

Endourology

Robot-Assisted Laparoscopic Management of Caliceal Diverticular Calculi



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ABSTRACT

Standard treatment modalities of caliceal diverticular calculi range from extracorporeal shockwave lithotripsy (SWL) over retrograde intrarenal surgery (RIRS), percutaneous nephrolithotomy (PNL) and laparoscopic stone removal. A 55-year-old woman presented with a history of pyelonephritis based on a caliceal diverticular calculus. Due to the narrow infundibulum and anterior location, a robot-assisted laparoscopic calicotomy with extraction of the calculi and fulguration of the diverticulum was performed, with no specific perioperative problems and good stone-free results. This article shows technical feasibility with minimal morbidity of robot-assisted laparoscopic stone removal and obliteration of a caliceal diverticulum.

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Introduction

Caliceal diverticula are rare non-secretory urothelium-lined cavities that become symptomatic when associated with a calculus or infection. Diagnosis is generally confirmed with contrast enhanced CT scan, showing the localization of the stone and giving information on the anatomy of the caliceal diverticulum and its connection with the collecting system.

Several therapeutic options for the management of symptomatic caliceal diverticular calculi are available, varying from SWL over RIRS, PNL and laparoscopic stone extraction. With the introduction of the robotic system, this minimal invasive treatment can be added in selected cases.

Case presentation

A 55-year-old woman presented with recurrent abdominal pain and a history of pyelonephritis. In her medical history, we withhold appendectomy and hypertension. Laboratory investigation revealed a normal kidney function with absence of infectious parameters.

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Radiologic investigation showed the presence of an anterior located caliceal diverticulum at the lower pole, with presence of a calculus of 13 mm (Fig. 1). Retrograde ureterography showed a very narrow infundibulum. Flexible ureteroscopy was performed with impossibility to access or open the diverticular neck, despite the use of methylene blue, injected retrograde in an attempt to identify the ostium of the diverticulum.

In a conjoint decision with the patient, we decided to perform a robot-assisted calicotomy with fulguration of the diverticulum and stone retrieval. Preoperatively a CT guided puncture of the calyx was performed, leaving a harpoon to facilitate diverticulum localization (Fig. 2). After retrograde placement of a double J stent, the patient was placed in left lateral decubitus and a pneumoperitoneum was established. The optic trocar was placed pararectal to the right, additionally two robotic trocars were placed, one subcostal and one distally in the right lower quadrant.

After incision on the white line of Toldt and medial mobilization of the colon, the fascia of Gerota was incised, using the harpoon as a repair (Fig. 3). The renal parenchyma covering the lower pole calyx was incised and the diverticulum was opened, with retrieval of the caliceal stones in a laparoscopic bag. The urothelial mucosa of the calyx was fulgurated using monopolar scissors and the kidney parenchyma was closed using a continuous suture monocril 0 (Fig. 3). The procedure was finalized with placement of a drain, closure of the fascia of Gerota, retraction of the endobag and closure

