Case report

Renal rupture with perirenal hematoma after ureterorenoscopic holmium:YAG laser lithotripsy for a renal pelvic stone

Jeng-Sheng Chen, Chien-Chen Chang*

Department of Urology, Cheng Kung University Hospital, Tainan City, Taiwan

1. Introduction

Holmium:YAG laser lithotripsy has been widely used in general urological practice since its introduction in the early 1990s. Advantages of the holmium:YAG laser include minimal invasiveness, the ability to fragment all kinds of urinary calculi regardless of composition, safety, and a high stone-free rate. These advantages make it the first choice for disintegrating calculi. Recently, ureterorenoscopic lithotripsy techniques based on the holmium:YAG laser were introduced to manage upper urinary tract calculi. The success rate was as high as 95%, depending on the stone size and location within the collecting system. Increased interest has been focused on this area.

Usually, ureteroscopic lithotripsy is safe; however, some complications are still reported. Ureteral perforation during the operation, urinary tract infection, and ureteral stricture were reported as procedure-related complications. The complication rate was as low as 4% among 598 patients in a study by Sofer et al.3 There were no reports of renal rupture. This is a rare but critical situation. We report our experience with a case of renal rupture with bleeding after ureterorenoscopic holmium:YAG laser lithotripsy in a patient with a renal pelvic stone.

2. Case report

A 75-year-old Taiwanese male with hypertension and diabetes mellitus regularly visited the general practice outpatient department. Asymptomatic microscopic hematuria was incidentally noted. A kidney, ureter, bladder (KUB) film was taken, which showed a left renal pelvic stone with about a 2 cm extension to the upper ureter (Fig. 1). He was referred to our department for further treatment. An intravenous pyelogram showed a 2 cm left renal pelvic stone, with extension to the upper ureter, hydronephrosis of the upper calyx with thin parenchyma, and a blunting of other calyces (Fig. 2). A percutaneous nephrolithotomy was suggested, but the patient and his family were concerned about the operation due to his old age, so they chose retrograde ureterorenoscopic holmium:YAG laser lithotripsy. They also refused an indwelling pigtail percutaneous nephrostomy, although this procedure is less invasive. After spinal anesthesia, the surgeon used a semirigid 6.9-Fr-tip ureteroscope (Circon-ACMI, Southborough, MA, USA) to identify the renal stone. Lithotripsy was carried out with a holmium laser (VersaPulse PowerSuite holmium and dual wavelength lasers; Lumenis, Santa Clara, CA, USA). The laser pulse energy was strictly controlled to 0.8–1.0 J with a frequency setting of five pulses/second. The laser wavelength was 2.1 μm. The laser power was 4.0–5.0 W. Normal saline irrigation was used during treatment with a 50 mL syringe through the ureteroscope, to keep the operative field clear, and forced
hand control) irrigation was sometimes attempted. The operation was performed in this manner and lasted about 90 minutes. The procedure was stopped due to the patient’s intolerance of left-flank pain. A double-J stent was smoothly placed at the end of the operation. A postoperative KUB film was taken, which showed some residual renal pelvis stones near the proximal end of the double-J stent (Fig. 3).

After the patient was sent back to the recovery room, however, his blood pressure dropped from a baseline of 150/70 mmHg to 77/50 mmHg. Normal saline challenge was immediately performed, and the blood pressure soon recovered. During the first postoperative day, his vital signs were stable. He only complained of mild left-flank pain, and was discharged on postoperative Day 2 with stable vital signs and mild left-flank pain.

Two days after discharge, acute onset of severe left flank pain occurred. He came to our emergency department. According to the patient’s statement, there was no heavy weight lifting, trauma history, or coagulopathy history. After walking upstairs, he became constipated. On physical examination, the patient appeared acutely ill. His body temperature was 36.4°C, heart rate was 118 beats per minute, respiratory rate was 21 cycles per minute, and blood pressure was 151/83 mmHg. He had painful swelling of the left upper quadrant, but ecchymosis was not present. The bowel sound was hypoactive. The laboratory data showed a decreased hemoglobin level of 9.9 mg/dL, compared to 11.6 mg/dL 4 days previously. We rechecked the patient’s hemoglobin in the emergency department, and this was 9.1 mg/dL. His creatinine level was 0.9 mg/dL and urine examination showed pyuria. Under the impression of internal bleeding, abdominal sonography was arranged. The abdominal sonogram revealed a left perirenal hematoma. Abdominal computed tomography confirmed a left subcapsular, perirenal hematoma and a stone which had dropped out of the left subcapsular space (Fig. 4). He was immediately admitted. Conservative supportive care with intravenous fluid supply, bed rest, pain control, and intravenous antibiotics was given. The pain gradually improved. He was discharged 7 days later in a stable condition and was uneventfully followed-up in our outpatient department.
3. Discussion

