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Retrospective Analysis of Post-Operative Sepsis Rates, Stone Composition, and Ureteral Stent Duration after Ureteroscopy and Laser Lithotripsy During COVID-19

Young Son
Rowan University

Julia T. Scali
Rowan University

Ian Madison
Rowan University

Paul Chialastri
Rowan University

Thomas Mueller
Rowan University

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SCHOOL OF OSTEOPATHIC MEDICINE

Retrospective Analysis of Post-Operative Sepsis Rates, Stone Composition, and Ureteral Stent Duration after Ureteroscopy and Laser Lithotripsy During COVID-19

Young Son, D.O., Julia Scali, B.S., Ian Madison, B.S., Paul Chialastri, D.O., Thomas Mueller, M.D.
Rowan University School of Osteopathic Medicine, Urology Department

Introduction

Ureteroscopy with laser lithotripsy is routinely used to remove stones but results in manipulation of the genitourinary mucosa and has a well-established relationship with post-operative sepsis under certain conditions.^{1,2,3,4} Post-operative sepsis represents a significant morbidity and mortality cost to patients and the healthcare system.^{5,6} Several studies to determine risk factors for sepsis after ureteroscopy have been completed. Such risk factors include positive preoperative urine cultures, female gender, prolonged preoperative stent time > 1 month, and patients with sepsis at the time of initial stenting⁷. To improve sepsis rates, procedural alterations such as the use of disposable ureteroscopes have been introduced as there is some evidence that there may be residual bacteria on reusable ureteroscopes after sterilization. It is unclear how much this contributes to postoperative sepsis, as it may be an inflammatory response rather than true bacteremia⁸. Stone type may also be associated with bacteriuria as certain stones, such as struvite (magnesium ammonium phosphate) stones, form only in the presence of urease-producing bacteria such as *Proteus*, *E. coli*, and *Enterococcus*⁹. However, this has been challenged with recent percutaneous nephrolithotomy studies suggesting that struvite stones are created during infections but could potentially be sterilized, while carbonate apatite stones retain imprints of bacteria¹⁰. This investigation reviews if there were significant differences over the last three years in mean ureteral stent time, stone composition, or post-operative sepsis rates in patients who underwent ureteroscopy with laser lithotripsy, as well as if the COVID-19 pandemic had any significant impact on this data. Data has been shown that urological procedures has taken drastic decrease in number due to COVID-19 as elective cases were cancelled (figure 1)

Materials and Methods

A retrospective multi-institutional chart review was performed of all patients for which procedure code included ureteroscopy with laser lithotripsy to treat ureteral or kidney stones from April 2018 until December 2020. Patients were excluded if the composition of the stone was never reported or if the time to indwelling stent was unknown (presented from different hospital system without past medical records). Total data included 229 charts from four different hospitals and eleven operating surgeons. Patient charts were analyzed for factors including stone composition, stone size, stone weight, type of preoperative antibiotics, preoperative indwelling time of ureteral stent, and whether they were admitted postop or readmitted within 48 hours for suspicion of sepsis. The types of stone composition included oxalate monohydrate, oxalate dihydrate, carbonate apatite, uric acid, ammonium hydrogen urate, cysteine, amorphous carbonated calcium phosphate, octacalcium phosphate pentahydrate, calcium magnesium phosphate, sodium urate, and brushite. The data was then analyzed with t-tests to determine significant differences between stone composition from 2018, 2019, and 2020, preoperative ureteral stent indwelling time, and post-operative sepsis rate.

Results

The overall post-operative sepsis rates were 2.8% in 2018, 3.2% in 2019, and 8.0% in 2020. The mean indwelling stent time was 23.7 days in 2018, 19.4 days in 2019, and 12.3 days in 2020 with statistical significance shown in figure 2. The overall composition of stones treated was unchanged over the past three years with oxalate monohydrate as the most common stone type at 44.0 % in 2018, 47.0% in 2019 and 49.6% in 2020. The next most common stone was oxalate dihydrate stone with 21.5%, 21.5%, and 27.3% in 2018, 2019, and 2020, respectively. The

rate of ammonium hydrogen urate, amorphous carbonated calcium phosphate, sodium urate, octacalcium phosphate pentahydrate, and calcium magnesium phosphate was 0% in the years 2018 and 2020. Additionally, 0% of stones were compromised of cysteine in the years 2019 and 2020, compared to 2018 which had 1.4% cysteine stones.

