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A Technique to Flush Out Stone Fragments Through a Ureteral Access Sheath During Retrograde Intrarenal Surgery

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Abstract

Background: Retrograde intrarenal surgery (RIRS) has become the preferred treatment option for selected renal stones <20 mm. However, laser fragmentation of stones often results in residual small fragments that may prompt subsequent stone events. We describe a simple technique to facilitate removal of these fragments.
Case Presentation: A 68-year-old woman underwent elective RIRS for a 13 mm right renal pelvic stone. After laser fragmentation of the stone there were numerous <2 mm fragments too small to allow removal by a standard retrieval basket (i.e., NCircle® and NCompass® Nitinol Stone Extractors, Cook Medical, Bloomington, IN). A smaller ureteral access sheath (UAS) was advanced into the kidney within the preexisting larger UAS and, using a connecting piece from a Foley catheter, stone fragments were suctioned out through the smaller sheath. Stone-free status was corroborated endoscopically and with postoperative CT.
Conclusion: Stone fragments were flushed from the kidney using a simple irrigation technique through a coaxial UAS.

Keywords: ureteroscopy, ureteral access sheath, residual fragments

Introduction and Background

Retrograde intrarenal surgery (RIRS) is the preferred minimally invasive treatment modality for non-lower pole renal stones <20 mm. This method offers a superior stone-free rate and effectiveness quotient compared with extracorporeal shockwave lithotripsy, while also providing significantly less morbidity than percutaneous nephrolithotomy (PCNL). The primary objective of any therapy for urolithiasis is to render the patient stone free. However, after holmium laser lithotripsy, it is often extremely difficult to extract all fragments from the collecting system. Residual renal stone fragments may lead to recurrent renal colic, renal failure, urinary tract infection, and new stone formation. To wit, Danilovic and colleagues recently showed that residual stone fragments are found in 63% of cases when assessed by endoscopic evaluation at the end of the procedure, and in 25% when assessed by noncontrast CT (NCCT) 3 months postoperatively.[1] We present a simple technique that aided in clearing small stone fragments from the kidney during RIRS in one case.

Case Presentation

A 68-year-old woman with primary hyperparathyroidism and bilateral nephrolithiasis presented for a right PCNL. She had a preexisting right ureteral stent placed because of urosepsis associated with an obstructing right ureteropelvic junction (UPJ) stone measuring $12 \times 8 \times 13$ mm (750 HU). In addition, she had multiple small caliceal calcifications in her right kidney (Fig. 1). General anesthesia was administered and the patient was placed in prone position with her legs on spreader bars. The indwelling stent was partially removed using grasping forceps, and a guidewire was passed through the stent and into the renal pelvis. A 35 cm 16F Flexor® ureteral access sheath (UAS) (Cook Medical, Bloomington, IN) was passed up the ureter under fluoroscopic guidance to the level of the UPJ. A flexible ureteroscope was introduced through the UAS and the stone was identified in the renal pelvis. The caliceal stones were not visible endoscopically and were presumed to reside within the renal papillae.

The pelvic stone was approached with a 365 μm holmium laser fiber at 0.3 J and 50 Hz, which allowed for dusting of the stone. Despite attempts to completely ''dust'' the stone, the stone broke up into dust and larger fragments that we were unable to reduce further in size. After extensive basketing there remained a substantial sediment of stone material in the renal pelvis. At this point the patient was placed in 30° Trendelenburg position and tilted to the right so that stone fragments migrated to the anterior upper pole calices. The white funnel of a new 45 cm 14F Flexor® UAS was cut with a

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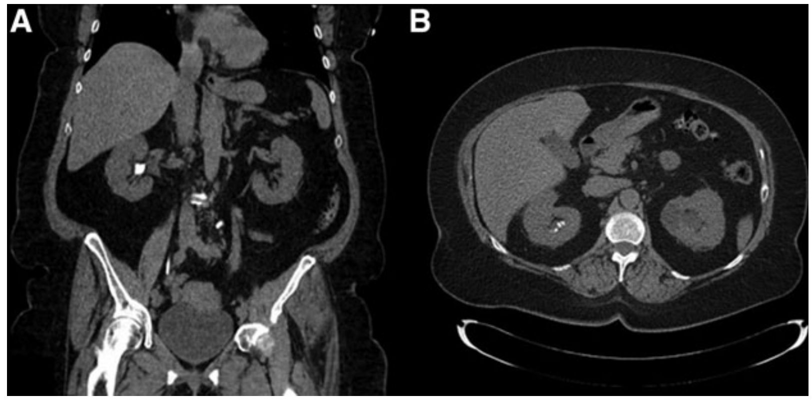

FIG. 1. Preoperative NCCT imaging illustrating right renal calculus. **(A)** Coronal view of the stone in the right renal pelvis. **(B)** Axial view of endoscopically confirmed submucosal calcifications in the right upper pole. NCCT, noncontrast CT.

