients were evaluated retrospectively; therefore the informed consent is not applicable.

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### Authors' Contribution

Conception and design: Buğday MS; Acquisition of data: Buğday MS, Çakmak BS, Çiçek R; Analysis and interpretation of data: Buğday MS, Çakmak BS, Çiçek R; Drafting the article: Buğday MS; Supervision: Buğday MS; Validation and final approval: All authors.

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