



Is a ureteral stent required before flexible ureteroscopy?

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Contributions: (I) Conception and design: All authors; (II) Administrative support: None; (III) Provision of study materials or patients: None; (IV) Collection and assembly of data: None; (V) Data analysis and interpretation: W Zhu, Y Lai, Q Deng, J Zhang, H Wang, H Liang; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

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Background: To retrospectively evaluate the therapeutic effectiveness and safety of flexible ureteroscopes without preoperative ureteral stent placement.

Methods: A total of 243 patients who had undergone flexible ureteroscopy (fURS) lithotripsy were reviewed. The patients were divided into two groups: 119 patients without preoperative ureteral stent placement were set as group A; and the remaining 124 patients who received preoperative ureteral stent placement were set as group B. The operative time, length of hospital stay, hospital costs, stone-free rates (SFRs), complications, and re-operation rates of the two groups were respectively compared.

Results: Pairwise analysis indicated the following: the average operative time of group A was longer than that of group B (66.53±10.19 versus 59.85±9.85 min, P=0.0001), the average length of hospital stay of group A was considerably shorter than that of group B (6.56±0.90 versus 10.67±1.50 d, P=0.0001), the SFRs of group A were significantly lower than those of group B at 3 days postoperatively (36.1%, 43/119 versus 51.6%, 64/124, P=0.0034), and the average hospital costs were substantially lower in group A than those in group B (18,756 versus 23,450 RMB, P=0.0001). However, there were no notable differences observed in the following: SFRs between the groups at 1 month postoperatively (84.0%, 100/119 of group A versus 85.5%, 106/124 of group B, P=0.895), complications rates (20.1%, 26/124 in group A versus 20.1%, 23/114 in group B, P=0.597), and re-operation rates (15.1%, 18/119 in group A versus 16.9%, 21/124 in group B, P=0.558).

Conclusions: These results indicated that fURS without preoperative ureteral stent placement is safe and effective for the treatment of upper urinary calculi.

Keywords: Flexible ureteroscopy (fURS); upper urinary calculi; ureteral stent; urology

Submitted Sep 24, 2020. Accepted for publication Dec 13, 2020.

doi: 10.21037/tau-20-1458

View this article at: <http://dx.doi.org/10.21037/tau-20-1458>

Introduction

Urolithiasis is the third most common dysfunction of the urinary system, and affects 10–15% of the general population globally (1,2). The incidence of urolithiasis has increased over the past decades. Most patients who suffer from kidney stones are between 30 and 50 years old, and

the recurrence rate is about 35–50% (3). Most stones that are 4 mm in diameter or smaller are spontaneously and asymptotically eliminated from the body via urination. However, stones measuring 5 mm or larger are not typically removed from the body through the urine, and could cause severe pain, urethral obstruction, hydronephrosis, infection, and hemorrhage, and thus must be referred to a urologist

(4,5). The diagnosis and treatment of urolithiasis is still a major challenge for urologists (4,6).

Over the recent decades, a variety of strategies have been developed and utilized for the surgical management of kidney stones, benefitting from many technological advancements (7). Generally, urologic surgical approaches are increasingly becoming less invasive and mainly include extracorporeal shockwave lithotripsy (ESWL), ureteroscopy (URS), and percutaneous nephrolithotomy (PCNL). The choice of surgical modality for ureteral and renal calculi are optimized individually on the basis of stone size, location, and composition (if known), as well as local expertise and patient preference (8). However, current European Association of Urology (EAU) guidelines recommend URS and PCNL endourological procedures, and ESWL has lost its place as the primary modality for active ureteral stone treatment, despite still being effective (1). At present, due to developing technologies in the endoscopic armamentarium, flexible ureteroscopy (fURS) has gained in popularity and become the primary therapeutic option for the treatment of renal stones (<2 cm) because of its high stone-free rates (SFRs) and low morbidity (8-11).

Some investigations have demonstrated that ureteral stent (Double-J tube) placement has been widely applied before fURS to dilate obstructed ureters and allow for better access to the upper tract during ureteroscopy, which could improve the efficiency of the procedure and significantly enhance the SFRs (12,13). Conversely, several studies have reported that there were no significant differences in the SFRs between pre-stented and non-stented patients who undergo fURS (12-15). Preoperative ureteral stents may also cause additional complications, including urinary tract perforation, urosepsis, ureter avulsion, and bleeding with transfusion (12,13,16-18). Thus, it remains controversial whether a ureteral stent is required before fURS for patients without obvious ureteral strictures (19,20).

