Submitted: 23 December, 2022 Accepted: 08 February, 2023 Published: 28 February, 2023 DOI:10.22514/jomh.2023.017

ORIGINAL RESEARCH

JOMH Journal of Men's Health

Effect of retrograde intrarenal surgery on the inflammatory reaction, renal function indicators and clinical efficacy in male patients with kidney stones

Bin Qin[1,*], Weihao Luo[2], Qingguo Wu[1], Peng Yang[1], Yiwen Liang[1], Hanchu Ji[1], Zhaokai Gan[1]

[1]Department of Urology, The Eighth Affiliated Hospital of Guangxi Medical University, The People's Hospital of Guigang, 537100 Guigang, Guangxi, China
[2]Department of Urology, The First Affiliated Hospital of Guangxi Medical University, 530022 Nanning, Guangxi, China

***Correspondence**
ggqb2021@163.com
(Bin Qin)

Abstract

To investigate the effect of retrograde intrarenal surgery (RIRS) and percutaneous nephrolithotripsy on the inflammatory reaction, renal function indicators and clinical efficacy in male patients with kidney stones. 122 male patients with kidney stones were separated into the study group (n = 61) and the control group (n = 61) in terms of distinct clinical treatment regimens. The study group was treated with retrograde intrarenal surgery, while the control group was treated with percutaneous nephrolithotripsy. Inflammatory reaction indicators (Interleukin-6 (IL-6), Interleukin-10 (IL-10), serum tumor necrosis factor-α (TNF-α)), renal function indicators (blood urea nitrogen (BUN), serum creatinine (Scr), blood uric acid (BUA), serum β2 microglobulin (BMG)) and other clinical indicators (operative time, hospital stay, intraoperative blood loss, Visual analogue scale (VAS) pain score, complications) were observed and compared. Upon the treatment, significantly lowered inflammatory factors including IL-6, IL-10, TNF-α and renal function indicators including BUN, Scr, BUA, BMG were shown in study group. Notably shortened operative time and hospital stay were presented in study group with lowered intraoperative blood loss and pain score. The total incidence of complications in study group was 3.28%, significantly lower than 14.75% in control group. Compared with percutaneous nephrolithotripsy, retrograde intrarenal surgery for the treatment of male kidney stones with a diameter of less than 3 cm can improve the inflammatory reaction of male patients, maximize the preservation of renal function indicators, and eminently promote the clinical comprehensive efficacy.

Keywords

Retrograde intrarenal surgery; Percutaneous nephrolithotripsy; Male kidney stones; Inflammatory reaction; Renal function; Clinical efficacy

1. Introduction

Urolithiasis remains quite common in clinical practice, and the incidence is roughly between 5–15% worldwide [1]. However, in China, the incidence is slightly lower than the evaluation level of the global incidence, roughly in the interval of 1–5% [2, 3]. Nonetheless, the total number of population with urolithiasis is relatively high due to the large population base in China. Besides, with the improvement of people's material living conditions and the changes in dietary habits, the incidence of this disease has shown a certain increasing trend in China [4, 5]. Emerging as a common type of urolithiasis, kidney stones are influenced by multiple factors. Among them, the incidence of male patients is substantially higher than that of female patients. Generally, the crystalline material and organic substances in the urine of patients are abnormally focused in the kidneys, and then form stone-like substances after a certain period of accumulation, which eventually affected the exertion of renal function in patients, thereby resulting in pain and related symptoms in the urinary system and reducing the quality of life of patients [6–8]. At present, surgical treatment is the most common and effective clinical therapy for kidney stones [8, 9]. With the continuous development and advancement of medical technology, the surgery for treating kidney stones has gradually developed from the earliest traditional open surgery and laparoscopic surgery to extracorporeal shock wave lithotripsy, percutaneous nephrolithotripsy, and retrograde intrarenal surgery [10, 11]. To further compare the effects of RIRS and percutaneous nephrolithotripsy on the inflammatory reaction, renal function indicators and clinical efficacy in male patients with kidney stones admitted to our hospital, these patients were selected as the study subjects for the following studies and reports.

