

# Does Stone Removal Help Patients with Recurrent Urinary Tract Infections?

Mohamed Omar, Abdullahi Abdulwahab-Ahmed, Hemant Chaparala and Manoj Monga\*

From the Glickman Urological and Kidney Institute, Cleveland Clinic Foundation, Cleveland, Ohio

**Purpose:** We evaluated the impact of surgical extraction of nonobstructing asymptomatic stones on recurrent urinary tract infections and identified predictors of patients who may be rendered infection-free.

**Materials and Methods:** We retrospectively reviewed charts to identify patients with recurrent urinary tract infections who underwent surgical stone extraction and were rendered stone-free. Demographic variables as well as procedure, infectious etiology, stone composition and the systemic inflammatory response syndrome rate were also recorded. Patients were divided into 2 groups. Group 1 had no evidence of recurrent infection following surgery while recurrent infection developed in group 2. Univariate analysis was performed using the Wilcoxon signed rank and Fisher exact tests. Logistic regression was used for multivariate analysis.

**Results:** We identified 120 patients with recurrent urinary tract infections and a nonobstructive renal stone. Surgical management included shock wave lithotripsy in 32% of cases, ureteroscopy in 7% and percutaneous nephrolithotomy in 61%. Of the 120 patients 58 (48%) remained infection-free after surgery while 62 (52%) experienced recurrent infection. Factors associated with a higher risk of recurrent infections included type 2 diabetes mellitus (OR 1.73,  $p = 0.01$ ), hypertension (OR 2.8,  $p = 0.007$ ) and black ethnicity (OR 13.7,  $p = 0.009$ ). *Escherichia coli* infections were more likely to resolve (OR 0.34,  $p = 0.01$ ). In contrast, *Enterococcus* infections were more likely to persist (OR 2.5,  $p = 0.04$ ). On multiple logistic regression analysis only race, hypertension and *E. coli* infections were significant predictors of infection clearance.

**Conclusions:** Of patients with recurrent urinary tract infections and asymptomatic renal calculi 50% may be rendered infection-free following stone extraction. Patients with risk factors for recurrent infections after surgery should be counseled that stone extraction might not eradicate the infection.

**Key Words:** kidney, calculi, urinary tract infections, lithotripsy, ureteroscopy

URINARY tract infections are the most common bacterial infection affecting the general population.<sup>1</sup> One of 3 women will have at least 1 UTI requiring medical evaluation by age 24 years. The annual incidence of UTIs in

the United States is estimated to be 3% in men and 12% in women.<sup>2</sup> A certain subset of individuals is affected by recurrent UTIs, defined as 3 or more UTIs per year, or 2 or more in 6 months.<sup>3</sup>

## Abbreviations and Acronyms

ESWL = extracorporeal shock wave lithotripsy  
GFR = glomerular filtration rate  
HTN = hypertension  
KUB = plain x-ray of kidneys, ureters and bladder  
NCCT = noncontrast computerized tomography  
PCNL = percutaneous nephrolithotomy  
SIRS = systemic inflammatory response syndrome  
US = ultrasound  
UTI = urinary tract infection

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\* Correspondence: Stevan Strem Center for Endourology and Stone Disease, Glickman Urological and Kidney Institute, Cleveland Clinic, 9500 Euclid Ave., Q10-1, Cleveland, Ohio 44195 (telephone: 216-445-8678; e-mail: [mongam@ccf.org](mailto:mongam@ccf.org)).

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The relationship between nephrolithiasis and UTI is unclear. Traditionally infection stones were believed to be caused by urease producing bacteria, leading to the formation of struvite stones.<sup>3,4</sup> However, recent studies demonstrated that 35% of stones associated with infection are calcium stones.<sup>4,5</sup> Additionally, studies of UTI during renal colic episodes demonstrated prevalence rates of 7% to 28%.<sup>5-7</sup> UTI may develop as a consequence of urinary stasis secondary to obstruction by the stone. Alternatively UTIs may promote the formation of stones.

A specific challenge facing the urologist is the patient with recurrent UTIs and asymptomatic, nonobstructing renal calculi. Often it is proposed that management of the associated UTI is contingent on removal of the stone as the stone acts as a nidus or collecting surface for recurrent infections.

