Treatment of renal lithiasis with single-use ureteroscope Uscope 3022

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ABSTRACT

IFlexible ureteroscopes have come a long way from the first generation of analog devices to the latest digital technologies that offer increased flexibility and reliability. Moreover, until recently, ureteroscopy could only be performed using reusable ureteroscopes. Disposable flexible ureteroscopes were developed as an alternative to reusable ureteroscopes, which had the problem of damage after multiple uses, special equipment for sterilization, and the cost of repairs. The purpose of this study was to analyze the effectiveness and safety of Pusen Uscope UE 3022. A randomized prospective study was performed in the Urology department of „Saint John" Clinical Emergency Hospital between 2021 and 2023, using the Pusen Uscope 3022 single-use flexible ureteroscope. A total number of 100 patients met the inclusion criteria. The patients were analyzed in three groups: group I - stone size <10 mm, group II - 10-20 mm, group III 20-40 mm. The success rate in the first group was 100% after 2 procedures, in group II the success rate after the first procedure was 88.2%, 91.2% after the second procedure and 94.1% after the third procedure. In the third group the success rate was 75% after the first procedure, 83.3% after the second procedure and 91.7% after the third procedure.A total of 113 procedures were performed with an overall success rate of 90% after one procedure, 95% after two procedures, 97% after three procedures. This study demonstrated that the Pusen Uscope3022 disposable flexible digital ureteroscope represents a viable alternative in the flexible endoscopic treatment of kidney stones, demonstrating good safety and efficacy.

Keywords: flexible ureteroscopy, single-use ureteroscopy, Pusen Uscope UE 3022

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Introduction

Flexible ureteroscopes have come a long way from the first generation of analog devices to the latest digital technologies that offer increased flexibility and reliability. In recent years, fURS have become the most used treatment methods for kidney stones ≤ 2 cm due to their minimally invasive characteristics and short learning curve [1, 2, 3].

Moreover, until recently, ureteroscopy could only be performed using reusable ureteroscopes [4]. A large number of surgeries may decrease the performance of the reusable ureteroscope for subsequent procedures [5].

Disposable flexible ureteroscopes were developed as an alternative to reusable ureteroscopes, which had the problem of damage after multiple uses, special equipment for sterilization, and the cost of repairs. Some disposable ureteroscopes have similar features to reusable flexible ureteroscopes, and others have even more advanced features. One of the most famous and used ureteroscopes is the Uscope 3022. The purpose of this study was to analyze the effectiveness and safety of Pusen Uscope UE 3022.

Material and method

A randomized prospective study was carried out in the Urology department of„Saint John"Clinical Emergency Hospital between 2021 and 2023, using the Pusen Uscope 3022 single-use flexible ureteroscope. A total number of 111 patients with single kidney stones were included, of which 100 patients met the inclusion criteria - age older than 18 years, sterile urine culture or patient with 72 hours of antibiotic treatment prior to the intervention, single kidney stone identified by ultrasound or RRVS.

A complete blood and urine analysis was performed, following the following parameters: blood count, urea, creatinine, blood sugar, urine ultrasound, UIV, RRVs, CT, complete urine exam and urine culture.

If a patient had a positive urine culture, he was treated with antibiotic according to the antibiogram and rescheduled for a later procedure. Each patient received prophylactic antibiotic therapy according to the EAU Guidelines. The patients were analyzed in three groups according to the size of the kidney stones: group I with stone size <10 mm, group II with stone size between 10-20 mm, group III with stone size > 20 mm but not greater than 40 mm.
Patient groups:

Stone dimensions in Group I	Stone dimensions in Group II	Stone dimensions in Group III
<10 mm	10-20 mm	20 - 40 mm

Table I. The division of patients into groups according to the stone size

On the first postoperative day, all patients had an X-ray, and one month postoperatively they underwent ultrasound or CT with a low radiation dose. Residual lithiasis and stone-free rate were thus determined. Stone-free status was defined in an asymptomatic patient with no signs of infection, no obstructive lithiasis or fragments smaller than 3 mm.