In this study, we performed a retrospective review of patients who had undergone fURS with and without preoperative stent placement. We compared and evaluated the differences in operative time, SFRs, re-operation rates, length of hospital stay, and hospital costs between the patient groups, and aimed to investigate whether a ureteral stent is required before undergoing fURS for patients suffering from upper urinary calculi.

We present the following article in accordance with the STROBE reporting checklist (available at <http://dx.doi.org/10.21037/tau-20-1458>).

Methods

Patient demographics

All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). This research was approved by the Research Ethics Boards of the People's Hospital of Longhua Shenzhen. Written informed consent was obtained from the patients beforehand.

The inclusion criteria were as follows: (I) patients with stone diameters less than 2 cm located in unilateral upper ureteral, unilateral renal pelvis, or both unilateral ureteral and renal pelvis; and (II) patients who had undergone uncomplicated fURS with or without preoperative ureteral stent placement. The exclusion criteria were as follows: (I) patients with isolated kidney or renal insufficiency; (II) patients with ureteral malformations or ureteral stenosis; (III) patients with preoperative urinary tract infection; (IV) patients with severe cardiopulmonary dysfunction; (V) patients with bilateral urinary tract stones; (VI) patients who could not be placed in the lithotomy position; and (VII) patients with severe urethral strictures.

The included patients were classified into two groups depending on whether they had a ureteral stent placed prior to fURS. All patients had received ultrasonography, plain film of kidney-ureter-bladder (KUB), and computed tomography urography (CTU) examination before the operation. All routine experimental examinations, including urine analysis, urine culture, renal function testing, and coagulation profiling were performed prior to fURS. Clinical parameters such as gender, age, and comorbidities were retrieved and summarized in *Table 1*.

Surgical procedure

All surgical procedures were performed by four experienced urologists (QH, HL, JZ, and HW) using a standardized technique with last-generation flexible ureteroscopes. The decision to stent (F5 Double-J tube, Bard Medical, Covington, USA) or not to stent the patient prior to fURS was determined according to the discretion of the urologist. All patients had received general anesthesia and were placed in the lithotomy position. Subsequent ureteroscopic procedures were performed with zebra guidewires, including a safety wire (Sensor, Boston Scientific, Natick, USA). A ureteral access sheath was routinely used, and was typically 35 cm for women and 45 cm for men, with the

Table 1 Patient demographics and stone characteristics

| Group | Gender | | Laterality of stones | | Age (year) | Size of stones (mm) | Hydronephrosis | | Location of stone | |
|-----------------------|--------|--------|----------------------|-------|-------------|---------------------|----------------|----------|-------------------|--------|
| | Male | Female | Left | Right | | | Mild | Moderate | Ureter | Pelvis |
| Group A (non-stented) | 74 | 45 | 72 | 47 | 46.39±9.55 | 14.52±3.32 | 61 | 58 | 62 | 57 |
| Group B (pre-stented) | 78 | 46 | 68 | 56 | 42.99±11.23 | 15.54±3.38 | 75 | 49 | 57 | 67 |
| P value | 0.426 | | 0.193 | | 0.940 | 0.898 | 0.066 | | 0.078 | |

sheath diameter determined according to the discretion of the surgeon.

The conventional F5 Double-J tube and F16 catheters were routinely placed postoperatively for all patients. Ultrasonic and KUB examinations were performed preoperatively, and at 1-month and 3-months after fURS to determine the residual calculus (representative images are shown in *Figure 1*). All patients were discharged from hospital in an outpatient setting.

Analyzed parameters

We retrospectively reviewed data from patient documentation, KUB, CTU, and operation reports. Patient demographics and stone characteristics were analyzed. We compared parameters including operative time, re-operation rates, SFRs, length of hospital stay, hospital costs, and complications rates between both groups.

Statistical analysis

The SPSS20 statistical software was utilized for statistical analysis. Groups were compared using the Mann-Whitney U test. Categorical variables were compared using Fisher's exact test. $P < 0.05$ was considered to be statistically significant.

Results

Among the 245 patients who underwent fURS, 119 patients did not receive preoperative ureteral stents (group A), while the remaining 124 patients had received preoperative ureteral stent placement (group B). The two groups were matched for age ($P=0.940$), gender ($P=0.426$), laterality of stones ($P=0.193$), location of stones ($P=0.078$), and size of stones ($P=0.898$). The patient demographic and stone characteristics of the two groups are summarized in *Table 1*.

