



Ureteral Balloon Complications in Ureteroscopy

Üreteroskopide Üreteral Balon Komplikasyonları

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ABSTRACT

Aim: Complications of ureteral balloon used in the endoscopic treatment of ureteral stones were investigated.

Material and Method: This retrospective study evaluated patients who underwent ureteral balloon dilatation by a single surgeon between 2015 and 2018 and followed up for at least one year. Intraoperative complications were determined according to the modified Satava complication classification, while postoperative complications were determined according to the Clavien classification. In the postoperative follow-up, patients with a residual stone size of less than 4 mm were considered successful treatment.

Results: A total of 54 patients were included in this investigation. Stones were detected in the kidney in 16 (29.6%) patients and the ureter in 38 (70.4%) patients. The ureteroscope diameters used in those operations were 8.5–11.5 fr., and the ureteral access sheath diameters were 10–12 fr. Balloon dilatation was performed in 20 (37.1%) patients because the ureteral access sheath could not be passed and in 34 (62.9%) patients because the ureteroscopy could not be passed. Successful treatment was achieved in 47 (87.03%) patients. Due to balloon dilatation, intraoperative complications developed in 5 (9.2%) patients. Perforation was observed in 1 (1.85%) patient, lost access and subsequent ureteral stricture in 1 (1.85%) patient, and mucosal injury in 3 (5.55%) cases. General complications (fever, hematuria, calculus, and late ureteral stricture) were reported in 6 (11.1%) patients.

Conclusion: The surgeon's experience does not reduce ureteral balloon complications. There is a need for more studies by experienced surgeons who are well standardized on this subject.

Key words: urolithiasis; dilatation; ureteroscopy; complication

ÖZET

Amaç: Endoskopik üreter taşı tedavisinde kullanılan üreteral balon komplikasyonları araştırıldı.

Materyal ve Metot: 2015–2018 yılları arasında bu konuda deneyimli tek cerrah tarafından üreteral balon dilatasyonu yapılan ve operasyon sonrası en az 1 yıl takibi olan hastalar retrospektif olarak çalışmaya dahil edildi. Operasyon anında gelişen komplikasyonlar modifiye Satava komplikasyon sınıflamasına göre, sonrasında olanlar Clavien sınıflamasına göre belirlendi. Postoperatif takiplerde rezidü taş boyutu <4 mm olan hastalar başarılı tedavi olarak değerlendirildi.

Bulgular: Çalışmaya 54 hasta dahil edildi. Taşlar 16 (%29,6) hastada böbrek içinde 38 (%70,4) hastada üreterde saptandı. Çalışmada kullanılan üreteroskop çapları 8,5–11,5 fr., üreteral access sheath çapları 10–12 fr. olarak belirlendi. 34 (%62,9) hastada üreteroskop, 20 (%37,1) hastada üreteral access sheath geçmediği için balon dilatasyon yapıldı. Çalışmada 47 (%87,03) hastada başarılı tedavi sağlandı. Balon dilatasyona bağlı 5 (%9,2) hastada intraoperatif komplikasyon gelişti. 1 (%1,85) hastada perforasyon, 1 (%1,85) hastada lost access ve sonrasında üreteral darlık ve 3 (%5,55) hastada mukozal yaralanma görüldü. Postoperatif 6 (%11,1) hastada genel komplikasyonlar (ateş, hematüri, taş yolu ve geç dönem üreteral darlık) görüldü.

Sonuç: Üreteral balon komplikasyonlarını cerrahın deneyimi azaltmamaktadır. Bu konuda iyi standardize edilmiş deneyimli cerrahların daha çok çalışmalarına ihtiyaç vardır.

Anahtar kelimeler: üriner taşlar; dilatasyon; üreteroskopi; komplikasyon

Introduction

Ureteroscopic laser lithotripsy (ULL) is a widely used surgical method to treat urinary stones¹. In retrograde procedures, an unforeseen obstacle in many patients is the calibration of the ureteral orifice or the ureter². Dilatation of the ureter with a balloon is a method that allows the passage of instruments to reach the stones. Yet, complications related to the balloon affect many urologists' preference for this technique^{2,3}. There are multicenter researches evaluating the efficacy and safety of balloon dilatation of the ureter. The present study evaluates the effectiveness and reliability of the results of a single surgeon who had experience in this field.

