



## Research Article

# Ureterorenoscopic Treatment of Distal Ureteral Stones in Morbidly Obese Patients

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### Abstract

**Objectives:** This study aims to analyze the outcomes of morbidly obese patients who underwent ureterorenoscopy in the treatment of distal ureteral stones.

**Methods:** The data of morbidly obese patients (>18 years of age) who underwent ureterorenoscopy for distal ureteral stones were examined retrospectively. Patients' demographic data, stone size, hydronephrosis degree, postoperative stent use, operation time, body mass index (BMI), hospital stay time, complication and stone-free rates were analyzed.

**Results:** The study population included 29 morbidly obese patients (19 males and 10 females) with a mean age of  $50.02 \pm 14.1$  years. The average stone size was  $28.58 \pm 8.55$  mm. The mean operation time was  $73.24 \pm 20.2$  minutes, and the mean hospital stay was  $1.65 \pm 1.14$  days. We found the success rate to be 93.1%. Postoperative follow-up revealed urinary tract infection in one patient, and severe colic pain in two patients. Four patients had hematuria lasting less than 24 hours and requiring no blood transfusion. There was no major complication causing morbidity or mortality in any patient.

**Conclusion:** Ureterorenoscopy is an effective treatment modality for the treatment of distal ureteral stones in patients with morbid obesity.

**Keywords:** Distal ureteral, ureterorenoscopy, morbid obesity, stone

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Urinary stone disease (USD) is the third most common pathology in daily urological practices following infections and prostatic diseases.<sup>[1]</sup> It is an important public health problem in human history since ancient times. Despite this old history, its etiology and pathogenesis have still not been fully resolved. Many factors such as gender, age, genetics, occupation, nutritional status, climate and socioeconomic conditions of the continent are blamed in the etiology.<sup>[2]</sup> A number of previous studies evaluating the prevalence of USD revealed that it varies highly from one society to another. Nephrolithiasis affects approximately 10% of the populations living in western countries.<sup>[3]</sup> Various analyzes were carried out on the European continent.

One of them is a large series study examining the prevalence of USD in Italy. It was reported that the diagnosis of urolithiasis was made in 10.1% of males and 5.8% of females in the study.<sup>[4]</sup> Another study found that 5.5% of males and 4% of females living in Germany had a history of one or more USDs.<sup>[5]</sup> In a similar study evaluating the incidence of USD in French society, its prevalence was found to be between 8.0% and 8.9%.<sup>[6]</sup> In Asia, it is predicted that the population is affected by urolithiasis in the range of 1% to 19.1%.<sup>[7]</sup> As for the USA, the lifetime risk of stone formation is 12% for males and 6% for females.<sup>[8]</sup> According to recent studies conducted in our country, the annual overall prevalence of USD is 14.8%.<sup>[9]</sup> Uluocak et al.<sup>[2]</sup> reported the annual

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prevalence of USD to be 11.42% in their study involving 1095 participants in Tokat, the site of the present study.

Obesity is an extremely important health problem, and its incidence has started to be monitored frequently due to the deteriorating eating habits in our century. Body mass index (BMI) of  $\geq 30$  kg/m<sup>2</sup> is defined as obesity, and  $\geq 40$  kg/m<sup>2</sup> is as morbid obesity. According to previous studies, approximately 11.5 million Americans are estimated to be morbidly obese.<sup>[10,11]</sup> In our country, according to the data of the Ministry of Health, the incidence of overweight and obesity are 20.5% in females and 41% in females with an overall rate of 30.3%. Besides, the prevalence of morbid obesity is 2.9%.<sup>[12]</sup> This situation serious problems such as type 2 diabetes, hypertension, heart diseases, and sleep apnea syndrome. In addition, urinary acid, sodium and calcium oxalate excretion increase in obese patients, in conjunction with adipose tissue. Therefore, patients are at increased risk of developing urinary stones.<sup>[10,13]</sup>

Open methods were previously considered to be unrivaled in the surgery of urinary system stones. However, they were associated with high cost and complication rates.<sup>[14]</sup> Nowadays, minimally invasive approaches are preferred in the medical world, especially in the treatment of USD as a result of revolutionary inventions in the field of endourology.<sup>[1]</sup> In this context, ureterorenoscopy is widely used in the treatment of ureteral stones with their high image quality as well as easy and practical application possibilities.<sup>[15]</sup>

This retrospective study aims to evaluate the success and complication rates by analyzing patients with morbid obesity and who were treated with ureterorenoscopy for distal ureteral stones.