A successful stone-free status was achieved if all endoscopically or radiographically visible stone fragments

had been completely removed. The SFRs were determined and compared at 3-days and 1-month following fURS. The group B patients who had received preoperative stent placement showed a significantly higher SFR at 3-days after fURS than that of non-stented patients (51.6%, $n=64/124$ vs. 36.1%, $n=43/119$, $P=0.0034$). However, there were no notable differences in the SFRs between the two groups at 1-month after fURS (84.0% vs. 85.5%, $P=0.895$) (*Figure 2*).

The total operative time was reduced by approximately 6 min in group B patients with preoperative ureteral stent placement (59.85 vs. 66.53 min, $P=0.001$, *Figure 3A*). Meanwhile, the length of hospital stay was longer in the pre-stented group than that of non-stented group (10.67 vs. 6.56 days, $P=0.001$, *Figure 3B*). No major complications were encountered during stent placement or ureteroscopy in presented patients in this study. We observed no significant differences in the primary complications, including chills, fever, urinary tract infection, and the need for analgesia, between the pre-stented and non-stented groups (21.3% vs. 20.1%, $P=0.597$). Furthermore, there were no significant differences in the re-operation rates between the groups ($P=0.558$). The hospital costs of the pre-stented patient group were markedly higher than that of non-stented group (23,450 vs. 18,756 RMB, $P=0.0001$, *Figure 4*). Details of the postoperative parameters comparison between the pre-stented and non-stented groups are shown in *Table 2*.

Discussion

Benefitting from technical advancements and the introduction of a wide range of disposables, fURS has gained in popularity in recent years. The most recent EAU guidelines recommend fURS as the primary therapeutic option in the treatment of upper urinary tract stones < 2 cm (9,21,22). Yet, the requirement for ureteral stent placement prior to fURS remains a topic of debate.

In the present study, we found that preoperative stenting could significantly increase the SFRs at 3-days after fURS, which seems to be consistent with several previous reports

