Jinpin Zhou et al. (2023) Efficacy and feasibility of self-made negative pressure reflux system combined with rigid ureteroscope in the treatment of upper ureteral calculi in exercise-minded patients.Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte vol. 23 (89) pp. 101-108
DOI: https://doi.org/10.15366/rimcafd2022.89.008

ORIGINAL

EFFICACY AND FEASIBILITY OF SELF-MADE NEGATIVE PRESSURE REFLUX SYSTEM COMBINED WITH RIGID URETEROSCOPE IN THE TREATMENT OF UPPER URETERAL CALCULI IN EXERCISE-MINDED PATIENTS

Tingbo Fu[1], Guojun Li[1], Lizhuan Liu[1], Weiguo Wang[1], Fei Xia[1], Jinpin Zhou[2*]

[1] Department of Urology, Xiangya Changde Hospital, Changde, 415000, China
2.Department of Urology, Dongan County People's Hospital, Yongzhou, 425900, China
*Corresponding author: Jinpin Zhou
E-mail: 411679970@qq.com

UNESCO Code / UNESCO Code:
Council of Europe classification / Council of Europe classification:

Recibido 30 de abril de 2020 **Received** April 30, 2020
Aceptado 26 de Enero de 2023 **Accepted** January 26, 2023

ABSTRACT

Objective: To explore the efficacy and feasibility of self-made negative pressure reflux system combined with rigid ureteroscopy in the treatment of upper ureteral calculi.
Methods The clinical data of 379 Exercise-minded patients with upper ureteral calculi treated in our hospital from January 2018 to August 2022 were analyzed retrospectively. F8.0/9.8STORZ ureteroscope was used to explore the ureteral opening on the affected side, and then the 200μm wavelength holmium laser fiber and F4 ureteral catheter were inserted into the stone incarceration site through the rigid ureteroscope, and the residual stone fragments which were clinically meaningless (the maximum diameter of the stone < 2mm) were completely sucked out by negative pressure reflux system.
Results A total of 379 Exercise-minded patients were included in this study, with a one-time success rate of 97.1% (368/379), aged 26 to 76 years, with an average of (47.5) years. Most of the Exercise-minded patients (63.2%) had low back pain and hematuria before operation. The average diameter of stone

was 0.8cm~2.8cm, the mean diameter of the stone was 1.8±1.0 cm.The operation time ranged from 18min to 52min, with an average of (37.86±25.64)min.The average length of hospital stay was (2.7±1.7) days (range, 1-8 days). On the first day after operation, the stone clearance rate was 84.43% (320/379), and the stone clearance rate was 90.77% (344/379) 3 months after operation. Among them, 4 Exercise-minded patients developed fever and 6 Exercise-minded patients had mild urinary fistula or renal pelvis perforation. Stone composition analysis was mainly ammonium phosphate stones and calcium oxalate stones.
Conclusion The treatment of upper ureteral calculi with self-made negative pressure reflux system combined with hard ureteroscope has the advantages of high stone clearance rate, low complications and greatly reducing the utilization rate of soft lens，and had high clinical promotion value.

KEY WORDS: Self-made negative pressure reflux system；Rigid ureteroscope；Upper ureteral calculi