## Methods

Data of morbidly obese patients (>18 years of age) who underwent ureteroscopic laser lithotripsy for distal ureteral stones between April 2014 and November 2018 were analyzed retrospectively. Obesity level was determined using BMI that was obtained by dividing the body weight by the square of height measured in centimeters. Patients with a BMI  $\geq 40$  were defined as morbid obese.<sup>[16]</sup> The starting point of the sacroiliac joint was used to determine the levels of ureteral stones. The ureteral stones under this determined point were accepted as distal ureteral stones.<sup>[14]</sup> We excluded the patients who were found to have stones localized in different areas of the urinary system and underwent surgery for these stones. We obtained a detailed medical history of all patients and performed thorough physical examinations.

Routine urine and blood parameters were used in the preoperative analysis. In addition, we used one or more imag-

ing modalities considering the general condition of the patients. Radiological tools used for this purpose were direct urinary tract radiography, ultrasonography, intravenous pyelography and non-contrast computed abdominal tomography.

The urethra and bladder were evaluated in detail by cystourethroscopy as the first step. Subsequently, a guide wire with a hydrophilic tip was advanced to the ureter under visualization. On the other hand, we performed balloon dilatation before ureterorenoscopy in patients with strictures at distal ureter. Finally, we analyzed the ureter in detail with a semi-rigid ureterorenoscope over the guide wire. We used the Lisa Laser Sphinx 60 (Germany) as a lithotripter, and utilized the energy provided by holmium: yttrium-aluminum-garnet (Ho: YAG). Depending on the clinical status of the patients and the stones, we fragmented the stones until they were able to pass spontaneously by using three separate holmium laser probes with a thickness of 272,360 and 450  $\mu$  (energy range: 0.6-1.1 J and 5-10 Hz). Three different ureteroscopes of 4.5/6.5 Fr, 8.0/9.8 Fr, and 8.5/9 Fr (Karl Storz, Germany) were used in this endourologic intervention. The choice of ureteroscope was made depending on the current state of the operating room and the patient. At the end of the procedure, 4.7 Fr double-J ureteral stent was placed in patients with a solitary kidney, ureteral pathology and stone load. All of these procedures were performed under general or spinal anesthesia, in the lithotomy position, at the endourology table, under fluoroscopic control, and under sterile conditions. In addition, we assured that there was no growth in the absolute urine culture and administered first-generation cephalosporin (1g IV) before the procedure.

Medical expulsive therapy is used in many clinics in the treatment of distal ureteral stones in urological practices. There are various treatment modalities in the literature such as non-steroidal anti-inflammatory drugs, steroids, calcium channel blockers, antimuscarinic drugs, phosphodiesterase type 5 inhibitors and alpha blocker agents together with effective hydration.<sup>[14,17]</sup> In this clinical study evaluating morbidly obese patients, we recommended medical expulsive treatment before the procedure considering the high anesthesia risk and the medical expenses of the country.

Our evaluation included the demographic data, stone size, hydronephrosis degree, postoperative stent use, operation time, BMIs, hospital stay, complication and stone-free rate. The patients' data were expressed as mean  $\pm$  standard deviation (minimum and maximum). For the data analysis we used the Statistical Package for the Social Sciences (SPSS) 18.0 software. Patients who did not attend regular follow-

up and did not give consent for use of their data for scientific purposes were excluded from the study. This study is a retrospective analysis of patient records, and prepared in compliance with the Declaration of Helsinki.

## Results

The study included 29 morbidly obese patients, 19 males and 10 females. The mean age of the patients was  $50.02 \pm 14.1$  years and all of them were  $>18$  years of age. Sixteen of the stones were on the right side, nine on the left, and four stones were located bilaterally. Two patients included in the study had solitary kidneys. In 19 patients we observed one stone. Of the remaining patients, six patients had two stones, three patients had three stones and one patient had four stones. Six patients underwent emergency surgery due to anuria and acute renal failure. All patients were evaluated in terms of anesthesia. 20 of the patients were classified as ASA (American Society of Anesthesiologists) 3, while the other was ASA 4. The mean stone size was  $28.58 \pm 8.55$  mm. The mean BMI of all patients was  $43.75 \pm 2.51$  kg/m<sup>2</sup>. A total of nine patients had a history of extracorporeal shock wave lithotripsy (ESWL) in the last one month. In terms of main symptoms of patients to present our clinic, 21 had side pain, six had anuria and two had hematuria. Hydronephrosis was observed in all patients before the intervention. A total of eleven patients had Grade 2 hydronephrosis, seven patients had Grade 1, five patients had Grade 3, and two patients had Grade 4. In addition, grade 2 hydronephrosis was observed in four patients with bilateral ureteral stones in both kidneys. All patients underwent direct urinary tract radiography and ultrasonography. On the other hand, non-contrast computed tomography of the abdomen was accepted as diagnostic radiologic method in 24 patients, while intravenous pyelography was used in others. A total of 10 patients had strictures at distal ureter. Operation was performed simultaneously by applying balloon dilatation. During the ureterorenoscopy, we reached the distal ureteral stones in all patients.