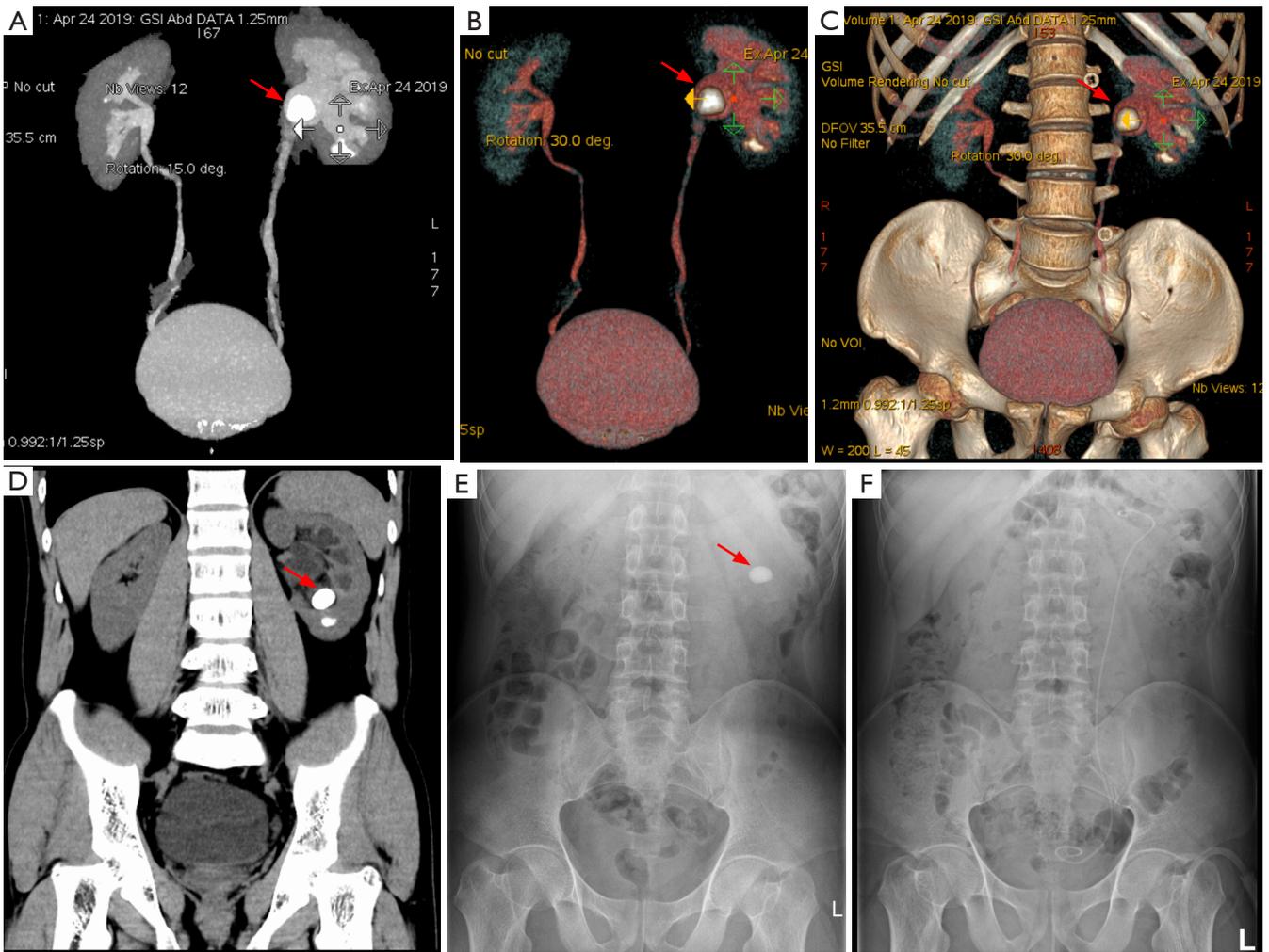


Figure 1 Representative images of CTU and KUB examination before and after fURS. (A-C) Representative images of 3D reconstruction before fURS; (D) representative image of magnetic resonance imaging (MRI) examination before fURS; (E) representative image of KUB examination at 1-week after fURS; (F) representative image of KUB examination at 1-month after fURS. The red arrows indicate lesion locations. CTU, computed tomography urography; KUB, kidney-ureter-bladder; fURS, flexible ureteroscopy.

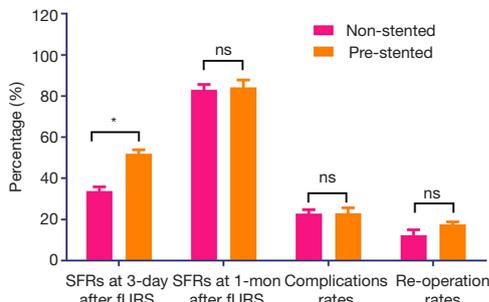


Figure 2 Comparison of SFRs, complications rates, and re-operation rates between the non-stented and pre-stented groups. *, $P < 0.05$; ns, no significance. SFR, stone-free rate; fURS, flexible ureteroscopy.

(12,17). However, the SFRs of stented and non-stented patients were quite similar with no significant differences at 3-months after surgery. In addition, the operative time was significantly reduced (by approximately 6 min) compared to that in the non-stented group. This could be attributed to the dilation of the ureter by preoperative stent placement, which enhanced the success rate of ureteroscopic access and provided improved vision of the ureteral tract (23). However, the reduced operative time makes little sense in clinical practice. Interestingly, several studies have claimed that the SFRs were significantly higher in pre-stented patients who underwent fURS with no major complications (13,19,24-26). This difference might be due to an overall

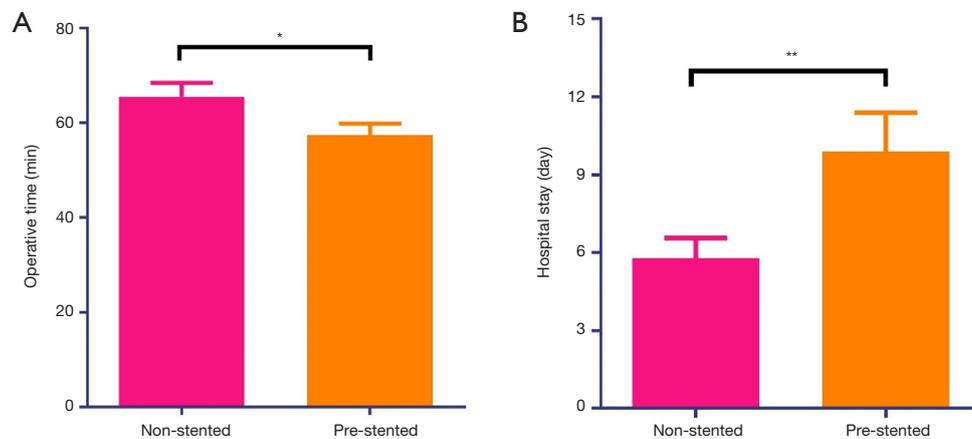


Figure 3 Comparison of operative time and length of hospital stay between the non-stented and pre-stented groups. *, $P < 0.05$; **, $P < 0.001$.