INTRODUCTION

Urolithiasis is a common disease in urology, which is divided into upper urinary tract calculi and lower urinary tract calculi. In China, the main symptoms are low back pain, frequent urination, urgent urination, fever and hematuria(Lai et al., 2021). Upper ureteral calculi are the most common in upper urinary tract calculi, and the most common clinical treatment is transurethral soft ureteroscopic lithotripsy（Retrograde Intrarenal Surgery，RIRS）(J. Zhang et al., 2022). However, RIRS requires a high level of operation for clinicians, and lithotripsy should be performed after the ureteral sheath is placed under the action of safety guide wire(Liu et al., 2013). If the number of stones in the patient is relatively large, the load is large, and the lithotripsy time is longer, it is easy to lead to serious complications such as water poisoning, septic shock, or even death(Hu et al., 2018). At the same time, this operation results in more expensive medical expenses for Exercise-minded patients than other similar operations, and the damage rate of soft ureteroscope is higher than that of hard ureteroscope (Gan et al., 2020).Therefore, this study used a retrospective analysis of the clinical data of 379 Exercise-minded patients with upper ureteral calculi treated by self-made negative pressure reflux system (F4 ureteral catheter, 200um wavelength holmium laser, negative pressure suction tube(Choi, Seo, Kwon, & Kim, 2019), negative pressure suction bottle) combined with single instrument channel 8.0/9.8FSTORZ ureteroscope from January 2018 to August 2022, in order to obtain a more optimal clinical treatment(Gao et al., 2021).

Materials and methods

Clinical data

In this study, the clinical data of 379 Exercise-minded patients with upper ureteral calculi treated with self-made negative pressure reflux system combined with rigid ureteroscope in our hospital from January 2018 to August 2022 were analyzed retrospectively. all patients need to be diagnosed by urinary color ultrasound or urinary CT before operation and there were 202 males and 177 females, aged from 26 to 76 years old, with an average age of (46.5 ±1.2) years.63.2% of the exercise-minded patients were treated with low back pain and hematuria. The average body mass index (BMI) of the exercise-minded patients included in the study was (24.5 ±3.6) kg/m2.Case inclusion criteria: there were surgical indications, renal function, blood coagulation and other related preoperative examinations were not significantly abnormal. All Exercise-minded patients need to be evaluated by ASA grade before operation, most of them are grade I ~ II, a few exercise-minded patients are ASA grade III and the coexisting disease has been stable for more than 3 months and all Exercise-minded patients can tolerate operation after strict evaluation by anesthesiologist.

Operation methods

After taking the lithotomy position after general anesthesia, using 8.0/9.8FSTORZ ureteroscope to explore the ureteral opening on the affected side, retrograde endoscopy from the distal end of the ureter to the proximal end under the guidance of zebra guide wire was used to observe the course of the ureter and whether there was any stricture. If there was any stricture, after relevant treatment, through the stricture, after reaching the stone incarceration. 200 μm holmium laser fiber and F4 ureteral catheter were inserted into the stone incarceration site through the ureteroscopic operation channel for lithotripsy. The water intake channel is F4 ureteral catheter, and the tail end of F4 ureteral catheter is connected with scalp needle by assistant, and silk thread is knotted and fixed. The outlet channel is the water inlet switch on the right side of the ureteroscope, which opens the water inlet switch on the right side and connects the negative pressure suction tube and the negative pressure suction bottle. The left ureteroscopic water intake switch can be controlled by itself, which is completely open without negative pressure suction, and the negative pressure suction is maximum when completely closed. 200μm holmium laser fiber was used to crush the stone into clinically meaningless residual stone fragments (the maximum diameter of the stone < 2mm), and then sucked out under negative pressure. If in the process of lithotripsy, large stone fragments fall into the lower renal calyx or the renal calyx outside the field of vision of hard endoscope, then change to RIRS, and the stone is dragged into the upper ureter by using a set of stone net basket and then broken again. Most of the postoperative exercise-minded patients with routine indwelling catheterization were removed 1-2 days after operation if there were no obvious bleeding, fever and other abnormalities. After operation (before discharge), the stones on abdominal plain film

(Kidneys Ureter Bladder, KUB) were basically removed, and the ureteral stent tube was not twisted, discounted or protruded.