Since the introduction of holmium:YAG laser lithotripsy in the early 1990s, it has proven to be a useful tool in the urological armamentarium. It is widely used for soft-tissue incision, fragmentation of all kinds of urinary tract stones, urethelial tumor excision, etc. With advances in holmium:YAG laser technology, ureterorenoscopic techniques to treat renal stones have been utilized. There are still some limitations and problems that need to be overcome: removal of a large stone burden, intrarenal influx of infected stones, and prolonged operative durations. Soler et al. reported 598 patients treated with various flexible and semirigid endoscopes. The overall stone-free rate was 97%. When the results were stratified by location, the stone-free rate was 98% in the distal ureter, 100% in the mid-ureter, 97% in the proximal ureter, and 84% in the kidney.

Indications for retrograde ureteroscopic treatment of large upper urinary-tract calculi include: complex comorbid medical conditions, refused or failed prior percutaneous nephrolithotomy, failed prior extracorporeal shock wave lithotripsy (ESWL), failed medical therapy of radiolucent calculi, bleeding diathesis, morbid obesity, severe kyphoscoliosis, renal ectopia, and a solitary kidney. Due to personal reasons, our patient chose retrograde ureterorenoscopic holmium:YAG laser lithotripsy. In managing proximal ureteral and intrarenal calculi, a flexible ureteroscope was demonstrated to be a useful tool. A better approach, low morbidity, and a high success rate were reported. Unfortunately, we do not have this instrument.

Relatively fewer operative complications associated with holmium:YAG laser lithotripsy were reported compared to electrohydraulic lithotripsy or percutaneous nephrolithotomy. Soler et al. reported an overall complication rate of 4%, including ureteral perforation, ureteral stricture, and urinary tract infection. Fuganti et al. reported urethral injury, mucosal tears/false passages, mucosal erosion, ureteral perforation, paraureteral stones, and ureteral avulsion. In our case, during the operation, the lithotripsy procedure was carried out under direct vision and with no trauma to the collecting system. We did not blindly disintegrate the renal stone. The pulse energy was strictly controlled. Normal saline instillation into the operation field was handled by an experienced urologist. However, the patient still developed renal rupture with bleeding. Unlike ESWL, the laser energy is more focused on the target with the holmium:YAG laser; Jou et al. reported that its optic penetration depth is only 0.4 mm. Laser-related renal rupture is less likely with surgery under direct vision.

We propose possible mechanisms for renal rupture in this case. First, during the operative procedures, the hydraulic pressure created by instilling a large volume of normal saline may have imposed significant pressure on the thin parenchyma of the upper renal calyx. Second, the renal pelvis stones may have been coated with bacteria. Sepsis and urinary tract infections after lithotripsy in patients with renal pelvic stones are not uncommon. The inflammatory process may have further weakened the renal capsule, making it more vulnerable to hydraulic pressure. Third, atherosclerosis of the renal vasculature caused by hypertension is associated with loss of tensile strength of the vascular wall. It was reported as a post SWL bleeding complication. Although evidence of vasculature-related complications in retrograde ureterorenoscopic laser lithotripsy is still lacking, long-term diabetes mellitus and hypertension may both contribute to the renal vessel fragility, which can induce renal bleeding. When correlated with the clinical course, early postoperative shock appearing in the recovery room may imply renal rupture during the operation.

From this case, we suggest remaining alert during routine renal echo assessment prior to retrograde ureteroscopic holmium laser lithotripsy, especially with large renal stones, including staghorn stones with hydronephrosis. The thin renal parenchyma noted on the preoperative imaging studies suggests its fragile nature in the face of hydraulic pressure. Perioperative antibiotic coverage is also important. In addition, early occurrence of hypotension may imply intraoperative renal bleeding. Repeated imaging studies, such as renal echo, intravenous pyelogram, or computed tomography, are recommended. Further studies of the risk factors for renal rupture with bleeding after retrograde ureteroscopic holmium laser lithotripsy may provide clinicians with more information prior to the operation.

Conflicts of interest statement

The authors declare that they have no financial or non-financial conflicts of interest related to the subject matter or materials discussed in the manuscript.
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References