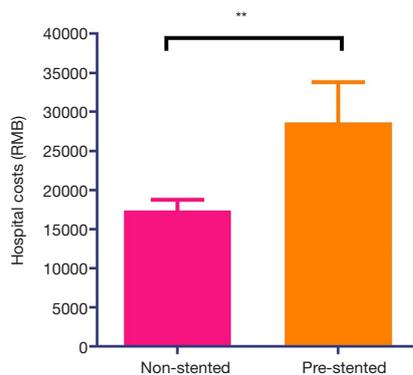


Figure 4 Comparison of hospital costs between the non-stented and pre-stented groups. **, $P < 0.001$.

lower stone size and upper stone location in our series.

According to the results of our retrospective analysis, the complication and re-operation rates were not significantly different between preoperative stented and non-stented groups, which was similar to previous findings (12,14,17,27). No major complications were encountered during stent placement or ureteroscopy in presented patients in this study. Other complications, such as postoperative bleeding and ureteral mucosal injury, which might be caused during intraoperative flexible ureteroscope sheath insertion and Holmium laser lithotripsy (28,29), were not included in this study.

Although preoperative stent placement is significant in the treatment of upper ureteral calculi, it results in an increased hospital stay and hospital costs. This is likely

attributable to the extra preoperative stenting procedure, which will inevitably extend the hospital stay and increase hospital costs. For patients with ureteral stone street, where large residual stones cannot be excreted via ESWL, rigid ureteroscopy or secondary fURS should be performed subsequently (30). However, this is not related to the preoperative placement of Double-J tubes.

There are some limitations in our study that should be noted. Firstly, the major limitation of our study was that the consensus for Double-J stent placement was not identified preoperatively. The urologists decided whether or not to stent independently, without guidelines or previous agreement. The preoperative stent size and duration of SFRs was unclear. Secondly, the number of included patients is not large enough, owing to the fact that this study was performed in one single hospital. Thirdly, considering that this is a retrospective study, potential inherent selection bias cannot entirely be excluded.

In summary, we found that preoperative ureteral stent placement can help to decrease the operative time and improve the SFRs for patients undergoing fURS, but not significantly so. Preoperative stenting extended the length of hospital stay and increased hospital costs, but had no influence on complication and re-operation rates. These findings lead to the conclusion that preoperative ureteral stent placement before fURS for the treatment for upper urinary calculi is not reasonable. However, given the limitations of this study, more high-quality investigations including prospective randomized clinical trials are required to confirm our findings.

Table 2 Comparison of postoperative parameters between the two groups

| Variable | Group A (non-stented) (n=119) | Group B (pre-stented) (n=124) | P value |
|-------------------------------|-------------------------------|-------------------------------|---------|
| Operative time (min) | 66.53 | 59.85 | 0.0001 |
| Length of hospital stay (day) | 6.56 | 10.67 | 0.0001 |
| SFRs at 3-days after fURS | 36.1% (43/119) | 51.6% (64/124) | 0.0034 |
| SFRs at 1-month after fURS | 84.0% (100/119) | 85.5% (106/124) | 0.895 |
| Complications rates | 21.3% (25/119) | 20.1% (26/124) | 0.597 |
| Re-operation rates | 15.1% (18/119) | 16.9% (21/124) | 0.558 |
| Hospital costs (RMB) | 18,756 | 23,450 | 0.0001 |

fURS, flexible ureteroscopy. SFRs, stone-free rates.

Acknowledgments

Funding: This study was financially supported by the Shenzhen Science and Technology Program (Basic Research Project, No. JCYJ20180228163919346 to ZW) and the Shenzhen Longhua Science and Technology Innovation Fund (2017009 to ZW, 20150925A0410013 to HL).

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <http://dx.doi.org/10.21037/tau-20-1458>

Data Sharing Statement: Available at <http://dx.doi.org/10.21037/tau-20-1458>

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at <http://dx.doi.org/10.21037/tau-20-1458>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study involving human participants were in accordance with the Declaration of Helsinki (as revised in 2013). This research was approved by the Research Ethics Boards of the People's Hospital of Longhua Shenzhen. Written informed consent was obtained from the patients beforehand.

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(English Language Editor: A. Kassem)

Cite this article as: Hu Q, Ji Y, Wang Z, Lai Y, Deng Q, Zhang J, Wang H, Liang H, Zhao H. Is a ureteral stent required before flexible ureteroscopy? *Transl Androl Urol* 2020;9(6):2723-2729. doi: 10.21037/tau-20-1458