Result

All the exercise-minded patients included in this study completed the operation successfully. The success rate of one entry was 97.1% (368/379). The diameter of the stone was 0.8~2.8cm, and the average diameter was (1.80 ±1.0) cm.The operation time was 18min～52min, with an average of 37.86 ±25.64min.The average hospital stay was 1 to 8 days, and the average hospital stay was 2.7 ±1.7 days.The stone clearance rate was 84.43% (320/379) on the first day after operation, and the stone clearance rate was 90.77% (344/379) 3 months after operation. Among them, 4 exercise-minded patients had fever after operation, and the highest body temperature was 40℃, which was considered as urogenic bacteremia. They were treated with symptomatic rapid fluid replacement such as anti-infection for 1 day and 3 days, and were discharged after improvement. Six exercise-minded patients had slight urinary fistula or renal pelvis perforation without special treatment. The main stone composition analysis was ammonium phosphate stone and calcium oxalate stone. The proportion of preoperative indwelling ureteral stents was 25.6% (97/379). Because of the large stone fragments falling into the lower renal calyx or the renal calyx outside the visual field of hard endoscope, 10 exercise-minded patients underwent stone removal by soft ureteroscope. The current subjects were followed up 3 months after operation, there were no serious complications such as ureteral stricture and septic shock, and most patients only had mild hematuria, frequent urination and urgent urination. All the patients in this study returned to hospital one month after operation, and the ureteral stent was removed immediately after reexamination of kidneys ureter bladder (KUB） on the affected side. In 7 patients, stone fragments were not excreted at the end of the ureter 3 months after operation, and ureteroscopic forceps were used to remove the ureteral stent under local anesthesia.

Conclusion

At present, there are many methods for the treatment of urolithiasis. Ureteroscopic lithotripsy (Ureteroscopic Lithotripsy,URL), as one of the most common endoscopic procedures for the treatment of urolithiasis through natural cavity(Y. Yang et al., 2020), has the advantages of mild postoperative pain, shorter postoperative hospital stay(Wang et al., 2017), higher stone clearance rate than extracorporeal shock wave lithotripsy, and higher than laparoscopic ureterolithotomy (Laparoscopic Ureterotomy And Lithotomy,LUAL) and percutaneous nephrolithotomy (Percutaneous

Nephrolithotomy). PNL) has the advantages of less postoperative complications (Alkan et al., 2015). However, hard ureteroscopy still has some limitations in the treatment of upper ureteral calculi. Therefore, at present, hard ureteroscopy combined with soft ureteroscopic lithotripsy is mostly used to treat upper ureteral calculi (Yao, Jiang, Xie, & Liu, 2021). In China, the expensive hospitalization expenses that exercise-minded patients are difficult to pay is one of the shortcomings of RIRS, so there are still great limitations in the development of RIRS in grass-roots hospitals. Therefore, this study explores a new method for the treatment of upper ureteral calculi through self-made negative pressure reflux system combined with hard ureteroscope, which can significantly reduce the consumption of soft ureteroscope and intraluminal retrograde infection, reduce the economic burden of exercise-minded patients and other advantages. it provides a new method for grass-roots hospitals to treat upper ureteral calculi through rigid ureteroscope (Librenjak, Šitum, Gugić, Milostić, & Duvnjak, 2011).

The advantages and disadvantages of several surgical methods for the treatment of upper ureteral calculi were compared: (1) URL: simple, low cost and short hospital stay, but there was no reflux in the process of lithotripsy, and the broken stones were easy to block the visual field of ureter and lead to non-continuous lithotripsy. At the same time, it was also easy to cause complications of long-term ureteral stricture caused by ureteral edema. And the upper stone is easy to escape, so it is necessary to change the mode of operation (P. Zhang et al., 2021). (2). RIRS: there are some differences in the technical level of soft ureteroscope among different doctors, and it is easy to damage the ureter by establishing a channel under non-direct vision; the efficiency of lithotripsy is slow; the equipment is easy to be damaged and the cost is high(Darwish et al., 2019). (3) .PNL: it requires very fine surgical skills and high lithotripsy efficiency, but it may cause serious complications such as massive hemorrhage, septic shock, arteriovenous fistula, peripheral organ injury and so on(Asutay et al., 2022). (4). Self-made negative pressure reflux system combined with ureteroscopic lithotripsy:①. It can be removed by lithotripsy under endoscope without repeatedly going in and out of ureter to reduce ureteral spasm, injury, edema and other related complications(Zhan et al., 2021).②. Easy to operate, safe, no need to use high-end equipment and consumables, easy to carry out widely. ③. The chief surgeon controlled negative pressure suction combined with assistant controlled infusion of normal saline to keep the surgical field continuous and clear, effectively prevent water poisoning and reduce infection(Jung, Hong, Lee, & Lee, 2021), but also reduce the probability of stone escape and avoid ureteral edema.④. Reduce the consumption rate of percutaneous nephroscope, soft endoscope and laparoscopy. ⑤.F4 ureteral catheter not only has the function of entering water, but also helps to incite the calculi at the incarcerated ureteropelvic junction, pick the stones into a suitable place in the upper segment of the ureter for lithotripsy(Astroza et al., 2019), and further insert into the marginal