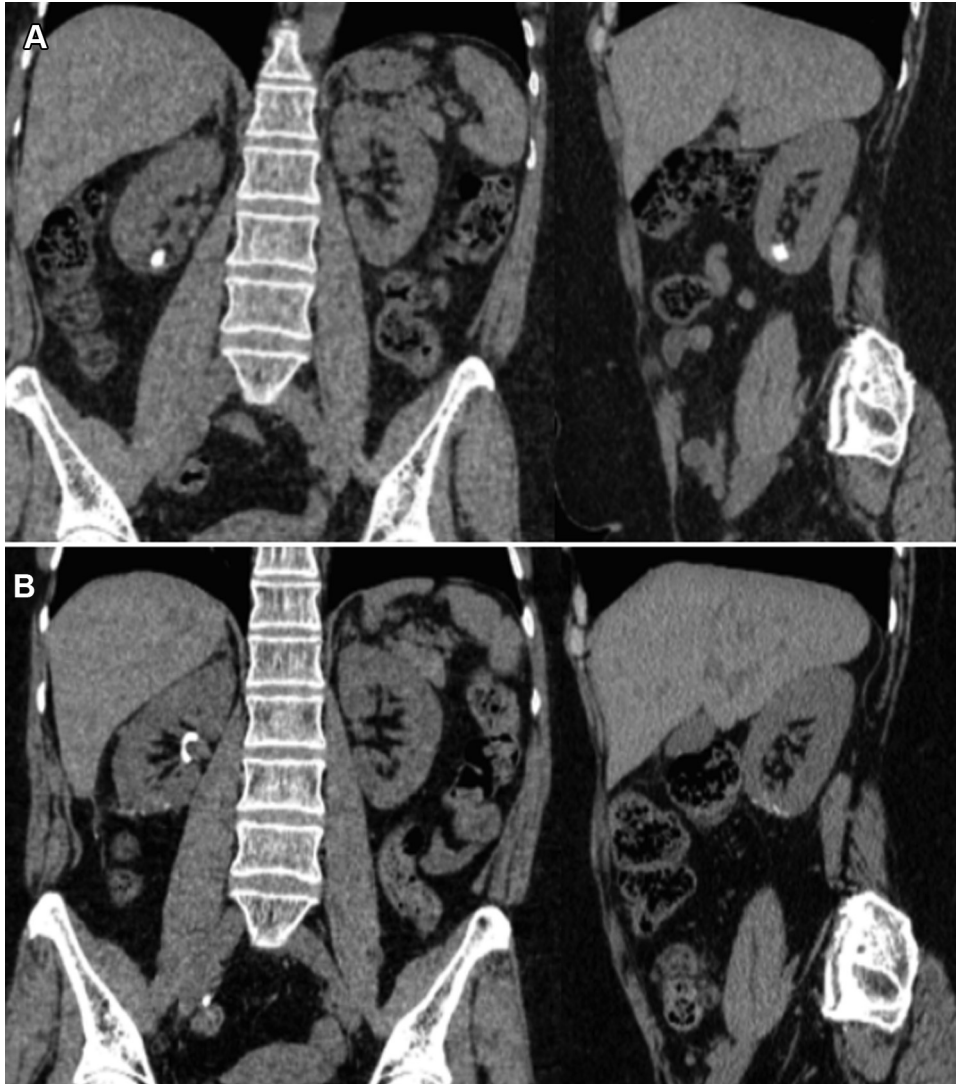


Figure 1. CT image of the anteriorly located caliceal diverticular calculus before (A) and after (B) treatment.

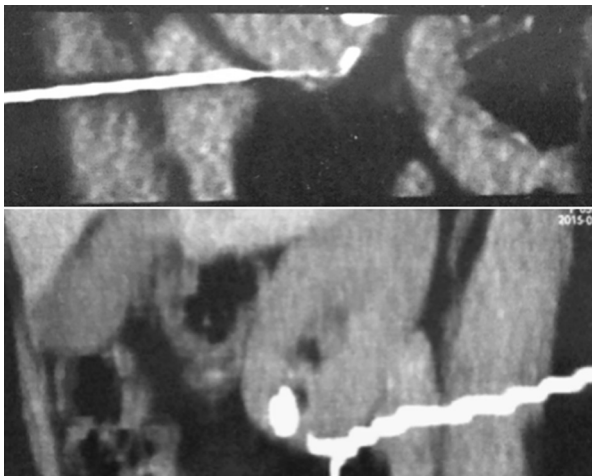


Figure 2. CT guided placement of harpoon.

of the wounds. The operative time was 120 minutes with an estimated blood loss of 50 mL.

No specific postoperative problems were encountered and the patient was discharged at day 2. Postoperative imaging showed absence of calculi and till now (6 months postoperatively) the patient hasn't had any pain or infectious episodes.

Discussion

The vast majority of patients with caliceal diverticula are asymptomatic, however operative intervention is needed in case of chronic pain or recurrent urinary tract infection. There's no consensus on the optimal treatment paradigm in patients with caliceal diverticula. Treatment modality should be selected according to patient related factors as diverticulum localization, diverticular neck anatomy, stone burden and patients preference.

SWL can provide symptomatic pain relief in 36–70% of patients, but stone-free rates are low, ranging from 4–20%.¹ Passage of the fragments is often prohibited by the same abnormality that caused urinary stasis and stone formation in the first place: a long and