The mean operation time was  $73.24 \pm 20.2$  minutes, and the mean hospital stay was  $1.65 \pm 1.14$  days. Thirty three ureteral units underwent surgical intervention. Of the 29 patients, 27 were completely freed of distal ureteral stones, and the success rate was determined as 93.1%. In the remaining two cases, the main cause of failure was migration of the stone to the kidney during the fragmentation. We placed double-j stents in 21 (72.4%) patients. Solitary kidney, postrenal acute renal failure, ureteral stricture, increased stone load and ureteral edema were noted as the main reasons for double-j stent application. Complications were as follows: two patients had severe colic pain that was

thought to be due to obstruction of the ureteral lumen. Four patients had hematuria that did not require blood transfusion lasting  $<24$  hours. One patient had urinary tract infection. *Escherichia coli* growth was observed in their urine culture. They were hospitalized for five days and received third-generation cephalosporin therapy. None of the patients had any major complications that might lead to morbidity or mortality such as ureteral perforation, ureteral avulsion, urosepsis.

## Discussion

There is an increasing trend in the prevalence of morbid obesity in relation to changing socioeconomic conditions and sedentary lifestyle in our century. Morbidly obese patients experience some metabolic changes. Among them, insulin resistance, hyperinsulinemia, hyperoxaluria, hypocalcemia and hypercalciuria are closely related to urinary stone formation. In urology clinics, there is a significant increase in the number of morbidly obese patients presenting with USD and the rates of surgical intervention.<sup>[18]</sup> Previous studies evaluating the prevalence of urolithiasis and BMI report that 10 to 35% of the patients with BMI  $\geq 30$  had urolithiasis.<sup>[19]</sup> It is estimated that ureteral stones constitute 20% of all urinary stones. 70% of ureteral stones consist of distal ureteral stones. Clinical features of the patient are very important in the treatment of ureteral stones. According to previous clinical studies, approximately 98% of ureteral stones  $<5$  mm, and an average of 53% of ureter stones between 5 and 10 mm can fall spontaneously. On the other hand, distal ureteral stones may cause complications such as complicated urinary tract infection, hydronephrosis and renal dysfunction if they do not leave the urinary tract.<sup>[20]</sup>

Clinicians are faced with many difficulties in the management of USD in morbidly obese patients. They experience the first difficulty during the diagnostic evaluation phase. It is almost impossible to detect non-specific findings of USD by physical examination. Besides, the diagnostic value of radiological evaluations that are almost always applied in USD patients is quite limited. In the ultrasonographic examinations, the actual depth of the insonation and the effectiveness of the sonographic rays are weakened directly related to abnormal fat tissue. As a result, the urinary system is evaluated inadequately. Regarding the use of direct urinary tract graphy, intravenous pyelography and non-contrast computed tomography, the patients are exposed to both high-dose and multiple shots in order to provide an analyzable radiological result. In addition, many clinics do not have a radiological table that is resistant to their high body weights. Similarly, in the treatment of distal ureteral stones in morbidly obese patients, there

are great difficulties compared to those of normal weight distribution.<sup>[21]</sup> There are many different options such as medical expulsive therapy, ESWL, ureteroscopy, open or laparoscopic ureterolithotomy in treatment management.<sup>[17]</sup> In the past, open surgical procedures were considered to have almost no alternative in the treatment of distal ureteral stones. However, these interventions were associated with high cost and long hospital stay. There were also high complication rates following surgery. Today, open surgical approaches are preferred in extremely large impacted stones, and in very limited cases such as complete ureteral avulsion and advanced ureteral perforation. Open surgical approaches, due to metabolic changes in morbidly obese patients, bring many additional problems. One of the most prominent problems the surgeon experiences is the limitation of vision and movement in the surgical field due to the high fat layer. There is also an increased risk of wound infection after surgery secondary to many factors such as increased tension, changes in immune factors and disorders in tissue perfusion.<sup>[22]</sup>