T-tests were used to compare the mean indwelling ureteral stent time from 2018 to 2019, 2019 to 2020, and 2018 to 2020 (figure 3). Similarly, T-tests were used to compare stone compositions from the same years. Pre-operative cultures were also obtained for all the patients in the data set. Of those that had post-operative sepsis, four of the patients had a positive urine culture, three had mixed gram-positive species (one in each year), and 5 had negative urine cultures.

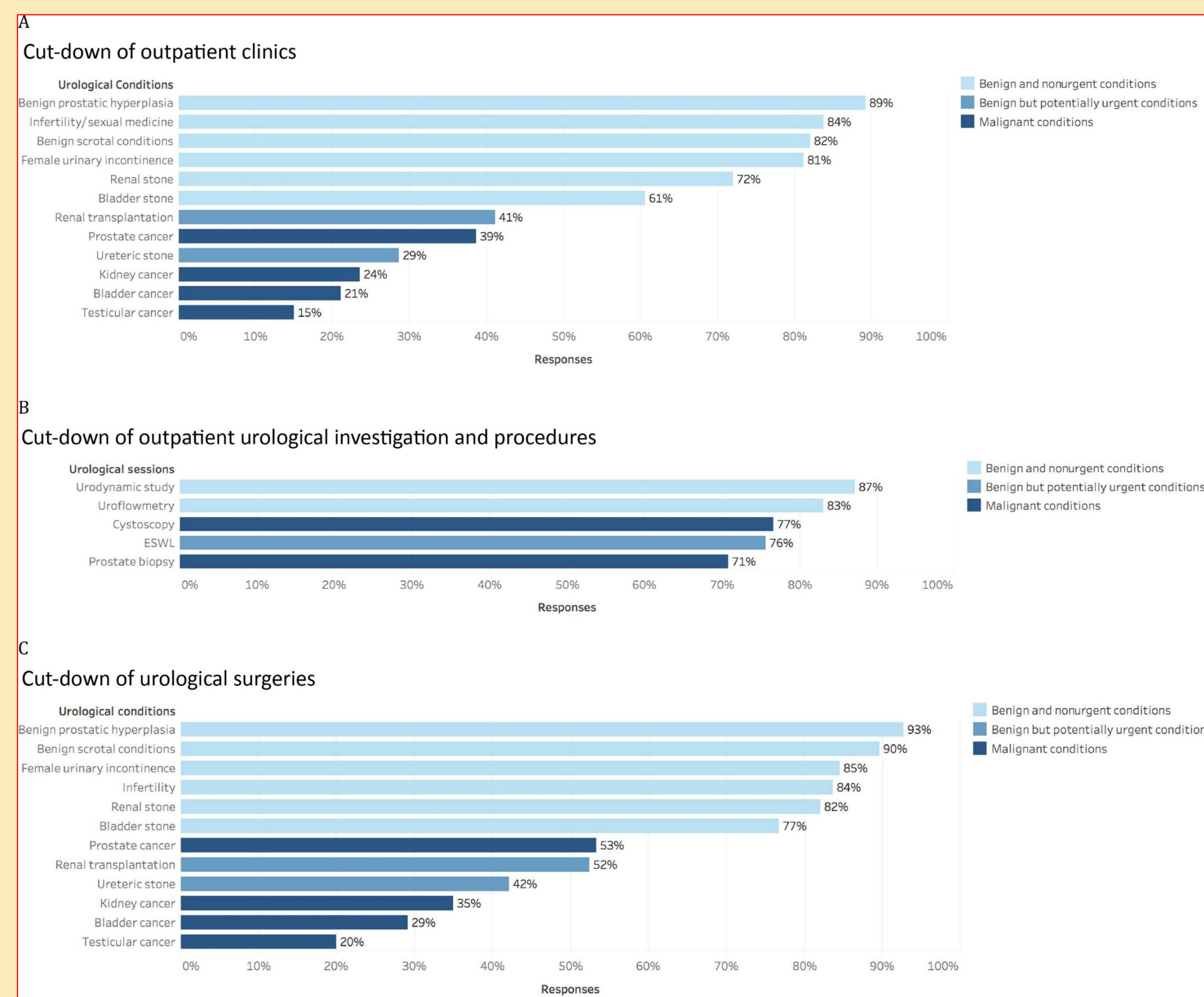


Figure 1: bar graph representing decline in urological procedure from COVID-19 in outpatient clinic and procedures.

	Indwelling Ureteral Stent Time (Days)	Post-operative Sepsis Rates
2018	23.7	2.78%
2019	19.4	3.19%
2020	12.3	8.00%

Figure 2: Indwelling stent duration and post operative sepsis rates seen in 2018, 2019, and 2020

P-Value	Indwelling Ureteral Stent Time (days)	Post-Operative Sepsis Rate
2019 vs. 2018	0.32	0.887
2020 vs. 2019	0.05	0.121
2020 vs. 2018	0.014	0.132

Figure 3: T-value factor: indwelling and post-operative between 2018, 2019 and 2020

Discussion

Ureteroscopy with laser lithotripsy is one of the most common procedures performed for the definitive treatment of ureteral or kidney stones. Ureteral stents are often used in guidance of ureteroscopy and to treat an obstruction due to these stones. The specific composition of kidney stones is also important in endourology as it can guide the medical treatment modality used to prevent or even treat kidney stones. The year 2020 was challenging as elective surgeries

were cancelled in the first half of the year due to COVID-19, hence the decrease in indwelling stent time as seen from our practice. In this study, we demonstrated that the composition of kidney stones and post-operative sepsis rates remained unchanged while the indwelling ureteral stents time decreased during COVID-19 pandemic.

