Flexible Ureteroscopy in Staghorn Calculi

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ABSTRACT

Introduction: Staghorn calculi are large, branched kidney stones that occupy a significant space of the pyelocaliceal system. Traditionally, percutaneous nephrolithotomy (PNL) has been the treatment of choice for staghorn calculi. Compared to PNL, ureteroscopy is inferior for treating staghorn calculi because it has a lower clearance rate for big kidney stones. This study seeks to investigate the effectiveness of fURS in treating staghorn calculi.

Materials and Methods: From January 2018 to December 2022, 28 cases of staghorn calculi (type A, B, and C) diagnosed at Saint John Clinical Emergency Hospital and Sanador Hospital were analysed. Included were the patient's features and medical history. All cases were evaluated with comprehensive imaging (CT scan and follow-up KUB) and blood and urine analysis. All procedures were performed with the same device: Olympus URF-V2.

Results: The male-female ratio was 1.8:1. All patients included were diagnosed with complete staghorn calculi type A, B, and C, and the evaluated stone density was over 800 HU. Two to three procedures of fURS were necessary. The stone-free rate evaluated after three months was 91.6% (stone-free status was considered when the residual fragments were < 3 mm). The mean intervention time per procedure was 81.24 min. The complication rate was evaluated and revealed mostly mild Clavien I and II. The mean hospitalization time was 1.6 days.

Conclusion: Staged flexible ureteroscopy (fURS) is an effective alternative treatment for staghorn calculi stones and is associated with high stone-free rates and low complication rates.

Keywords: staghorn calculi, outcomes, flexible ureteroscopy.

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Introduction

The prevalence rates of urinary lithiasis vary from 1-20%, higher in countries with high standard of living (USA, Spain, Germany) [1,2]. Urolithiasis prevalence increases with age. Male individuals older than 80 have the highest prevalence of kidney stones - 19.7%, followed by 18.8% in men 60–79 years, 11.5% in men 40–59 years, and 5.1% in men 20–39 years of age [3].

Staghorn renal calculi are large renal calculi that occupy nearly the entirety of the renal collecting system. They are often associated with infectious types of stones or specific metabolic defects. [4] Staghorn calculi are more often reported in women than men and are usually unilateral [5]. Moores and O'Boyle classified the Staghorn calculi from Type A to F depending on the position of the stone in the pyelocaliceal system. The patients included in this paper have type A, B, and C staghorn calculi. This Type A calculus occupies the entire pyelocaliceal system, the Type B calculus occupies the pelvis and two calyceal groups, and the Type C stone occupies the pelvis and one calyx group [6].

Percutaneous nephrolithotomy (PCNL) and retrograde intrarenal surgery (RIRS) are the procedures to treat this disease. The first-line treatment of staghorn stones was PCNL [7] For kidney stones ≤2.0 cm the first-line treatment recommended by guidelines is RIRS [8]. When treating kidney stones larger than 2.0 cm RIRS has been reported to have a lower stone-free rate compared to PCNL [9]. For the past few decades, RIRS has become increasingly popular in the treatment of staghorn stones because of the technological advances that improved the stone-clearance rate [10]. Diri et al. reported that other treatments such as RIRS can be considered to be a multimodal therapy in certain circumstances PCNL was still the recommended first-line treatment for staghorn calculus [5].

Meanwhile, the Holmium laser (holmium yttrium-aluminium-garnet) has served as the gold standard for endoscopic lithotripsy, despite the development of other options [11,12]. The application of flexible ureteroscopy together with holmium laser technology is favorable for navigating through the deformed and distorted urinary tract [13]. J. Cohen et al. concluded in a single-center study that occurred over 10 years that staged, retrograde, flexible ureteroscopy is an alternative to percutaneous therapy with acceptable efficacy and low morbidity [14].

This study aimed to investigate the effectiveness of fURS in treating staghorn calculi in an experienced single-center study.

Materials and Methods

We retrospectively analyzed 28 cases of staghorn calculi diagnosed at Saint John Clinical Emergency Hospital and Sanador Hospital between January 2018 to December 2022. All patients were operated by doctors with long experience in the endoscopic treatment of renal lithiasis. The gold standard for diagnosing any renal stone, particularly staghorn stones, is a non-contrast Computed Tomography (CT) scan [Fig. 1]. All the patients had preoperative CT scans to evaluate the type of staghorn calculi.