ESWL is a treatment modality commonly used in the treatment of urinary tract stones; however, its role is quite limited. The reason for this is the weight limitation in ESWL equipment in morbidly obese patients, inability to target stones due to inadequate fluoroscopic or sonographic imaging, and decreased effective power due to increased skin distance. There is a very limited number of publications on the subject in the literature.<sup>[23]</sup> In the clinical analysis of the effectiveness of ESWL in morbidly obese patients, Thomas and Cass reported a stone-free rate of 50% in ureteral stones at 3-month follow-up.<sup>[24]</sup> Dede et al.<sup>[25]</sup> reported a 67% success rate for ESWL in the treatment of upper ureteral stones in morbidly obese patients. In our study, nine patients had a history of unsuccessful ESWL. In addition to all these, clinicians prefer endourological methods in distal ureteral stones mostly in the initial planning because of their high success and patient satisfaction rates.<sup>[26]</sup>

The historical development of endourological treatment methods of ureteral stones started with Young. He used a cystoscope in highly dilated ureter in a child patient with ureteral stone. In the following period, 1976 and 1978, ureterorenoscopy started to be used in the urology, as a result of Goodman and Lyon's clinical studies.<sup>[27]</sup> Over the years, advances in the design of ureterorenoscopy and technical developments have led to an increase in the success rates of endoscopic USD treatment and a significant reduction in complications.<sup>[28]</sup> Complications such as hematuria, obstruction, renal colic, fever, urinary tract infection, urinoma, hematoma, stone migration, pyelonephritis, urosepsis, ureter damage and avulsion can be seen.<sup>[29]</sup> Large series studies in the literature demonstrate that the

major complication rate of ureteroscopy is less than 0.1%.<sup>[30]</sup> We observed no major complication in our study; however two patients had transient obstruction in the ureter lumen and four patients had hematuria due to ureteral mucosal damage, and one patient had urinary tract infection. Studies reported from professional health centers in our country revealed that the success rates in the ureteroscopic treatment of distal ureteral stones ranged between 75.7% and 98%.<sup>[31]</sup> There is a limited number of publications on the use of this endourological treatment modality in morbidly obese patients. But, it is seen that high success rates are quite similar compared to individuals of normal weight distribution. Natalin et al.<sup>[32]</sup> reported the initial success rates for distal ureteral stones ranging from 90% to 100% in their studies evaluating the efficacy of ureteroscopy in obese patients. In another study Drăguțescu et al.<sup>[33]</sup> found the success rate of ureteroscopy to be 97.5% in middle and distal ureteral stones in obese patients. Nady et al.<sup>[34]</sup> evaluated 63 patients in their study on the efficacy and safety of semi-rigid ureteroscopy in obese patients and reported a surgical residual rate of 1.6%. Besides, the same study demonstrated that no major complication was observed in any of the patients, and one patient underwent open surgical intervention for the treatment of USDs. Another study by Nguyen and Beli evaluated 48 cases of morbid obesity with USD. They reported that ureteroscopic laser lithotripsy had a stone-free rate of 77.8% after the first attempt.<sup>[35]</sup> In our series, success rate was determined as 93.1%.

Finally, morbidly obese patients have a high risk of encountering a number of anesthetic problems that need to be handled with extreme attention, such as difficult vascular access, difficulty positioning orotracheal tubes due to increased fat stores in the tongue and neck region, and the risk of aspiration.<sup>[23]</sup> In our series, there was no life-threatening complication related to anesthesia.

### Limitations of the Study

A number of potential limitations need to be considered. The main limitations were that the study was a retrospective study and the number of cases was limited. Other limitations worth mentioning are that biochemical analyses of the stones could not be performed due to technical insufficiency, and scopi times and stone-skin distances could not be calculated.

### Conclusion

Our study has led us to conclude that ureterorenoscopy is an effective treatment modality for distal ureteral stones in morbidly obese patients with its low complication and high success rates. However, further randomized and prospective studies are needed to support our data.



## Disclosures

**Ethics Committee Approval:** Approval for this study was granted by the Tokat Province Health Directorate on February 28, 2019 at meeting no. 4, decision no. 9.

**Peer-review:** Externally peer-reviewed.

**Conflict of Interest:** None declared.

**Authorship Contributions:** Concept – E.K., A.E.; Design – E.K., A.E.; Supervision – E.K., A.E.; Materials – E.K., A.E.; Data collection &/or processing – E.K., A.E.; Analysis and/or interpretation – E.K., A.E.; Literature search – E.K., A.E.; Writing – E.K., A.E.; Critical review – E.K., A.E.

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