2. Materials and methods

2.1 Clinical data

122 male patients with kidney stones received in our hospital from January 2020 to January 2021 were divided into study and control group in accord with different clinical treatment methods, with 61 cases in each group. The study group was aged 39–58 years, with an average age of (50.16 ± 4.16) years. The stone diameter of was 1.3–1.88 cm, with an average of (1.42 ± 0.21) cm. The stone number was 1–2, with an average of (1.98 ± 0.13). This group include 35 cases of unilateral kidney stone and 26 cases of bilateral kidney stone. The control group was aged 42–60 years, with an average age of (50.21 ± 4.13) years. The stone diameter was 1.11–1.92 cm, with a mean one of (1.45 ± 0.24) cm. The number of stones was 2–3, with mean one of (2.03 ± 0.18). This group include 38 cases of unilateral kidney stone and 23 cases of bilateral kidney stones. The clinical data between both groups indicated no remarkable difference.

2.1.1 Inclusion criteria

(1) Male patients who meet the relevant clinical diagnostic criteria for kidney stones; (2) Patients with complete clinical data; (3) Patients with kidney stones less than 3 cm in diameter; (4) Patients without relevant surgical contraindications.

2.1.2 Exclusion criteria

(1) Patients with liver, kidney and lung dysfunction; (2) Patients with blood diseases; (3) with immune diseases; (4) with tumors.

2.2 Surgical methods

2.2.1 Control group

Patients in this group were subjected to percutaneous nephrolithotripsy, and the specific steps were as follows:

After the patient were given general anesthesia, the lithotomy position was taken and a ureteral catheter was indwelled in the patient's affected side of the ureter and placed in the renal pelvis. The patients took prone position, and the affected side was elevated 30 degrees. In the region between the scapular line and posterior axillary line of the patient, B-ultrasound was adopted to guide the puncture enter the target renal calyces. A guide wire was left over the puncture needle, the needle was withdrawn, and the channel was dilated to F16 *via* utilizing a fascial dilator. The ureteroscope was inserted into the renal calyces and renal pelvis to explore the stones through the dilating sheath of nephroscope, and holmium laser was employed to break down the stones after discovery, with parameters of energy 1–2 J and a frequency 10–20 Hz. The stone residue was removed from the body by rinsing.

2.2.2 Study group

Patients in this group underwent the retrograde intrarenal surgery, and the specific steps were as follows:

After the patients were given general anesthesia, the lithotomy position was taken, a rigid ureteroscope was placed in the affected side of the ureter and ascended to the ureteropelvic junction, a guide wire was indwelled, and the rigid ureteroscope was withdrawn. Along the guide wire, F12 dilating sheath of nephroscope was placed and flexible ureteroscope was placed to the renal pelvis. Holmium laser was employed to shatter the stones after discovery, with the same parameters as the control group. The larger residue was removed using the basket manipulation. The location of the stone should be paid close attention to, and the endoscope body should be adjusted appropriately. After breaking down the stones, flexible ureteroscope was withdrawn and F6 double J tube was left along the guide wire.

2.3 Outcome measures

Inflammatory reaction indicators (Interleukin-6 (IL-6), interleukin-10 (IL-10), serum tumor necrosis factor-α (TNF-α), renal function indicators (blood urea nitrogen (BUN), serum creatinine (Scr), blood uric acid (BUA) and serum β_2 microglobulin (BMG)) and other clinical indicators (operative time, hospital stay, intraoperative blood loss, VAS pain score, complications) were observed and compared between the study and control groups.

2.3.1 Detection of inflammatory reaction and renal function indicators

10 mL peripheral venous blood was collected from the patients under fasting state in the morning and allowed to stand for 20 min. The samples were centrifugated utilizing a centrifuge at a speed of 3200 r/min for 10 min. The levels of IL-6, IL-10, TNF-α, BUN, Scr, BUA and BMG were measured by enzyme-linked immunosorbent assay (Sigma-Aldrich (Shanghai) Trading Co., Ltd, Shanghai, China) according to the supporting manual.