In recent retrospective study from University of Selcuk in Turkey, the rate of complicated ureteral stone was significantly higher during the COVID-19 period, possibly due to deferring non-urgent cases that could have evolved to urgent and emergent situations. They found that the rate of emergent procedures was three-fold for treatment of ureteral stones in the COVID-19 restrictions period compared to the past¹¹. Similar to our study, the rate of ureteral stent placement in the study was also decreased compared to the non-COVID-19 period. Although they did not specify the rate of post-operative sepsis, in their population more patients were found to have septic stones at presentation.

Positive pre-operative urine culture has been associated with increased risk for sepsis during ureteroscopy and laser lithotripsy. However, mixed cultures are deemed to be a contaminate during the collection process and professional opinion is used to continue with the stone surgery or to abort until negative urine culture. Currently there is limited data showing mixed gram-positive urine culture and its correlation to post-operative sepsis. The known risk factors to predisposing patients to post-operative sepsis include female gender, prolonged stent time >1 month, and patients with history of sepsis at the time of ureteral stent insertion. Stone types may also be associated with bacteriuria as struvite (magnesium ammonium phosphate) stones form in the presence of urease producing bacteria such as *Proteus mirabilis*, *Escherichia coli*, and *Enterococcus*¹².

There are several limitations to this study. It is performed retrospectively and therefore no causality can be determined from the collectable data. There is a limited number of patients in the population that may not represent the population of a different area. Also, procedure time was not studied and may reflect an important variable in relation to sepsis, although stone sizes were comparable which one would consider may correlate to similar operative times for lithotripsy.

Conclusion

The indwelling ureteral stent duration has statistically decreased with many cancelled elective cases in the first half of 2020. The composition of ureteral and kidneys stones has also been unchanged through the pandemic.

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