Original Article

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# Feasibility of Anesthesia-Free Ureteroscopic Lithotripsy in Elderly Patients with Urinary Tract Infections

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**Purpose:** Patients with underlying diseases, particularly in the elderly, urinary tract obstruction with a ureter stone would progress to severe conditions. Some of them have poor general conditions to endure anesthesia. Therefore, this study validated the feasibility of ureteroscopic stone removal without anesthesia for elderly patients with ureter stones who were under impending septic conditions or severe urinary tract infections.

**Materials and Methods:** Thirty-four patients (16 males and 18 females) were included in this study. All of them had serious problems, making it difficult to endure anesthesia. Most of them were inserted pre-operative percutaneous nephrostomy catheter, and ureteroscopic lithotripsy was performed successfully after intravenous analgesic injection (pethidine 25 mg).

**Results:** The mean age was 71.8±10.84 years. The locations of the stones were upper ureter in 11, mid-ureter in 6, and lower ureter in 17 cases. Urine and blood cultures identified bacteria from 17/34 patients. *Escherichia coli* was the most common (10/17), followed in order by *Klebsiella pneumoniae* and *Staphylococcus epidermidis* in 5 and 2 cases, respectively. Most patients had an abnormal white blood cell count (19,400±4,233.3/μl) and elevated C-reactive protein levels (110.3±83.6 mg/L). No patient had to stop the operation because of intolerable pain. The mean of the visual analog pain scale was 3.2±0.86. The overall success rate was 100%.

**Conclusions:** The trial of ureteroscopic lithotripsy after administering analgesics could improve the condition of elderly patients whose general condition is too poor to endure anesthesia without serious complications.

**Keywords:** Urolithiasis; Ureteroscopy; Urinary tract infections; Analgesics

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## INTRODUCTION

Ureteral stones frequently cause urinary tract obstruction [1], which increases the risk of complications, such as infection [1] and deterioration of renal function, so they must be removed even if there are no symptoms [2]. When urinary tract obstruction occurs, urine stagnates, making infections more likely. Active treatment is essential because the response to antibiotic treatment is poor before the obstruction is relieved, and sepsis can occur if the infection worsens. If a urinary tract infection occurs because of acute urinary tract obstruction and progresses to urosepsis [3],

a percutaneous nephrostomy (PCN) can alleviate the symptoms and reduce the risk of infection. Nevertheless, it is essential to remove stones reliably to prevent the progression to infection, sepsis, and deterioration of renal function [4]. In particular, in the case of the elderly or those with underlying diseases, such as diabetes, sepsis can occur easily, even with local infection. The mortality rate is high, so stones must be removed [5,6].

Some elderly patients with underlying medical conditions may be unable to tolerate anesthesia. Routine preoperative pulmonary function tests and echocardiography are not required if ureteroscopic lithotripsy can be performed without anesthesia in these patients. As a result, the overall treatment period can be shortened. It can also prevent the progression of severe urinary tract infections and sepsis.

Therefore, this study performed ureteroscopic lithotripsy after an intravenous injection of analgesics instead of anesthesia in elderly patients with ureteral stones, for whom anesthesia is difficult. Before and after ureteroscopy (URS), the visual analog pain scale (VAS), total success rate, administration period, operation time, white blood cell (WBC) counts, and C-reactive protein (CRP) levels were measured to verify the effectiveness of ureteral stone removal by URS without anesthesia.

## MATERIALS AND METHODS

This study was conducted retrospectively on 16 male and 18 female patients and was approved by the Institutional Review Board (IRB) of the Daegu Catholic University Medical Center (IRB No. CR-23-099). Most patients were admitted via the emergency room; the chief complaints were fever, flank pain, and urinary tract infections. They suffered from serious underlying diseases, such as diabetes, aspiration pneumonia, dementia, spinal stenosis, compression fracture of the spine, old cerebrovascular accidents, rheumatoid arthritis, congestive heart failure, hypertension, emphysematous pyelonephritis, neurogenic bladder, hypothyroidism, and herpes zoster. Most patients had at least 2 diseases. Therefore, their condition was too poor to tolerate local or general anesthesia. A PCN catheter was inserted in 32 out of 34 patients to prevent progression to a serious condition, such as urosepsis.