2.3.2 VAS pain score

Visual analogue scale (VAS) served to assess the pain perception. The scores ranged from 0–10, with 0 represents no pain, 10 represents severe pain and higher scores indicates more severe pain.

2.4 Statistical processing

SPSS (22.0, SPSS Inc., Chicago, IL, USA) software served to analyze data. The measurement data and enumeration data presented as ($\bar{x} \pm s$) and examples (%), and *t*-test and χ^2 test were used, respectively. $p < 0.05$ demonstrated significant differences.

3. Results

3.1 Comparison of inflammatory reaction indicators between study and control groups

Before treating, the inflammatory factors including IL-6, IL-10 and TNF-α between both groups manifested no striking difference. Upon treating, significantly lowered IL-6, IL-10 and TNF-α were shown in the study group (Table 1, $p < 0.05$).

3.2 Comparison of renal function indicators between study and control groups

Before the treatment, there was no significant difference in renal function indicators including BUN, Scr, BUA and BMG

between the study and control groups. After the treatment, the levels of BUN, Scr, BUA and BMG in the study group were significantly lower than that in the control group (Table 2, $p < 0.05$).

3.3 Comparison of clinical surgical indicators between study and control groups

The operative time and hospital stay of study group were significantly shorter than that of control group, the intraoperative blood loss and pain score were also significantly lower than that of control group (Table 3, $p < 0.05$).

3.4 Comparison of complications between study and control groups

The study group comprised 1 case of infection and 1 case of hematuria after the treatment, with an overall complication rate of 3.28%. The control group contained 2 cases of infection, 5 cases of hematuria and 2 cases of ureteral injury after the treatment, with an overall complication rate of 14.75%. Lowered incidence of total complications was presented in the former (Table 4, $p < 0.05$).

4. Discussion

Kidney stones are a common disease in urology, and patients are predominantly male in terms of gender characteristics [12]. In general, low back pain is a common clinical symptom after the onset, and some patients experience unbearable pain, severely reducing the quality of life. Although kidney stones are considered benign disease, long-term kidney stones, if not treated clinically in a timely manner, can further affect the normal exertion of renal function in male patients, and can endanger the patient's life in severe cases [13, 14].

At present, clinical studies on the pathogenesis of kidney stones remains elusive, but a considerable proportion of people believed that [15, 16] kidney stones are caused by integrated factors. The direct reason for the formation of kidney stone is the gradual increase in the content of lithogenic components in the urine of patients, and the lithogenic substances continuously precipitate and accumulate locally in the kidney to form stones [17].

Surgical treatment is the mainstay of clinical regimen for kidney stones. Especially in recent years, with the continuous development of medical diagnosis and treatment and the theoretical practice of minimally invasive surgery, the clinical treatment for kidney stones has also entered a brand-new era [18, 19]. The emergence of extracorporeal shock wave lithotripsy has changed the perspective of traditional surgical treatment of kidney stones, and has rapidly gained widespread recognition among clinical practitioners and patients since its introduction by virtue of its non-invasive nature, efficient, safe, and economical characteristics [20, 21]. Nonetheless, its clinical efficacy also has certain limitations, and multiple treatments are required for male patients with more fat, hard stone texture, and ureteral stricture, and the comprehensive efficacy needs to be improved [22, 23]. Subsequently, percutaneous nephrolithotripsy and retrograde intrarenal surgery have also been used more in clinical practice to improve surgical outcome.