renal calyx, assistant pressure to draw water, the stones outside the field of vision of ureteroscope can be washed out under pressure, and lithotripsy in the visual field can be carried out(J. Yang, Huang, Li, Tang, & Ai, 2022).

In conclusion,the self-made negative pressure reflux system combined with hard ureteroscope is safer and more effective than other operations in the treatment of upper ureteral calculi, has a higher stone clearance rate, and improves the efficiency of the use of medical resources(Resorlu et al., 2013). reduce postoperative hospital stay and hospitalization costs, greatly reduce the utilization rate of soft ureteroscope, and have high clinical promotion value(Landman, Lee, Lee, & Monga, 2003).

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Funding

This study was not supported by any funds.

REFERENCES

Alkan, E., Sarıbacak, A., Ozkanli, A. O., Basar, M. M., Acar, O., & Balbay, M. D. (2015). Flexible ureteroscopy can be more efficacious in the treatment of proximal ureteral stones in select patients. *Advances in Urology, 2015*.

Astroza, G. M., Sarras, M., Salvado, J. A., Majerson, A., Neira, R., & Dominguez, J. (2019). Early ureteroscopic treatment in patients with urosepsis associated with ureteral calculi is a safe approach. A pilot study. *Central European Journal of Urology, 72*(2), 163.

Asutay, M. K., Lattarulo, M., Liourdi, D., Al-Aown, A. M., Pagonis, K., Nedal, N., . . . Kallidonis, P. (2022). Does ureteral access sheath have an impact on ureteral injury? *Urology Annals, 14*(1), 1.

Choi, J. D., Seo, S. I., Kwon, J., & Kim, B. S. (2019). Laparoscopic ureterolithotomy vs ureteroscopic lithotripsy for large ureteral stones. *JSLS: Journal of the Society of Laparoendoscopic Surgeons, 23*(2).

Darwish, A. E., Gadelmoula, M. M., Abdelkawi, I. F., Abdellatif, A. M., Abdel-Moneim, A. M., & Hammouda, H. M. (2019). Ureteral stricture after ureteroscopy for stones: a prospective study for the incidence and risk factors. *Urology Annals, 11*(3), 276.

Gan, S., Guo, Z., Zou, Q., Gu, C., Xiang, S., Li, S., . . . Wang, S. (2020). Novel semirigid ureterorenoscope with irrigation and vacuum suction system: introduction and initial experience for management of upper urinary calculi. *International braz j urol, 46*, 786-793.

Gao, S.-L., Wu, H., Su, Q.-X., Zhang, Z.-Y., Zhang, Z., Lu, C., . . . Zuo, L. (2021).

Comparison of the effects of retroperitoneoscopic ureterolithotomy and ureteroscopic lithotripsy in the treatment of upper ureteral calculi. *Medicine, 100*(38).

Hu, J. S., Xie, G. H., Yuan, H. S., Liu, G. L., Jia, X. L., Zheng, Z., & Cheng, Y. (2018). Guide sheath-assisted ureteroscope lithotripsy for upper ureteral calculi: An observational study on 81 cases. *Experimental and Therapeutic Medicine, 16*(4), 3459-3463.