Ureteroscopic stone removal was performed with an intravenous injection of an analgesic (pethidine, 25 mg). An 8 Fr semi rigid ureteroscope (KARL STORZ SE & Co. KG) was used. The perception of pain during surgery was measured using VAS. The success rate of stone removal was evaluated by plain film radiography or ultrasonography. Stones equal to or larger than 4 mm were considered residual stones. After surgery, Double J stents were placed in 32 out of 34 patients. Urine and blood cultures were performed before surgery to identify urinary tract infection-causative bacteria. In addition, the WBC counts and CRP levels in the blood were measured to check the degree of the inflammatory response before surgery. In addition, the size and major components of the removed stones were analyzed.

**Table 1.** Baseline patient profile, stone characteristics, and stone management

| Variable | Value |
|---|---|
| Age (y) | 71.8±10.84 |
| Sex, M:F | 16:18 |
| Stone characteristics | |
| Stone diameter (mm) | 7.62 (4-15) |
| Stone location | |
| Upper ureter | 11 (32.3) |
| Middle ureter | 6 (17.6) |
| Lower ureter | 17 (50.0) |
| Stone management | |
| PCN | 32/34 (94.1) |
| Ureteroscopic lithotripsy under analgesics | 34/34 (100) |
| Postoperative double J stent placement | 32/34 (94.1) |

Values are presented as mean±standard deviation, number only, number (range), or number (%).
M: male, F: female, PCN: percutaneous nephrostomy.

## RESULTS

The mean age of the patient in this study was 71.8±10.84 years (Table 1). Thirty out of 34 patients were transported from nursing hospitals. Eighteen out of them were transported in a bedridden state. The patients underwent ureteroscopic lithotripsy within 10 days after PCN, and the operation time was 15-37 minutes (Table 2). None of the patients discontinued surgery because of intolerable pain during surgery. One patient was transferred to the Department of Internal Medicine for the treatment of pneumonia, and other patients showed a normal recovery. The hospitalization period was 10-19 days, and the patient was discharged 5.4±5.75 days after URS. The VAS was 3.2±0.86 (Table 2), and the surgical success rate was 100%.

The location of the ureteral stone was as follows: 11 cases in the upper, 6 cases in the middle, and 17 cases in the

**Table 2.** Duration of admission, operation time, and pre-operative laboratory findings

| Variable | Value |
|---|---|
| Average length of stay (d) | 12.1±7.5 (10-19) |
| Operation time (min) | 27.5±12.3 (15-37) |
| Time between urgent renal decompression and stone intervention | 9.4±1.5 |
| VAS | 3.2±0.86 |
| WBC counts (/μl) | 19,400±4,233.3 (13,800-24,600) |
| CRP levels (mg/L) | 110.3±83.6 (6.9-217.1) |
| Positive blood & urine culture | |
| *Escherichia coli* | 10 (29.4) |
| *Klebsiella pneumoniae* | 5 (14.7) |
| *Staphylococcus epidermidis* | 2 (5.9) |

Values are presented as mean±standard deviation (range) or number (%).
VAS: visual analog pain scale, WBC: white blood cell, CRP: C-reactive protein.

lower ureter (Table 1). URS with a holmium laser removed the stones, which had sizes ranging from 4 to 15 mm, with a mean size of 7.62 mm (Table 1). An analysis of the composition of stones showed that 18 out of 34 cases were calcium oxalate stones, 12 cases were calcium phosphate stones, and 4 cases were uric acid stones.