Currently, both percutaneous nephrolithotripsy and retrograde intrarenal surgery are optimal treatments in clinical practice for kidney stones less than 3 cm in diameter, but there are distinct views on which method to use in clinical practice [24–26]. In this article, two therapies were compared in the treatment of male kidney stones less than 3 cm. The data derived from this study indicated that in terms of inflammatory factor indicators, patients treated with retrograde intrarenal surgery in study group showed substantially lower inflammatory factor indicators (IL-6, IL-10 and TNF-α) following treatment. It mainly benefited from the treatment of retrograde intrarenal surgery that the urinary catheter, the natural orifice of the human body, is applied for the treatment, which prevented the local kidney and related tissues of patients from the damage of puncture during percutaneous nephrolithotripsy, and the inflammatory response caused by puncture has been effectively controlled [27]. As for renal function indicators, after the treatment, the levels of BUN, Scr, BUA, BMG and other renal function indicators in study group were considerably lower. The result suggested that, during the treatment with retrograde intrarenal surgery, the secondary damage to the kidney is avoided and the patient's renal function is protected to the maximum. Meanwhile, flexible ureteroscopy is able to reach deeper calyces, renal pelvis and other parts, thus the overall effect of lithotripsy and clearance is better [28, 29]. In terms of clinical surgical indicators, the operative time and the hospital stay of the study group were shorter than that of the control group, the intraoperative blood loss and the pain scores were significantly lower than that of control group. This result suggests that because there is no puncture process during retrograde intrarenal surgery, the surgical operation is easier, postoperative blood loss is effectively controlled, postoperative recovery is faster, and pain is also effectively controlled [30]. In terms of complications, the former consisted of 1 case of infection and 1 case of hematuria after the treatment, with an overall complication rate of 3.28%. The control group comprised 2 cases of infection, 5 cases of hematuria and 2 cases of ureteral injury after treatment, with an overall complication rate of 14.75%. Markedly lowered occurrence rate of total complications was exhibited in study group. This finding further validated the safety and comparative advantages of retrograde intrarenal surgery. These investigations were also consistent with previous studies [31, 32].

Compared with rigid ureteroscope, flexible ureteroscope is slender and easier to pass through twisted or narrowed ureter. Flexible ureteroscope lens is more flexible and can be deflected in multiple directions into renal calyces that cannot be reached by rigid ureteroscope, treating stones in complex areas and removing them from the body non-invasively. Therefore, retrograde intrarenal surgery has the advantages of simple operation, small trauma, high safety and fast recovery time. Percutaneous nephrolithotripsy is performed by establishing a channel from the waist to the kidneys, and then placing the laser directly on the stone surface for lithotripsy, which can be independent of the stone location and has a high stone clearance rate. However, flexible ureteroscope has less local irritation to patients and can effectively protect the patient's

TABLE 1. Comparison of inflammatory reaction indicators between study and control groups ($\bar{x} \pm s$).

Group	N	IL-6 (pg/mL)		IL-10 (pg/mL)		TNF-α (ng/mL)	
		Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Study group	61	7.21 ± 0.54	11.24 ± 1.05	3.62 ± 0.24	9.11 ± 0.68	1.31 ± 0.11	1.78 ± 0.15
Control group	61	7.24 ± 0.64	14.52 ± 1.22	3.64 ± 0.31	13.05 ± 1.24	1.29 ± 0.12	2.34 ± 0.21
t value	—	0.2798	15.9152	0.3984	21.7594	0.9596	16.9479
p value	—	0.7801	0.0000	0.6910	0.0000	0.3392	0.0000

IL-6: Interleukin-6; IL-10: interleukin-10; TNF-α: serum tumor necrosis factor.

TABLE 2. Comparison of renal function indicators between study and control groups ($\bar{x} \pm s$).

Group	N	BUN (mmol/L)		Scr (μmol/L)		BUA (μmol/L)		BMG (μL /min)	
		Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Study group	61	11.65 ± 1.21	5.34 ± 0.41	187.35 ± 16.25	94.35 ± 9.56	482.15 ± 44.26	351.25 ± 34.16	69.52 ± 6.11	54.36 ± 4.16
Control group	61	11.55 ± 1.19	7.89 ± 0.65	188.35 ± 17.06	147.35 ± 13.26	483.15 ± 43.16	426.35 ± 40.69	69.49 ± 5.94	63.54 ± 6.19
t value	—	0.4602	25.9154	0.3315	25.3224	0.1263	11.0403	0.0275	9.6136
p value	—	0.6462	0.0000	0.7408	0.0000	0.8997	0.0000	0.9781	0.0000

BUN: blood urea nitrogen; Scr: serum creatinine; BUA: blood uric acid; BMG: serum β_2 microglobulin.

TABLE 3. Comparison of clinical surgical indicators between study and control groups ($\bar{x} \pm s$).

