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CASE REPORT

Complex cystine kidney stones treated with combined robot-assisted laparoscopic pyelolithotomy and intraoperative renoscopy

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ABSTRACT

Introduction: Cystinuria, a rare autosomal recessive disease characterized by a defect in cystine renal reabsorption, can often determine complex cystine renal calculi, leading to important complications such as urinary obstruction, urinary infections, and impaired kidney function. Complex kidney stones can have a difficult management and can be very arduous to treat.

Case description: We present the case of a 20-year-old Jeowah's witness woman with complex cystine renal stones treated with combined robot-assisted laparoscopic pyelolithotomy and intraoperative renoscopy.

Conclusions: The combination of robot-assisted laparoscopic pyelolithotomy and intraoperative renoscopy can be useful to achieve an immediate high stone clearance rate also in complex renal stones. This combined technique could be indicated to minimize intraoperative bleeding. Moreover, it can also be used in pediatric cases or when there is no ureteral compliance. However, this strategy can be performed only in hospital referral centers by expert surgeons.

Keywords: Cystine, Kidney stones, Laparoscopic, Pyelolithotomy, Renoscopy, Robotic

Introduction

Cystinuria is a rare autosomal recessive hereditary disorder of renal and intestinal transport characterized by the excessive urinary excretion of cystine, ornithine, lysine, and arginine (COLA). This selective proximal renal tubular defect leads to a failure in the reabsorption of dibasic amino acids filtered by the renal glomerulus. The abnormally high urinary excretion of cystine, poorly soluble amino acid, facilitates the recurrent formation of kidney stones with a possible loss of kidney function.

Cystine stones account for 1-2% of all urinary stones in adults and 6-8% of the stones reported in pediatric studies. Stones can begin in childhood, grow very large, and recur rapidly; they result in the need for multiple procedures of stone removal, and are resistant to external shock-wave lithotripsy (ESWL).

The aim of the treatment of cystinuria is to prevent stone formation but, when complex renal calculi are already present, it is important to remove the stones in order to preserve renal function.

Nowadays, a lot of minimally invasive approaches for renal stone treatment are available; however, surgical strategies or multimodality approaches can be sometimes necessary particularly for complex stones (1-3).

Case description

A 20-year-old Jeowah's witness woman with a 6-year history of bilateral renal calculosis was referred to our Center for treatment.

The family history was remarkable for renal calculosis on the maternal side. Since 2010, she presented several bilateral renal colics due to bilateral renal calculosis, complex on the left side. Several treatment attempts were performed along the years in different Hospitals. In particular, she underwent a left percutaneous lithotripsy, a bilateral ESWL, and an ureterorenoscopy with the positioning of ureteral double J (DJ) stent without clinical success. The chemical examination of a spontaneously ejected stone revealed the presence of cystine and urate. Blood and urine tests showed normal parathyroid hormone (PTH) (5.2 pg/ml), hyperoxaluria (57.2 mg/24 h), cystinuria (387 mg/l), and hyperuricuria (811 mg/24 h). A specific therapy for cystinuria was suggested, but the patient showed a poor therapeutic compliance throughout the years.

Once admitted to our Hospital, a urographic computerized tomography (CT) showed a left hydronephrosis with hydroca-

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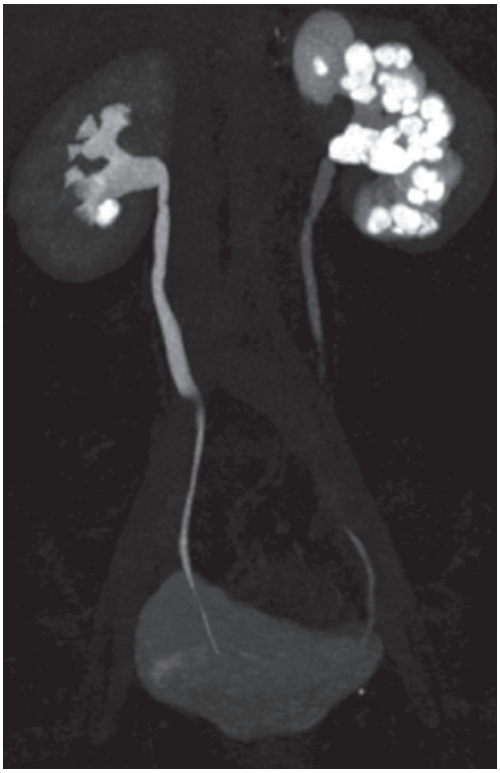

