A Patient with Fragmentation of a Calcified Ureteric Stent Requiring Ureteroscopy and Laser Lithotripsy

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Patient: Male, 39-year-old
Final Diagnosis: Fragmented ureteric stent
Symptoms: Lumbar pain
Medication: —
Clinical Procedure: Laser lithotripsy • ureteroscopy
Specialty: Urology

Objective: Unusual clinical course
Background: Encrustation of the ureteral stent is a common complication that occurs after a prolonged indwelling duration. Other identified risk factors in the literature include urinary sepsis, chemotherapy, chronic renal failure, metabolic or congenital abnormalities, and nephrolithiasis. This report presents the case of a 39-year-old man with nephrolithiasis and fragmentation of a calcified right ureteric stent that required ureteroscopy and laser lithotripsy.

Case Report: A 39-year-old man was initially admitted for ureteroscopy and laser lithotripsy after the diagnosis of bilateral urolithiasis. Ureteral stents were placed. One postoperative month later, the patient returned for follow-up and stent withdrawal. Follow-up computed tomography revealed a normal left kidney, intact bilateral ureteral stents, and residual right renal stones. However, an attempt to completely withdraw the stent failed and the patient had to undergo a secondary right ureteroscopy with laser lithotripsy. The fragmented proximal section of a calcified right ureteral stent with occluded lumen was found intraoperatively and sent for product analyses. After successful reintervention, the patient had a new right ureteral stent placed, which was successfully withdrawn during his next follow-up.

Conclusions: Ureteral stent encrustation may occur earlier than anticipated, possibly due to underlying patient risk factors. Complications, such as fragmentation of the ureteral stent, may occur during withdrawal. Physicians should be aware of any predictors for early ureteral stent encrustation to prevent unnecessary reintervention.

Keywords: Kidney Calculi • Lithotripsy • Postoperative Complications

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**Background**

Ureteral stent placement is a common urological practice. The procedure is minimally invasive and is thus widely used as short-term relief after the management of urolithiasis [1]. Constant modifications are being made to the device’s material and design. This is done to meet the rising demand for ureteral stents as the prevalence of urinary stones is increasing. Therefore, the complication rate from indwelling stents is increasing, such as hematuria, infection, rupture, encrustation, and stone formation. An encrusted indwelling ureteral stent can break during the extraction process and this risk can exert a psychological burden on the patient. This report presents the case of a 39-year-old man with nephrolithiasis and fragmentation of a calcified right ureteric stent requiring ureteroscopy and laser lithotripsy.

**Case Report**

A 39-year-old man was admitted to our hospital with recurrent lumbar pain for 2 days and hematuria for half a year. His past medical history was unremarkable. On physical examination, the patient exhibited tenderness in the bilateral lumbar region. Biochemical results were unremarkable. Urinalysis showed 7.5 mg/L in urine erythrocytes (reference rage, negative: <0.3). Upon admission, a plain computed tomography (CT) scan was arranged, which revealed bilateral nephrolithiasis and a left ureterolithiasis (Figure 1). The patient underwent elective bilateral flexible ureteroscopy with holmium laser lithotripsy and ureteral stent placement on 20 January 2021. After the stones were pulverized, fragments larger than 2 mm were manually removed. Two F5 Polaris Ultra ureteral stents (Boston Scientific, Marlborough, MA, USA) were used, 1 placed in the ureter on each side. Postoperative composition analysis of the stone returned as calcium oxalate dihydrate.

One month after the operation, a follow-up CT scan revealed no migration of bilateral indwelling ureteral stents and residual right renal stones. The patient did not present with any concerns and proceeded to have his stents withdrawn. The left ureteral stent was successfully removed. However, the physician experienced difficulty during extraction of the right ureteral stent, and only removed the distal segment of the device. The patient was readmitted to undergo an elective surgical procedure for removal of the indwelling proximal segment of the ureteral stent. On 25 February 2021, the patient underwent right ureteroscopy with holmium laser lithotripsy and right ureteral stent replacement. Intraoperative findings were the remaining segment of the stent with a renal stone attached to the proximal end. The stone was pulverized, followed by extraction of the broken stent (Figure 2) and the installation of a new ureteral stent. We reported the event to Boston Scientific and returned the damaged F5 Polaris Ultra ureteral stent (Figure 3) for product analysis. Postoperative composition analysis of the stone also returned as calcium oxalate dihydrate.