Group	N	Operative time (min)	Hospital stay (d)	Intraoperative blood loss (mL)	Pain score (score)
Study group	61	69.61 ± 6.59	3.80 ± 0.54	21.56 ± 0.53	1.02 ± 0.53
Control group	61	85.18 ± 8.08	6.49 ± 0.62	75.16 ± 7.10	3.21 ± 0.41
t value	—	11.6630	25.5531	58.7983	25.5262
p value	—	0.0000	0.0000	0.0000	0.0000

TABLE 4. Comparison of complications between study and control groups (n, %).

Group	N	Infection	Hematuria	Ureteral injury	Overall complications
Study group	61	1 (1.64)	1 (1.64)	0 (0.00)	2 (3.28)
Control group	61	2 (3.28)	5 (8.20)	2 (3.28)	9 (14.75)
χ^2 value	—		—		4.8960
p value	—		—		0.0269

renal tissue.

In the current study, due to the limited cases and some limitations of patients, only male patients served as the study subjects, and only kidney stones less than 3 cm in diameter were studied. In the future, with the accumulation of cases and experience, the advantages and disadvantages of RIRS and percutaneous nephrolithotripsy in treating kidney stones should be compared in a larger range of researches to provide reference for clinical research and related practice.

5. Conclusions

In conclusion, this study concluded that compared with percutaneous nephrolithotripsy, RIRS for the treatment of male kidney stones less than 3 cm in diameter can improve the inflammatory response of patients, maximize the preservation of patients' renal function indicators, and significantly improve the clinical comprehensive efficacy.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

BQ—designed the study and carried them out; BQ, WHL, QGW, PY, YWL, HCJ and ZKG—supervised the data collection, analyzed the data, interpreted the data, prepare

the manuscript for publication and reviewed the draft of the manuscript. All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Committee of the Eighth Affiliated Hospital of Guangxi Medical University, The People's Hospital of Guigang (Approval no. GYLLPJ-20230112-01). Written informed consent was obtained from a legally authorized representative for anonymized patient information to be published in this article.

ACKNOWLEDGMENT

Not applicable.

FUNDING

This research received no external funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Ulvik Ø, Æsøy MS, Juliebø-Jones P, Gjengstø P, Beisland C. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. European Urology. 2022; 82: 73–79.

[2] Dasgupta R, Cameron S, Aucott L, MacLennan G, Thomas RE, Kilonzo MM, *et al.* Shockwave lithotripsy versus ureteroscopic treatment as therapeutic interventions for stones of the ureter (TISU): a multicentre randomised controlled non-inferiority trial. European Urology. 2021; 80: 46–54.

[3] Ulvik Ø, Sørstrand Æsøy M, Juliebø-Jones P, Gjengstø P, Beisland C. Reply to Jinze Li, Yin Huang, Dehong Cao, and Qiang Wei's letter to the editor re: Øyvind Ulvik, Mathias Sørstrand Æsøy, Patrick Juliebø-Jones, Peder Gjengstø, Christian Beisland. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. Eur Urol. 2022; 82: 73–79. European Urology. 2022; 82: e72.

[4] Ulvik Ø, Sørstrand Æsøy M, Juliebø-Jones P, Gjengstø P, Beisland C. Reply to Hyung Joon Kim and Khurshid R. Ghani's letter to the editor re: Øyvind Ulvik, Mathias Sørstrand Æsøy, Patrick Juliebø-Jones, Peder Gjengstø, Christian Beisland. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. Eur Urol. 2022; 82: 73–9. European Urology. 2022; 82: e41–e42.

[5] Dasgupta R, McClinton S. Reply to Gorrepati Rohith and Prasant Nayak's letter to the editor re: Ranan Dasgupta, Sarah Cameron, Lorna Aucott, *et al*. Shockwave lithotripsy versus ureteroscopic treatment as therapeutic interventions for stones of the ureter (TISU): a multicentre randomised controlled non-inferiority trial. Eur Urol 2021; 80: 46–54. European Urology. 2021; 80: e124–e125.