Fig. 1 - Pre-operative CT urography: this image represents the left kidney stones before the treatment.

lyces caused by multiple large stones (2 cm) in the renal pelvis and many other stones of about 1 cm inside the calyces. The images also showed a thinned left renal parenchyma. In the right kidney, a stone of about 1 cm was placed in one of the inferior calyces. Mean stone attenuation in Hounsfield units (HU) was 680. No urinary axes abnormalities were detected (Fig. 1).

We first treated the patient on the right side, where a smaller stone burden was present. We performed a right ureterorenoscopy achieving only a partial removal of the stone. The treatment was completed with an ESWL 3 days later.

After 3 months, we performed a left videolaparoscopic robot-assisted pyelolithotomy with intraoperative renoscopy. A left ureteral DJ stent was preoperatively positioned. We used a transperitoneal robotic surgical approach with the same surgical ports of robot-assisted laparoscopic pyeloplasty. The patient was placed in the right lateral decubitus 60° rotated upwards. An intraperitoneal access was performed via open surgery 1 cm lateral to the umbilicus. A 12-mm robotic camera trocar was inserted through an access track, and pneumoperitoneum was achieved with an insufflation pressure of 10 mmHg CO_2. The two operative robotic ports were placed, respectively, one between the anterior superior iliac spine and the umbilicus and the other on the pararectal line 1 cm beyond the costal arch. The white line of Toldt was cut and the left colon was medialized to expose Gerota's fascia, which was incised isolating the renal pelvis. Once the renal pelvis was incised, some staghorn stones of about 3 cm were brought out using the robotic tongs. The numerous stones localized in the calyces were removed performing an intraoperative renoscopy. A cystoscope was

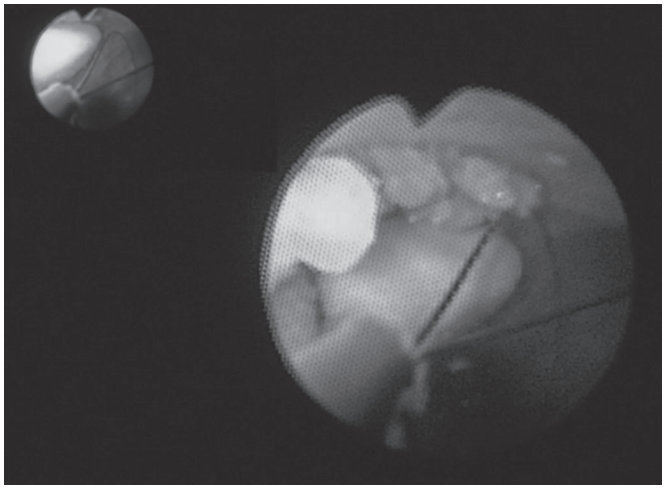

Fig. 2 - Intraoperative renoscopy with stones removal: this picture shows the basket used during the intraoperative renoscopy.

inserted in the abdomen through the lower laparoscopic trocar and the stones (size between 0.5 and 2 cm each) in each calyx were brought out with an endourological grasper (Fig. 2). It was not possible to remove one big stone in a superior calyx due to a narrow calyx infundibulum, so the stone was shattered with Holmium YAG laser energy and the resulting smaller fragments were removed with the grasper. To facilitate the collection of all the stones before their extraction from the abdomen, the fingers of a sterile glove were used as small intracorporeal carrying bags.

Each glove finger was inserted in the abdomen through a laparoscopic trocar and then all the stones were collected inside them. At the end of the procedure, the glove fingers were placed inside an endobag, and then removed.

This procedure allowed us to remove all the 36 stones (Fig. 3). After the procedure, an intraoperative ultrasound was performed and no residual calculi were detected inside the renal cavity. The global operation time was 6 hours and 35 minutes, with an estimated operative blood loss of 50 ml.

The stones chemical examination confirmed their cystine composition.