![Figure 1. Preoperative computed tomography scan showing bilateral kidney stones (yellow arrows) and larger right renal calculi (red arrow).](image-url)
On 17 March 2021, a postoperative X-ray detected no residual stone (Figure 4). The right ureteral stent was removed smoothly. The Boston Scientific analytic report concluded “the stent had calcified in the proximal section (renal); moreover, the stent was totally occluded due to the calcification presence in the stent.”

**Discussion**

Ureteral stents are one of the routinely used devices following urological procedures. Indwelling ureteral stent encrustation is a common complication after a prolonged time. Currently, 2 scoring systems are used to determine the severity of ureteral stent encrustation, namely the FECal (forgotten, encrusted, calcified) [2] and KUB (kidney, ureter, bladder) [3] systems. Our patient was listed as Grade 3 for the FECal system. Individual scores of 4, 1, and 1 are given for K, U, and B respectively, resulting in a total score of 6 for the KUB system. Singh et al formulated a grading system based on sizeable stone burden [4], and the ureteral stent in our case was mildly encrusted (less than 100 mm²). According to these 3 classification criteria, this case was mild to moderate calcification.

There are occasional reports on ureteral stent fragmentation. Spontaneous cases are rare [5], and common causes include prolonged indwelling time or that the patient had forgotten to have the stent withdrawn on time. Our patient had his stent for only 1 month after the operation, which was a relatively short period for encrustation to progress. The surgically-removed F5 Polaris Ultra ureteral stent was sent to Boston Scientific for product analysis. Based on the event description and product analysis, Boston Scientific concluded calcifications on the surface of the stent and within its lumen made it inflexible and brittle. During extraction, the proximal loop could not be straightened, and tension exerted on the now-vulnerable stent resulted in its fragmentation.
Yoshida [6] compared the short-term encrustation formation between Tria ureteral stent and Polaris Ultra ureteral stent. Both models had similar efficacy for preventing encrustation in the short-term period. In both ureteral stents, the shaft body showed significant inner luminal encrustation compared to the proximal or distal loop. This explains our difficulty in straightening the proximal loop, and the split occurring on the shaft. Our event is equivalent to their finding.

Torrecilla [7] conducted a double-blinded, multicenter, placebo-controlled trial on L-methionine and phylin. These chemicals are both urine acidifiers and crystallization inhibitors, which are beneficial to the reduction of encrustation of indwelling stents by infectious stones. However, the most commonly identified stone composition among Mainland Chinese is calcium oxalate; therefore, a urine alkalizer is more beneficial.

Kawahara [8] conducted a single-center cohort study on a total of 330 ureteral stents in 181 patients. They discovered that in terms of stent diameter, stent size less than 6F led to a significantly higher encrustation rate than a stent size more than 7F. However, small-diameter stents are often selected after the surgical management of urolithiasis. To reduce stent calcification rates from this aspect is difficult, and no current ureteral stent model can prevent calcification after prolonged indwelling time [9,10].

The most effective method to prevent ureteral stent calcification and its complications is through the early detection of signs of encrustation. Current imaging modalities, such as KUB and unenhanced CT, have low sensitivity in the early detection of ureteral stent encrustation. Blaheta [11] conducted a pilot study, finding that this could be done through sonographic twinkling-artifacts, but this method is not widely applied.

Conclusions

Early encrustation of ureteral stents can increase the risk of indwelling stent fragmentation that requires a secondary procedure for extraction. Physicians can identify possible risk factors such as urinary tract infection, urine pH, and stone composition for prevention. The physician should inform patients of such risks before they consent to the procedure.

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