Material and Method

This study adhered to the tenets of the Helsinki Declaration of the World Medical Association and received full approval from the Scientific Research Ethics

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Committee of Agri Ibrahim Cecen University (2021-305). The 2015–2018 period records of a single surgeon (KC), who had previous experience of 40 cases, were reviewed. Patients who underwent ureteral balloon dilatation and had at least 1-year of postoperative follow-up were included in the study retrospectively. Patients with ureteral stricture, upper urinary tract malignancy, or previous abdominal or pelvic radiation were excluded.

Demographic and clinical data were recorded by determining the age, gender, stone number, location and size, previous procedures, use of JJ stent, use of a balloon, duration of surgery, and hospitalization. The endoscopic intervention was started using 1 or 2 guidewires in all procedures. In cases where the instruments failed to reach the stones, urethrography was performed to determine the location and size of the narrow segment. Then, UroMax 18fr. /6 cm (Boston Scientific®) balloon dilator was used in 18 cm H₂O pressure under fluoroscopy; the ureteroscope was withdrawn with the help of imaging; ureteral damage was checked, and the operation continued. Intraoperative complications were determined according to the modified Satava classification, and postoperative complications were determined according to the Clavien classification. The postoperative ureteral stricture was diagnosed by endoscopy and urethrography, performed upon hydronephrosis development. In the postoperative follow-up, patients with a residual stone size of less than 4 mm were considered successful treatment.

Results are given as mean \pm standard deviation (SD). Data were analyzed using IBM SPSS-Statistics 24.0.

Results

Within the study criteria, 54 patients were enrolled. The mean follow-up time was 13 months. 16 (29.6%) of the stones were inside the kidney, 38 (70.4%) were in the ureter, and a JJ stent was used in 54 cases (100%). Demographic and stone characteristics of the patients are given in Table 1. The ureteroscope diameters used in the study were 8.5–11.5 fr., and the ureteral access sheath diameters were 10–12 fr. Balloon dilatation was performed in 20 (37.1%) patients because the ureteral access sheath could not be passed and in 34 (62.9%) patients because the ureteroscope could not be passed. Ureteral balloon usage indications are given in Table 2. In the present study, stone-free status was achieved in 47 (87.03%) patients.

Due to balloon dilatation, intraoperative complications developed in 5 (9.2%) patients. In 1 (1.85%) of these patients, perforation was seen, and open surgical repair was performed. Lost access was seen in 1 (1.85%) patient, the procedure was repeated, but then ureteral stricture developed with minimal hydronephrosis. No progression was detected in the follow-ups, and no additional procedures were required. In 3 (5.55%) patients with mucosal injury, stricture did not develop during follow-up.

In 6 (11.1%) patients and 1 (1.85%) of them had late ureteral stricture due to intraoperative lost access. According to the intraoperative modified Satava classification and postoperative Clavien classification, Complications are given in Tables 3 and 4.

Discussion

Success and complications in endoscopic treatment of ureteral stones depend on many factors. Using stone retrieval devices that prevent stone migration, such as baskets, stone cones, and entrapment increases success⁴. Diameter of ureteroscope and use of ureteral balloon dilator in narrow calibrated and difficult ureters affect success and complications⁵. The presence of patients with previous ureteral stricture or radiotherapy is also a determinant factor. The ureteroscope diameters used in our study were variable; whether stone retrieval catheters were used or not could not be determined. These are the limitations of the present study. On the other hand, conveying the experience and complications of ureteral balloon use by a single experienced surgeon (KC) in this field is a strong aspect of the study.

The use of stone cone, basket, and entrapment also enhances success in ULL^{4,6}. Studies in the literature have reported that the success rates increased from 75–80% to over 90–95% using these instruments^{2–4}. Although the use of stone retrieval catheters was not detected in our study, the success rate was 87.3%, in line with the literature.