Jung, H. D., Hong, Y., Lee, J. Y., & Lee, S. H. (2021). A systematic review on comparative analyses between ureteroscopic lithotripsy and shock-wave lithotripsy for ureter stone according to stone size. *Medicina, 57*(12), 1369.

Lai, L., Zhang, W., Zheng, F., Wang, T., Bai, P., Liu, Z., . . . Wang, H. (2021). Comparison of the Efficacy of ShuoTong Ureteroscopy and Simple Flexible Ureteroscopy in the Treatment of Unilateral Upper Ureteral Calculi. *Frontiers in Surgery, 8*, 707022.

Landman, J., Lee, D. I., Lee, C., & Monga, M. (2003). Evaluation of overall costs of currently available small flexible ureteroscopes. *Urology, 62*(2), 218-222.

Librenjak, D., Šitum, M., Gugić, D., Milostić, K., & Duvnjak, M. (2011). Ureterorenoscopic treatment of ureteral stones: influence of operator's experience and skill on the procedure outcome. *Croatian Medical Journal, 52*(1), 55-60.

Liu, Y., Zhou, Z., Xia, A., Dai, H., Guo, L., & Zheng, J. (2013). Clinical observation of different minimally invasive surgeries for the treatment of impacted upper ureteral calculi. *Pakistan journal of medical sciences, 29*(6), 1358.

Resorlu, B., Unsal, A., Ziypak, T., Diri, A., Atis, G., Guven, S., . . . Oztuna, D. (2013). Comparison of retrograde intrarenal surgery, shockwave lithotripsy, and percutaneous nephrolithotomy for treatment of medium-sized radiolucent renal stones. *World journal of urology, 31*, 1581-1586.

Wang, Q., Guo, J., Hu, H., Lu, Y., Zhang, J., Qin, B., . . . Wang, S. (2017). Rigid ureteroscopic lithotripsy versus percutaneous nephrolithotomy for large proximal ureteral stones: A meta-analysis. *PLoS One, 12*(2), e0171478.

Yang, J., Huang, Y., Li, Y., Tang, D., & Ai, Q. (2022). Efficacy of Flexible Ureteroscopic Lithotripsy and Percutaneous Nephrolithotomy in the Treatment of Complex Upper Urinary Tract Nephrolithiasis. *Computational and Mathematical Methods in Medicine, 2022*.

Yang, Y., Zhang, M., Yu, H., Wang, J., Liu, J., He, K., & Gao, J. (2020). Percutaneous nephrolithotomy and retroperitoneal laparoscopy in treatment of retrocaval ureter with right renal and ureteral calculi: a case report. *Journal of International Medical Research, 48*(9), 0300060520947917.

Yao, F., Jiang, X., Xie, B., & Liu, N. (2021). Comparison of ureteroscopy (URS) complementary treatment after extracorporeal shock wave lithotripsy

failure with primary URS lithotripsy with holmium laser treatment for proximal ureteral stones larger than10mm. *BMC urology, 21*(1), 1-7.

Zhan, X., Liu, D., Wang, G., Zhang, H., Kadier, A., Yao, X., & Xu, Y. (2021). The innovative use of ureter catheter in the surgery of obstructive uropathy. *Computational and Mathematical Methods in Medicine, 2021*.

Zhang, J., Li, B., Li, G., Yang, Z., Ye, N., Liu, Y., . . . Hong, J. (2022). Rigid ureteroscopic lithotripsy in the lateral decubitus position for upper urinary tract stones. *BMC urology, 22*(1), 1-8.

Zhang, P., Han, X.-W., Zhang, X., Zhu, X.-H., Li, T., Li, Y.-S., . . . Li, G. (2021). Clinical Observation of UreTron Single-Probe Ultrasonic Intracorporeal Lithotripter for Ureteral Calculi. *International Journal of General Medicine*, 4229-4237.