[6] Ulvik Ø, Sørstrand Æsøy M, Juliebø-Jones P, Gjengstø P, Beisland C. Reply to Frederic Panthier, Alba Sierra, and Olivier Traxer's letter to the editor re: Øyvind Ulvik, Mathias Sørstrand Æsøy, Patrick Juliebø-Jones, Peder Gjengstø, Christian Beisland. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. Eur Urol. 2022; 82: 73–9. European Urology. 2022; 82: e37–e38.

[7] Ulvik Ø, Sørstrand Æsøy M, Juliebø-Jones P, Gjengstø P, Beisland C. Reply to Alan J. Yaghoubian, Jonathan a. Khusid, and Mantu Gupta's letter to the editor re: Øyvind Ulvik, Mathias Sørstrand Æsøy, Patrick Juliebø-Jones, Peder Gjengstø, Christian Beisland. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. Eur Urol. 2022; 82: 73–9. European Urology. 2022; 82: e45–e46.

[8] Kim HJ, Ghani KR. Re: Øyvind Ulvik, Mathias Sørstrand Æsøy, Patrick Juliebø-Jones, Peder Gjengstø, Christian Beisland. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. Eur Urol. 2022; 82: 73–9. European Urology. 2022; 82: e39–e40.

[9] Panthier F, Sierra A, Traxer O. Re: Øyvind Ulvik, Mathias Sørstrand Æsøy, Patrick Juliebø-Jones, Peder Gjengstø, Christian Beisland. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. Eur Urol. 2022; 82: 73–9. European Urology. 2022; 82: e35–e36.

[10] Li J, Huang Y, Cao D, Wei Q. Re: Øyvind Ulvik, Mathias Sørstrand Æsøy, Patrick Juliebø-Jones, Peder Gjengstø, Christian Beisland. Thulium fibre laser versus holmium: YAG for ureteroscopic lithotripsy: outcomes from a prospective randomised clinical trial. Eur Urol. 2022; 82: 73–79. European Urology. 2022; 82: e71.

[11] Rohith G, Nayak P. Re: Ranan Dasgupta, Sarah Cameron, Lorna Aucott, *et al*. Shockwave lithotripsy versus ureteroscopic treatment as therapeutic interventions for stones of the ureter (TISU): a multicentre randomised controlled non-inferiority trial. Eur Urol 2021; 80: 46–54. European Urology. 2021; 80: e119.

[12] Schaeffer EM. Re: clinical characteristics of postoperative febrile urinary tract infections after ureteroscopic lithotripsy. Journal of Urology. 2020; 203: 12.

[13] Kilonzo MM, Dasgupta R, Thomas R, Aucott L, MacLennan S, Lam TBL, *et al*. Cost-utility analysis of shockwave lithotripsy *vs.* ureteroscopic stone treatment in adults. BJU International. 2023; 131: 253–261.

[14] Mazzon G, Choong S, Celia A. Comment on: ""VirtualBasket" ureteroscopic holmium laser lithotripsy: intraoperative and early postoperative outcomes". Minerva Urology and Nephrology. 2022; 74: 379–380.

[15] Bozzini G, Maltagliati M, Berti L, Besana U, Calori A, Pastore AL, *et al*. "VirtualBasket" ureteroscopic holmium laser lithotripsy: intraoperative and early postoperative outcomes. Minerva Urology and Nephrology. 2022; 74: 344–350.

[16] Dasgupta R, Cameron S, Aucott L, MacLennan G, Kilonzo MM, Lam TB, *et al.* Shockwave lithotripsy compared with ureteroscopic stone treatment for adults with ureteric stones: the TISU non-inferiority RCT. Health Technology Assessment. 2022; 26: 1–70.

[17] Zhang LW, Fei X, Song Y. The clinical efficacy of novel vacuum suction ureteroscopic lithotripsy in the treatment of upper ureteral calculi. World Journal of Urology. 2021; 39: 4261–4265.

[18] Zhao Z, Zeng G. The 365 μm holmium laser in flexible ureteroscopic lithotripsy: prospect and risk coexist? World Journal of Urology. 2020; 38: 3301–3302.