The incidence of the difficult ureter in ULL has been reported as 8–11%^{5,7,8}. Huffman and Bagley's study on the use of ureteral balloon in 122 patients said that ureteral perforation developed in 1 patient, but stricture did not develop afterward⁹. The study by Nicholas J. Kuntz et al. determined intraoperative complications as 5% and postoperative as 11%⁷. Among 155 patients included in their research,

Table 1. The characteristics of the patients and stones (n/%)

Number of patients (n)	54
Age (mean, years \pm SD)	39.26 \pm 14.02
Male:female ratio	22:32
Stone size (mm ²)	77.17 \pm 21.10
Stone location (n / %)	
Proximal ureter	4/7.4
Middle ureter	11/24.2
Distal ureter	23/42.5
Intrarenal	16/29.6
Operation time (munite)	27.75 \pm 6.58
Duration of hospitalization (day)	1.32 \pm 0.67

Table 2. Indications for ureteral balloon dilation (n / %)

Failure to place access sheath	20/37.1
Failure to pass ureteroscope	34/62.9
Tight ureteral orifice	44/81.4
Tortuous ureter	4/7.45
Not specified	6/11.1

Table 3. Intraoperative complications by modified Satava classification (n/%)

Satava 1	
Mucosal splitting/tear	3/5.55
Satava 2	
Perforation	1/1.85
Lost access	1/1.85

Table 4. Postoperative complications by Clavien grade (n/%)

Clavien 2	
Fever	3/5.55
Clavien 3b	
Excessive hematuria	1/1.85
Steinstrasse	1/1.85
Ureteral stricture	1/1.85

ureteral perforation was observed in 3 (1.9%) patients and lost access in 1 (0.64%) patient. Nonetheless, this was a multicenter study. The data of the single experienced surgeon in our examination revealed a perforation in 1 patient (1.85%), and there was no stricture development after open repair. In 1 (1.85%) of the patients, stricture developed due to lost access, but hydronephrosis did not increase in the follow-ups. Most

of the general complications were fever, hematuria, etc., related to ULL, and the ratios were similar. In a study on 9600 patients, the use of a ureteral balloon was 20–40%, and intraoperative complications were reported as 3.8–7% and postoperative complications as 2.5–4.6%¹⁰. However, in many studies, the rates are different because the complications cannot be fully standardized. For instance, complications such as mucosal injuries and calculus were not included, and classification was not used. In our analysis, the use and standardization of the Satava and Clavien classifications revealed the complication rate as 11.1%. Not but what, in our study, all cases were difficult ureters requiring a ureteral balloon.

In difficult ureters, a double j stent, which is an alternative to ureteral balloons, can be placed and waited for 2–3 weeks^{2,3,5}. In particular, in difficult ureters, some studies have reported 5% stricture in ULL operations without a ureteral balloon^{5,11}. Results in multicenter, multi-surgeon studies may be misleading as the instruments used cannot be standardized, and the learning curves of the surgeons are not known. Complications, especially perforation and strictures, are somewhat more expected in difficult ureters. In our case, ureteral strictures developed in 1 (1.85%) patient, which did not affect kidney functions. Even in the hands of experienced surgeons, using a ureteral balloon in difficult ureters does not seem to reduce complications.

The ureteroscope diameters used in our study were variable; whether stone retravel catheters were used or not could not be determined. On the other hand, conveying the experience and complications of ureteral balloon use by a single experienced surgeon (KC) in this field is a strong aspect of the study. The surgeon in our study had a balloon dilator learning curve of 40 cases. This learning curve may be insufficient. Nevertheless, having a certain experience did not significantly reduce complications. The fact that there were 54 patients in the study is another limitation, and there is a need for standardized studies on this subject with a higher number of patients.

Conclusion

The surgeon's experience (previous experience of 40 cases) does not reduce ureteral balloon complications compared to current literature. There is a need for more studies by experienced surgeons who are well standardized on this subject.

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