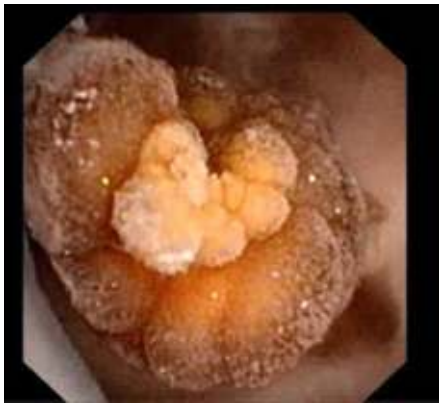


Figure 1 Stone fixed in the renal papilla undergoing fragmentation

The PUSEN Uscope 3022 model was used, which is a single-use flexible digital ureteroscope with a design similar to reusable ureteroscopes. It has an ergonomic plastic handle and an integrated fixed camera that is connected using a cable to its own CMOS digital image touch screen monitor or alternatively, it can be coupled to an operating theater screen via DVI connection.
The image features high resolution 1080p with a limited runtime of 4 hours. Lithotripsy was performed with a Dornier Medilas H Solvo 30W laser. Laser settings also influence retropulsion, which could affect the effectiveness of lithotripsy, increase operative time, and push ureteral stones into the renal pelvis. For dusting mode we used low energy (about 0.5J) and high frequency (about 17Hz), for popcorn mode we used high energy (>1J) and medium frequency (about 10Hz), and for fragmentation mode high energy (> 1J) and low frequency (<10Hz).



Figure 2,3. Laser fragmentation

In group I, most of the stones were located at the renal pelvis and upper calyx level (28 and 13 patients respectively) and at the middle and lower calyx level in the case of 7 and 6 patients respectively. In group II, most patients also had stones located in the pelvis and upper calyx (18, respectively 7 patients) and only 5 in the middle calyx and 4 in the lower one. In group III, 8 patients had pelvic stones and 2 each in the middle and lower calyx. We had no patients with upper calyx stones in this group.

Results

The results were evaluated using the obtained success rates and the Clavien-Dindo system. In the first group of 54 patients, after one procedure, a success rate of 94% resulted, which represented the complete resolution of a number of 51 patients. For the remaining 3 patients, a second flexible ureteroscopy intervention was performed, subsequently obtaining the success rate for them as well. Thus, 57 procedures were performed in the first batch.

In the second group, a total number of 34 flexible ureteroscopies were performed, achieving a success rate status of 88.2%, representing 34 completely resolved patients. Thus, 4 patients needed a second intervention, but only 3 of them returned to the second flexible ureteroscopy. After the second procedure the stone-free increased to 91.2%, another 2 patients requiring endoscopic reintervention for the third time with a 94.1% success rate. Thus, the second batch required the performance of 39 procedures.

In Group III, a total number of 12 flexible ureteroscopies were initially performed with a stone free rate of 75%, representing 9 patients. The other patients required a second endoscopic procedure reaching stone-free status in 83.3% of cases. Only 2 patients required a third flexible ureteroscopic intervention with a success rate of 91.7%. Thus, a total of 113 procedures were performed with an overall success rate of 90% after one procedure, 95% after two procedures, 97% after three procedures.

The success rate in the first group was 100% after 2 procedures in terms of stone size – with the smallest sizes of the three groups, in group II and III with larger calculus sizes, 3 procedures were needed, obtaining a rate of success increasing from one procedure to another as follows: in group II the success rate after the first procedure was 88.2%, 91.2% after the second and 94.1% after the third procedure. In the third group the success rate was 75% after the first procedure, 83.3% after the second procedure and 91.7% after the third procedure.

A total of 113 procedures were performed with an overall success rate of 90% after one procedure, 95% after two procedures, 97% after three procedures.

Most of the complications were minor under Clavien I (which did not require pharmacological or surgical treatment, endoscopic or radiological intervention, mild analgesics, antiemetics, antipyretics, diuretics were used) and Clavien II (different medication was used than the one previously used, including parenteral nutrition).

The success rate was maximum in the first group after 2 procedures being also influenced by the size of the calculus. As the stones in groups II and III increased in size, the success rate was lower and required a third procedure.

Discussions

Therefore, the operative time, the stone-free rate, the severity of the complications can be influenced by many factors. Longer procedures are associated with higher risks of systemic inflammatory response syndrome (SIRS), fever, or sepsis, especially in patients with infectious stones [6]. It should be avoided that the endoscopic procedure exceeds 90 minutes. Also, aspiration can reduce intrarenal pressure, intraluminal temperature and operating time.
The ability of a flexible ureteroscope to deflect is essential for intrarenal procedures because it is necessary for access and exploration of the renal pelvis, calyces, and in approaching diverticula. It is especially important when attempting treatment of lower pole stones because the lower pole has been observed to be more difficult to access.

Conclusions

This study demonstrated that the Pusen Uscope3022 disposable flexible digital ureteroscope represents a viable alternative in the flexible endoscopic treatment of kidney stones, demonstrating good safety and efficacy. The disposable URS is an effective tool that allows the treatment of large kidney stones.

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