The preoperative CT images calculated the stone surface area based on the largest volume (length × width = mm2). The follow-up evaluation was undertaken Three months after the operation using plain film of KUB (Kidney-Ureter-Bladder) for opaque stones, ultrasonography for non-opaque stones, or non-contrast CT of the whole abdomen.

All patients had a careful anamnesis and thus all the health problems they suffered from were noted. Upon admission, each patient had blood tests performed including blood count, creatinine, urea, electrolyte balance, uric acid, total serum calcium, and coagulation tests.

One of the important exclusion criteria from the study was a positive preoperative urine culture, thus all patients who underwent surgery had sterile urine cultures. All procedures from both medical centers were performed with the same fURS that Olympus URF- V2 developed. For easier access to the kidney, Olympus URF-V2 has an 8.4 Fr 670 mm length shaft. It also has a standard 3.6 Fr working channel and a 275° bi-directional angulation [15]. Holmium laser lithotripsy using a 270 µm fiber was performed in dusting mode, fragmentation, or both. After each session, a ureteral double-J stent was placed temporarily to help small fragments (2 mm) pass naturally and guard the ureter from blockage. If they are clinically stable the patient is

usually discharged the day after the intervention [Fig. 2].
Since multiple operative sessions were needed for a single patient, a break period of several weeks was desired between them.

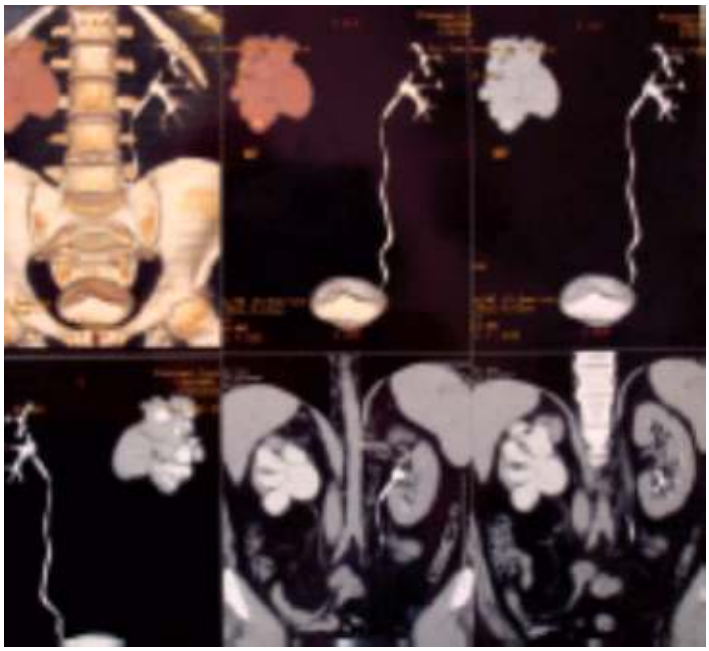


Fig.1 Staghorn calculi – CT scan.

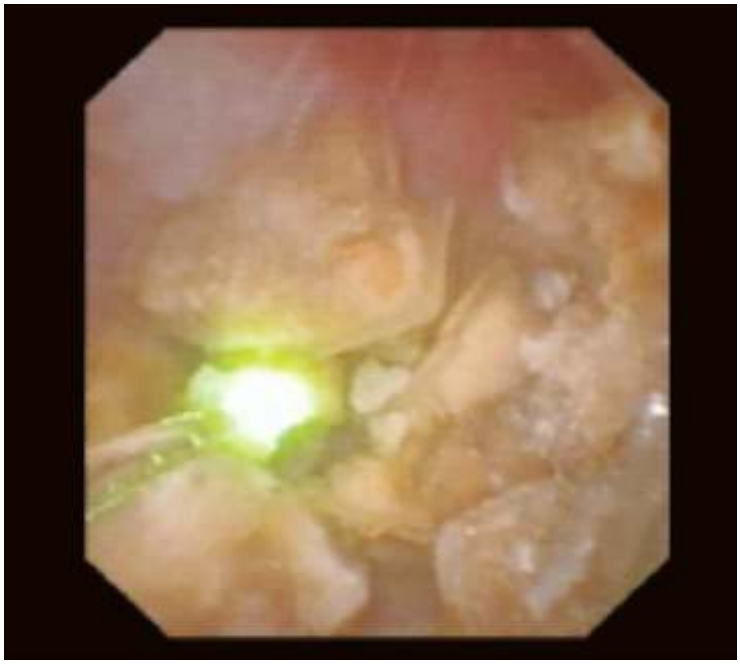


Fig. 2 Holmium Laser fragmentation of a staghorn calculi during fURS.