One month later, a new CT scan was performed detecting a residual stone in a left inferior calyx, so the patient underwent ureterorenoscopy with complete removal of the stone.

No intra or postoperative blood transfusions were necessary.

After surgery, the patient was started on a specific therapy with allopurinol, bicarbonate, and tiopronina, and after 2 months of follow-up, she was in good health and stone free with a preserved renal function.

Conclusion

The treatment of kidney stones is mainly based on endourological techniques or on ESWL. Percutaneous litothripsy (PNL) is indicated for high volume stones or when less invasive treatment strategies are inapplicable or ineffective.

Transperitoneal or retroperitoneal laparoscopic techniques can be useful in some cases of complex kidney stones.

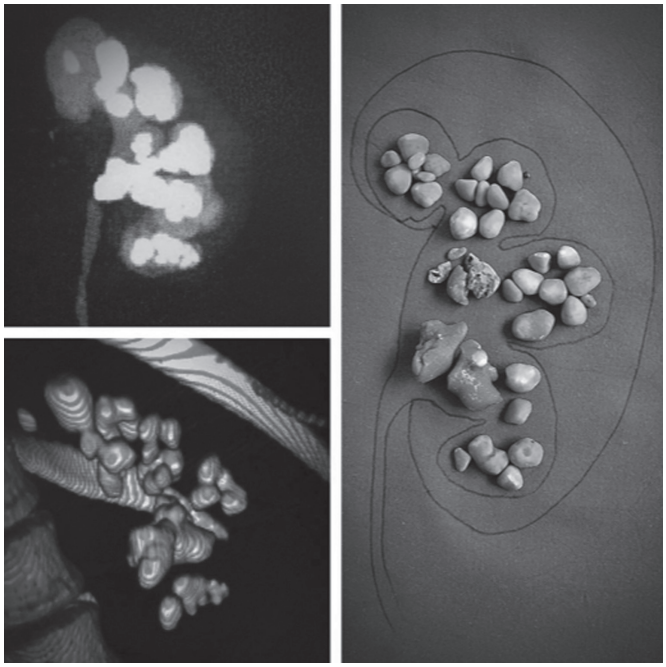

Fig. 3 - CT images compared with all the stones removed after the surgical procedure.

These techniques have quite completely replaced the more invasive open surgical approaches. Laparoscopic approaches can be implicated in the treatment of complex staghorn calculi, in the removal of stones from an anomalous or ectopic kidney, or simply when previous endourological approaches or ESWL have failed. Furthermore, laparoscopy could be used to give assistance during PNL, in the case of a concomitant pelvi-ureteric junction obstruction that needs to be corrected, in hydrocalyx symptomatic stones not amenable to endourological intervention (1-3).

Robot-assisted laparoscopy could be a valid minimal invasive alternative particularly when a reconstructive surgery has to be performed, due to the endo-wrist instrumentation, 7° of freedom, excellent visualization, and tremor filtration. The high cost of the robot-assisted approach represents the main disadvantage. However, it could be worthwhile when kidney stone clearance and concomitant urinary reconstruction have to be performed (3).

Our patient, who was a Jeovah's witness, underwent many minimally invasive procedures and PNL without success and with a high risk of bleeding.

The laparoscopy approach allows to avoid important bleeding compared with percutaneous access due to the absent damage of the renal parenchyma (4).

Laparoscopic pyelolithotomy can achieve a high stone-free rate (85-100%) after one-session management of large renal pelvis stones (2). One of the reasons of this high success rate may be that most stones can be removed integrally (4).

Many studies in literature describe the associated use of laparoscopic and endourological techniques to ensure an optimal stone clearance rate (1-3). According to that, the use of a flexible cystoscope allowed us to reach each renal calyx. Moreover, if the stones are too large to be extracted, they can be reduced in smaller fragments with a Holmium YAG laser fibre.

The combined use of robot-assisted laparoscopy and renoscopy is feasible and safe when performed by expert surgeons. It allows to achieve an optimal stone-free rate when other usual techniques have failed. In addition, this minimally invasive approach could be considered for young patients with large kidney stones and poor ureteral compliance or to lower the bleeding risk.

Disclosures

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