Mayo scissors and removed; the 14F UAS and its obturator were advanced over a guidewire within the 16F UAS under fluoroscopic guidance and into the upper pole anterior calices. The guidewire and obturator were removed. The latex drainage port of a Foley catheter was cut and fitted over the distal cut end of the 14F UAS (Fig. 2). A catheter tip syringe was attached to the latex drainage port and the right collecting system was gently flushed with 20 mL 0.9% saline. Fluid from the collecting system was then aspirated back into the syringe, which was then disconnected and the syringe's contents expelled on a gauze pad to look for fragments (Fig. 3). The syringe was filled with another 20 mL of saline and the process was repeated several times until the fluid evacuated contained no visible stone fragments. The 14F UAS was removed and a flexible ureteroscope was passed through the 16F UAS into the right kidney. Systematic inspection confirmed that all calices were free of stone fragments. NCCT scan the following day showed the only remaining renal calcifications were those that had been endoscopically confirmed as submucosal calcifications. Stone composition was 90% calcium phosphate and 10% calcium oxalate (monohydrate and dihydrate).

Discussion

Laser fragmentation of renal stones often results in small stone fragments that cannot be adequately removed by standard retrieval devices. Consequently, despite the goal of ''dusting'' a stone, depending upon its composition, stone fragments may settle within the collecting system. To our knowledge, none of the commercially available stone retrieval devices (baskets) can reliably entrap fragments <2 mm. Fragments ≤4 mm, commonly described as ''insignificant,'' often fail to pass spontaneously and may grow and lead to subsequent surgical intervention. Indeed fragment size (<4 or >4 mm) did not predict the need for surgical reintervention, implying that any fragment remaining has the potential to be the source of a future stone event.[2] In another study, 44% of patients with residual fragments had stone events and 29% required repeat intervention during a mean follow-up of 16.8 months. Indeed, even fragments that were only 2 mm were associated with similar rates of stone events and need for reintervention when compared with residual fragments of larger size.[3] Clearly, although dusting techniques, in the short term, are easier and require less intraoperative time, in the long run, a ''fragment and basket'' strategy may result in a longer interval before the next stone event.

In this case report, we propose a potentially simple method of clearing stone fragments that are otherwise too small to be retrieved using a basket. We utilized position changes to make the upper pole calices and upper section of the renal pelvis dependent thereby displacing fragments into these two areas. Next, a smaller UAS was advanced within the preexisting UAS into that specific calyx followed by gentle flushing and suction of all fragments. Stone-free status was confirmed both endoscopically and with a postoperative NCCT scan. We hypothesize that the turbulent flushing of the renal collecting system may help to disperse stone fragments and blood clots that are otherwise adherent to the urothelium, thus allowing for aspiration of particles through the UAS. In addition to facilitating clearance of stone material from the collecting system, this technique may also decrease the time spent on stone basketing, thereby reducing the overall operative time.

There are several limitations to our report. First, this technique requires the use of a UAS. Deployment of a 14F or 16F UAS is not always feasible because of the caliber of the ureter. In addition, the use of a second UAS adds to the total costs of the procedure. However, an alternative catheter such as a sterile nasogastric tube can be used as an irrigation channel.[4] A standard nasogastric sump tube (Bard Medical, Covington, GA) of 10F–14F diameter has a radiopaque stripe and is less expensive ($3.12) compared with the Flexor UAS

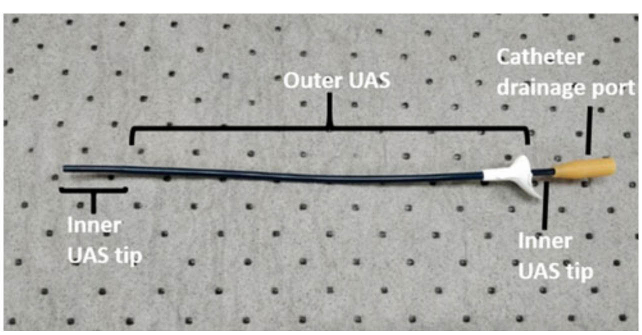

FIG. 2. Depiction of the irrigation system device. An inner 14F UAS was passed through an outer 16F UAS. A drainage port of a Foley catheter was attached to the cut tip of the inner UAS. UAS, ureteral access sheath.

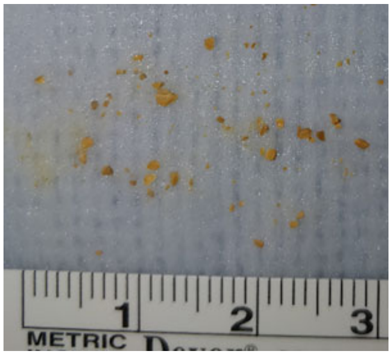

FIG. 3. Stone fragments flushed through the UAS, shown on a gauze pad next to a ruler (cm).

($18.12). Third, this technique may not be as effective in clearing fragments in the lower pole and interpolar calices as the UAS opening is aimed at the renal pelvis and upper pole; hence the need to displace fragments to the pelvis or upper pole by changing the patient's position so these areas become dependent. Fourth, the longer internal UAS has to be placed carefully under fluoroscopic guidance over its obturator and a guidewire to avoid injury to the kidney. Lastly, overly forceful flushing of fluid into the kidney could result in injury to the collecting system leading to extravasation of fluid. Applying a similar irrigation pressure as used during intraoperative pyelography and limiting the amount of fluid used with each flush to 10–20 mL may lessen the risk of extravasation.

Conclusion

In this initial attempt, the use of a coaxial UAS as an irrigation channel was effective in clearing stone fragments after RIRS in our patient.

Disclosure Statement

No competing financial interests exist.

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Abbreviations Used

CT = computed tomography
HU = Hounsfield units
NCCT = noncontrast CT
PCNL = percutaneous nephrolithotomy
RIRS = retrograde intrarenal surgery
UAS = ureteral access sheath
UPJ = ureteropelvic junction

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