Results

Our study included 18 male patients, with an average age of 56 years (range 23 – 83) and 10 female patients with an average age of 55 years (range 21 -85 years). The male-female ratio is 1.8:1.
A total of 5 patients presented type A staghorn calculi, type B was observed in 10 patients and the remaining 13 presented type C stones. All patients had unilateral renal lithiasis.
Preoperatively, the therapeutic alternatives were explained to the patients and they opted for more sessions of flexible urethroscopy to the detriment of PCNL. Three of the patients included in the study had a solitary kidney. Shi et al. reported that patients with a solitary kidney were more likely to develop acute kidney injury after PCNL compared to patients with normal bilateral kidneys, thus the decision to use flexible urethroscopy [16].
Overall, 67 ureteroscopies were performed on 28 stone burdens. After the first session, most of the patients had a stone-free rate of 66%.
For each of the patients with type A staghorn calculi a stone-free rate of 89% was obtained after three sessions. The highest clearance rates were observed for type C staghorn stones (94,2%), with each patient needing 2 flexible ureteroscopy sessions. After each procedure, a double JJ stent was placed.
The stone-free rate evaluated after three months was 91.6% (stone-free status was considered when the residual fragments were < 3 mm on the imagistic scan).
Complication rates were evaluated using the Clavien – Dindo modified system. No major intraoperative or postoperative complications were described. There were four minor postoperative complications, including three patients with fever that remitted under antibiotic therapy. One patient presented postoperative hematuria, quickly remitted under conservative methods.
The mean hospitalization time is 1,6 days. The patient that stayed the most was the one with solitary kidney and fever postoperative, 4 days. These mild complications prolonged the hospitalization stay.

Discussion

The surgeon's experience and judgment and each patient's preferences also played a significant role in the choice of this therapy. Chen et al. stated that multisession flexible ureteroscopy can result in a satisfied stone-free rate of 89.1%, similar to our study of 91,6%. [17]. Our results are consistent with the data found in the literature and confirm that it can be achieved at a decent stone-free rate after multiple sessions of flexible ureteroscopy. Additionally, it seems that ureteroscopy is important for managing remaining stones for staghorn calculi following primary PNL. AUA Guidelines state that patients with infectious staghorn calculi should strive for a stone-free condition [7].
Giusti et al. supported that FURS was sufficiently safe for use in individuals with solitary kidneys [18]. The risk of urosepsis after flexible ureteroscopy was theoretically increased by the increased operative time that is required in the treatment of large renal. Sepsis would be potentially fatal without therapy. Therefore, it is important to have a preoperative sterile urine culture test and keep the surgery time between 90 and 120 min [19]. In our study, the average operative time was 81.24 min, and thus the minor immediate postoperative complications.
Bai et al. stated that RIRS is often performed as an ambulatory surgery in Western countries, thus patients will choose RIRS as it is a less invasive treatment with less length of hospital stay [20]. Our study presented the same results, the patient was usually discharged the next day after the intervention.
Last but not least, it should be mentioned that shortly, continued technological advancements may redefine the role of ureteroscopy in the treatment of staghorn calculi [21]. A particularly intriguing idea that has recently been proposed as a way to speed up stone removal during ureteroscopy is active stone fragment aspiration over a ureteral access sheath [22, 23]. Also, due to its ability to surpass the constraints of the Holmium: YAG laser, investigations point to the Thulium fiber laser as a potentially significant development for ureteroscopic laser-lithotripsy [24].

Conclusions

Patients must know the pros and drawbacks of each line of treatment for this kind of stone so that they can reach a decision. They need to be informed that more than one procedure will be
necessary to overcome the entire stone burden if they choose the retrograde approach. In conclusion, flexible ureteroscopy proves to be efficient in treating staghorn stones with no major perioperative or postoperative complications.

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