[19] Ma Y, Jian Z, Li H, Wang K. Preoperative urine nitrite versus urine culture for predicting postoperative fever following flexible ureteroscopic lithotripsy: a propensity score matching analysis. World Journal of Urology. 2021; 39: 897–905.

[20] Ma Y, Jian Z, Li H, Wang K. Correction to: preoperative urine nitrite versus urine culture for predicting postoperative fever following flexible ureteroscopic lithotripsy: a propensity score matching analysis. World Journal of Urology. 2021; 39: 907–908.

[21] Wu ZH, Wang YZ, Liu TZ, Wang XH, Zhang C, Zhang WB, *et al.* Comparison of vacuum suction ureteroscopic laser lithotripsy and traditional ureteroscopic laser lithotripsy for impacted upper ureteral stones. World Journal of Urology. 2022; 40: 2347–2352.

[22] Lu P, Chen K, Wang Z, Song R, Zhang J, Liu B, *et al*. Clinical efficacy and safety of flexible ureteroscopic lithotripsy using 365 μm holmium laser for nephrolithiasis: a prospective, randomized, controlled trial. World Journal of Urology. 2020; 38: 481–487.

[23] Xia L, Xuan H, Cao Y, Du Z, Zhong H, Chen Q. Computational analysis of influencing factors and multiple scoring systems of stone clearance rate after flexible ureteroscopic lithotripsy. Computational Intelligence and Neuroscience. 2022; 2022: 1–8.

[24] Yu J, Li B, Ren BX, Zhang NY, Jin BX, Zhang JJ. Subcapsular renal haematoma after ureteroscopic lithotripsy: a single-centre, retrospective study in China. BMJ Open. 2022; 12: e062866.
[25] Ma Y, Jian Z, Xiang L, Zhou L, Jin X, Luo D, *et al*. Development of a novel predictive model for a successful stone removal after flexible ureteroscopic lithotripsy based on ipsilateral renal function: a single-centre, retrospective cohort study in China. BMJ Open. 2022; 12: e059319.
[26] Jung HD, Hong Y, Lee JY, Lee SH. A systematic review on comparative analyses between ureteroscopic lithotripsy and shock-wave lithotripsy for ureter stone according to stone size. Medicina. 2021; 57: 1369.
[27] Taguchi M, Yasuda K, Tsuchiya A, Kinoshita H. Usefulness of ureteroscopic lithotripsy in Izuo position for patients with difficulty opening legs. International Journal of Urology. 2022; 29: 1240–1242.
[28] Waseda Y, Takazawa R, Kobayashi M, Fuse H, Tamiya T. Risk factors and predictive model for incidence of difficult ureter during retrograde ureteroscopic lithotripsy. International Journal of Urology. 2022; 29: 542–546.
[29] Waseda Y, Takazawa R. Re: editorial comment to risk factors and predictive model for incidence of difficult ureter during retrograde ureteroscopic lithotripsy. International Journal of Urology. 2022; 29: 547–547.
[30] Alessandria E. Editorial comment to usefulness of ureteroscopic lithotripsy in Izuo position for patients with difficulty opening legs. International Journal of Urology. 2022; 29: 1242.
[31] Inoue T. Editorial comment to risk factors and predictive model for incidence of difficult ureter during retrograde ureteroscopic lithotripsy. International Journal of Urology. 2022; 29: 546–547.
[32] Yamashita S, Iwahashi Y, Deguchi R, Kikkawa K, Kohjimoto Y, Hara I. Three-dimensional mean stone density on non-contrast computed tomography can predict ureteroscopic lithotripsy outcome in ureteral stone cases. Urolithiasis. 2020; 48: 547–552.

How to cite this article: Bin Qin, Weihao Luo, Qingguo Wu, Peng Yang, Yiwen Liang, Hanchu Ji, *et al*. Effect of retrograde intrarenal surgery on the inflammatory reaction, renal function indicators and clinical efficacy in male patients with kidney stones. Journal of Men's Health. 2023; 19(2): 45-50. doi: 10.22514/jomh.2023.017.