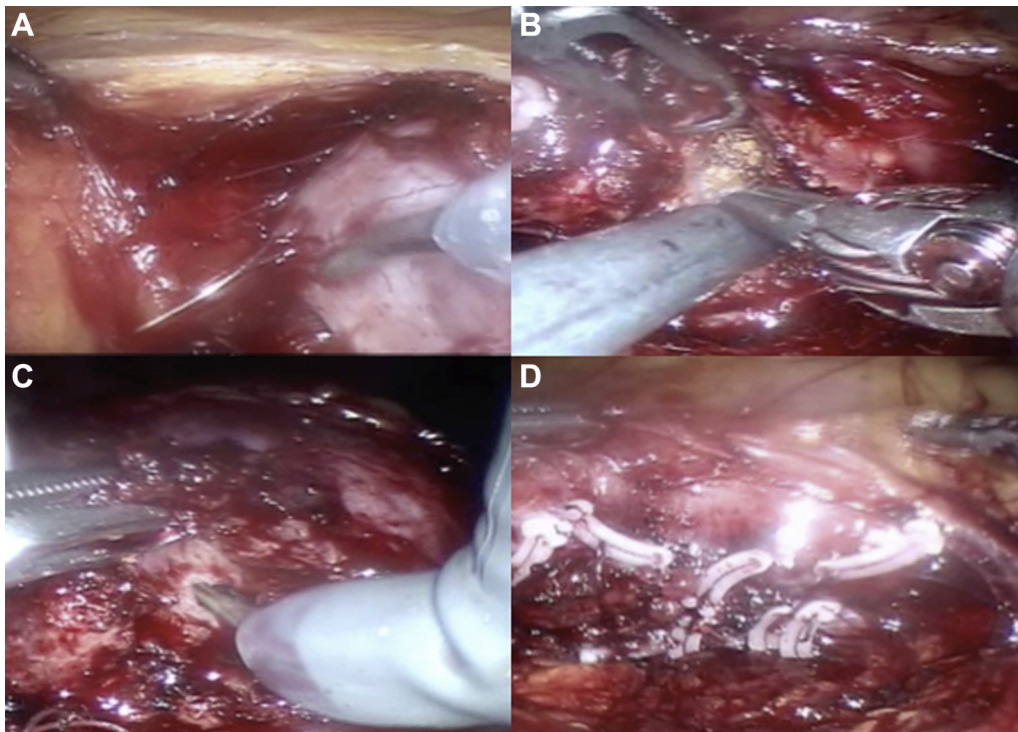


Figure 3. (A) Localization of diverticulum with repair of the harpoon. (B) Visualization of the diverticular calculus. (C) Fulguration of the diverticulum. (D) Closure of nephrotomy with the sliding knot renorrhaphy technique.

narrow diverticular neck. Impossibility to perform an eradication of the diverticulum, is also believed to be a negative factor in prevention of stone recurrence.²

RIRS allows for simultaneous ablation of the diverticular cavity and is a reasonable option for patients with diverticula in the upper or middle portions of the kidney, when the stone burden is small and the diverticular neck is short and easily accessible.^{1,2} Stone-free rates for RIRS range from 19 to 73%, but diverticular obliteration is as low as 18%.²

When the diverticulum is difficult to access with RIRS, PNL can have an advantage, certainly in posteriorly located mid- and lowerpole diverticula. It has shown to have high success rates as it can access more complex stones and it allows for fulguration or incision of the diverticular neck.² The technique can vary from a direct puncture of the diverticular neck or endoinfundibulotomy.¹ Puncture of an upper pole calyx and treatment of the lower pole diverticulum in a straight axis, could have been a treatment strategy in this case. However as we were not able to retrieve the orifice of the caliceal neck with ureteroscopy, retrieving the diverticulum with PNL would have been challenging. The efficacy of PNL must be weighed against its invasiveness, complication rates, as well as its limited role in anteriorly located diverticula.²

The technical advances in endourological surgery have significantly decreased the indications for open or laparoscopic stone surgery. However laparoscopic nephrolithotomy may be indicated when PNL or RIRS have failed or to remove a stone from an anterior diverticulum, especially if there is a thin layer of parenchyma overlying.³ Waingankar et al have enlisted different methods of laparoscopic approach, varying from trans- versus extraperitoneally, and different methods for obliterating the diverticulum.¹

With the introduction of the robotic system, three-dimensional vision, dexterity and ergonomic comfort have been added to the laparoscopic approach. Only one case report has been published describing the robot-assisted laparoscopic management of caliceal diverticular calculi.⁴ This treatment is safe with good short term stone-free results. Access to the diverticular calculus can be facilitated by the use of a preoperatively placed harpoon. However the laparoscopic approach for diverticular calculi stays more invasive than SWL, PNL and RIRS, and should only be considered when other alternatives are not feasible. The merits of the laparoscopic approach are encouraging peroperative outcomes and its long-term durable results.¹

Conclusion

Robot-assisted laparoscopic calicotomy can be added to the treatment options of caliceal diverticular calculi in selected cases. The procedure is technically feasible with minimal morbidity and acceptable stone-free rate. Localization of caliceal diverticulum can be improved using preoperative placement of a percutaneous harpoon. It should however only be considered when standard therapies are considered not feasible.

Conflict of interest

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