Urine and blood cultures identified the causative organisms in 17 out of 34 patients. The most common organism was *Escherichia coli*, which was detected in 10 of 17 patients (Table 2). *Klebsiella pneumoniae* and *Staphylococcus epidermidis* were detected in 5 and 2 cases, respectively. The applied antibiotics were third-generation cephalosporins, fluoroquinolones, carbapenems, aminoglycosides, and glycopeptides. These agents were tried empirically first, followed by sensitivity test results, mostly in combination. As a result of the preoperative blood test, WBC counts were 13,800-24,600/μl and CRP levels ranged from 6.9 to 217.1 mg/L (Table 2).

## DISCUSSION

Elderly patients, particularly those hospitalized in nursing hospitals, often suffer from chronic underlying diseases, and early diagnosis is delayed because of long bed life or not complaining of symptoms, leading to complications, such as urinary tract obstruction and urinary tract infection [7]. In this study, the mean age of the patients was 71.8 years old, and most had at least 2 underlying diseases. In the case of the elderly with underlying diseases, such as diabetes, cardiovascular disease, and neurodegenerative diseases, urinary tract obstruction progresses easily to sepsis [5,7], which is a serious situation with a fatality rate of 20 to 40% [8]. In a previous study [9], the success rate of ureteroscopic lithotripsy performed after decompression in patients with previous sepsis was similar to that in patients without sepsis. On the other hand, the complication rate was higher, and the total hospitalization period and postoperative antibiotic treatment period were longer. Therefore, a urinary tract obstruction will likely require urgent treatment in elderly patients with poor overall health. In most patients, PCN was performed to relieve the obstruction through rapid and adequate drainage. The urinary tract infections were treated with appropriate antibiotics. Special tests, such as pulmonary function tests and echocardiography, are necessary to determine if the elderly are in a suitable state for anesthesia, require reservations, and take time. In addition, the risk of anesthesia increases if the underlying disease is severe, and anesthesia may not be possible in some cases. Therefore, in this study, lithotripsy was performed using an 8 Fr semi rigid ureteroscope with intravenous injection of analgesics to solve the problem of elderly patients who are prone to severe diseases and cannot tolerate anesthesia. As a result, the worsening of symptoms due to urinary tract obstruction could be prevented, and renal function preserved.

Previous studies [10-12] measured the degree of pain felt by patients using the VAS. A VAS score of 4 or lower was classified as mild pain, indicating no significant discomfort to the patient. In the present study, the average VAS of patients during surgery was 3.2±0.86, and there was no case of discontinuation of surgery due to pain. As reported previously [13], the most common organism identified in this study was *E. coli*. All patients recovered and were discharged an average of 5.4 days after surgery, except for 1 patient who was transferred to internal medicine due to pneumonia.

Of the 34 patients in the study, 30 transferred from the nursing hospital. Among them, 18 patients were transferred while lying on a bed. The elderly population in Korea is increasing rapidly. Accordingly, the age of patients suffering from urinary tract obstruction due to ureteral stones is also increasing. Primary care institutions, such as nursing hospitals, need more careful patient management for elderly patients, and tertiary medical institutions need to prepare for prompt and appropriate treatment and prepare treatment

plans. This paper reported the prompt removal of stones successfully under analgesics in elderly patients with a poor general health status and in whom it was difficult to administer anesthesia.

## CONCLUSIONS

Most elderly patients with severe chronic diseases are hospitalized and receive treatment in nursing hospitals. In these patients, obstruction of the urinary tract caused by ureteral stones can easily accompany it. If not diagnosed early, the risk of serious complications, such as urinary tract infection and deterioration of renal function, is high. Therefore, this study attempted to remove urinary stones without anesthesia in high-risk elderly patients who were difficult to anesthetize and successfully removed them. Therefore, ureteroscopic lithotripsy after administering analgesics could be an effective treatment for these patients.

## CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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## AUTHOR CONTRIBUTIONS

D.Y.K. participated in the study conception and design. D.Y.K., H.J.J. participated in acquisition of data. D.Y.K., E.K.Y. participated in analysis and interpretation of data. D.Y.K., E.K.Y. participated in drafting and revising the article. All authors read and approved the final manuscript.

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