The objective of this study was to evaluate the likelihood of the resolution of recurrent UTIs after successful removal of asymptomatic, nonobstructing renal calculi.

## MATERIALS AND METHODS

We retrospectively reviewed the charts of patients who presented to our stone clinic with renal calculi and recurrent UTIs prior to surgery for stone removal. Patients were referred to the stone clinic after diagnosis of a nonobstructing and asymptomatic renal stone. Imaging, typically US followed by confirmatory NCCT, was obtained as part of the evaluation for recurrent UTIs by the referring primary care physician, infectious disease specialist or urologist. Postoperative recurrent UTIs were defined as documented positive urine cultures obtained due to symptoms or surveillance after successful removal of all stones at surgery with no residual stones on postoperative imaging.

Charts were reviewed to correctly identify baseline demographic variables as well as the type of surgery, type of infection, stone composition and incidence rate of SIRS. SIRS was diagnosed when patients demonstrated 2 of certain signs, including heart rate greater than 90 beats per minute, respiratory rate greater than 20 respirations per minute, serum white blood count greater than 12,000 or less than 4,000 per high power field and fever greater than 38C or less than 36C. Patients with UTIs within 1 month postoperatively were excluded from analysis because the infection may have been secondary to the procedure.

Patients were divided into 2 groups. Group 1 showed no evidence of recurrent infection 1 year after stone removal. Group 2 still showed evidence of recurrent UTI within 1 year after stone removal.

Univariate analysis was performed with the Wilcoxon signed rank and Fisher exact tests to compare different variables. Logistic regression was used to test variables on multivariate analysis.

## RESULTS

Of 120 patients 58 (48%) were rendered infection-free after surgery at a mean  $\pm$  SD followup of 14  $\pm$  3

months. A total of 62 patients (52%) continued to have infections with a mean time to the first recurrent UTI of 12  $\pm$  2 months. Gender and age were not significantly associated with repeat infections postoperatively on univariate analysis ( $p = 0.1$  and  $0.1$ , respectively, table 1). Black American ethnicity was associated with repeat infections after a stone procedure (OR 13.7,  $p = 0.0009$ ). Existing HTN also demonstrated a significant association with recurrent UTIs (OR 2.8,  $p = 0.007$ ). Diabetes mellitus showed no association with recurrent UTIs ( $p = 0.2$ ). However, when the groups were stratified by gender, males with diabetes mellitus were more likely to have recurrent infections (OR 1.73,  $p = 0.01$ ). Stone composition and type of stone removal procedure were not significantly associated with repeat infections on univariate analysis ( $p = 0.4$  and  $0.3$ , respectively). Infection with only *E. coli* bacteria was associated with successful clearance of infection ( $p = 0.01$ ). In contrast, infection with *Enterococcus* was associated with failed clearance ( $p = 0.04$ , table 2). Immunosuppression, steroid use, cancer, hospital stay, pH, SIRS incidence, GFR and creatinine were not significantly associated with repeat infections.

On multivariate analysis HTN ( $p = 0.01$ ), black ethnicity ( $p = 0.003$ ) and *E. coli* infection ( $p = 0.01$ ) maintained an association with unsuccessful clearance of infection, while age was associated with recurrent infections ( $p = 0.3$ ) (table 3).

Quinolone resistance was more common in the preoperative cultures of patients who had recurrent UTIs after stone removal compared to those who remained infection-free after stone removal (48% vs 27% of cultures,  $p = 0.02$ ). For those with *Enterococcus* multidrug resistance was noted preoperatively in 37% who remained infection-free postoperatively compared to 40% of those who had recurrent infections postoperatively ( $p = 0.9$ ).

For patients in whom infections recurred or persisted after surgery there was no significant difference between preoperative and postoperative cultures with regard to quinolone resistance (48% vs 57%,  $p = 0.3$ ),  $\beta$ -lactamase resistance (28% vs 19%,  $p = 0.08$ ) or multidrug resistance (48% vs 47%,  $p = 0.9$ ).

Of patients with recurrent UTIs postoperatively 82% continued to have infections with the same preoperative organism while in 18% there was a change in the bacterial species cultured.

## DISCUSSION

UTIs are among the most prevalent infectious diseases with a substantial financial burden on society. In the United States UTIs are responsible for more than 7 million physician visits annually, approximately 15% of all community prescribed antibiotics

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