CASE REPORT

Robotic-assisted laparoscopic management of a caliceal diverticular calculus

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SUMMARY

Purpose To report the first case of robotic-assisted laparoscopic management of a symptomatic caliceal diverticular calculus and review the literature on laparoscopic treatment for this condition.

Case report A 33-year-old obese woman with a 2×1 cm calculus within an anterior caliceal diverticulum located in the middle pole of the left kidney was referred to our service. She had already undergone two flexible ureterorenoscopies without success. We considered that a percutaneous approach would be very challenging due to stone location, thus we elected to perform a robotic-assisted laparoscopic procedure for stone removal and diverticulum fulguration. The procedure was uneventfully performed with no intraoperative or postoperative complications. The patient was discharged from the hospital on the second postoperative day and after 1.5 years of follow-up she is asymptomatic with no recurrence.

Conclusions The robotic-assisted laparoscopic approach to caliceal diverticular calculi is feasible and safe, providing one more option for treatment of stones in challenging locations.

BACKGROUND

Caliceal diverticulum is a non-secretory, urothelium-lined cavity containing urine within the renal parenchyma, communicating with the collecting system through a narrow neck. It may be a congenital or acquired lesion, secondary to conditions such as infection/kidney abscess, rupture of a simple renal cyst or vesicoureteral reflux, although the exact aetiology is uncertain. This condition is prone to urinary stasis, leading to recurrent urinary tract infections, milk of calcium and/or nephrolithiasis formation. Stones as a complication of a caliceal diverticulum occur in 10–50% of cases and the diagnosis is based on image examinations (ie, contrast-enhanced CT scan, intravenous urography).¹

Currently, there are several therapeutic options available for symptomatic stones in caliceal diverticulum, including shock wave lithotripsy (SWL), retrograde intrarenal surgery (RIRS) or percutaneous nephrolithotomy (PCNL).² In the past few years, the laparoscopic approach has also been reported as an effective procedure with low morbidity and high stone-free rate. We report the first case of robotic-assisted laparoscopic management of a caliceal diverticular calculus in a symptomatic patient; we have also reviewed the

literature on laparoscopic treatment of stones in caliceal diverticulum.

CASE PRESENTATION

A 33-year-old obese (body mass index=37 kg/m²) woman was referred to our service with a recurrent left-sided renal pain for 1 year. She had no history of upper urinary tract infection, haematuria or any voiding symptom. Her physical examination was unremarkable and laboratorial serum examinations were normal. A contrast-enhanced CT scan revealed a 2×1 cm calculus within an anterior caliceal diverticulum located in the middle pole of the left kidney. The renal parenchyma overlying the diverticulum was mildly atrophic (figure 1).

The patient underwent two attempts of flexible ureterorenoscopy (URS) at another institution before reaching our service. In the first procedure, the caliceal diverticulum was found and its neck incised using a holmium laser; the stone was fragmented but its removal was not possible due to significant bleeding, technical difficulties and prolonged operative time. There was an initial improvement in the patient's symptoms, however, with recurrence 3 months after the procedure. A second URS was then performed; nevertheless, the caliceal diverticulum was not identified due to total obliteration of the diverticular neck. After these two unsuccessful procedures, the patient remained symptomatic, requiring a definitive intervention. Based on the anterior location of the diverticulum and its small diameter we considered that a percutaneous approach would be very challenging. Therefore, we elected to perform a robotic-assisted laparoscopic procedure for stone removal and diverticulum fulguration.

TREATMENT

The patient was placed in a 45° right lateral decubitus with the table flexed to elevate the kidney. A standard four-port robotic-assisted laparoscopic approach for partial nephrectomy was used. Briefly, the left colon was medially reflected off the kidney and the Gerota's fascia was incised to identify and mobilise the kidney. The thickness of renal parenchyma overlying the diverticulum was almost normal and intraoperative laparoscopic ultrasound was used to identify its location. The renal artery was clamped using bulldog clamps. The renal parenchyma overlying the diverticulum was then excised and the diverticular wall opened. The stone was then removed with a robotic grasper and entrapped within an endoscopic bag. Thereafter,

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Figure 1 CT scan showing the caliceal diverticular calculus with a thin renal parenchyma overlying the stone: (A) coronal view and (B) axial view.

the diverticulum was fulgurated using monopolar scissors. We then elected to suture the adjacent renal parenchyma in order to avoid bleeding. The sliding knot renorrhaphy technique was used (figure 2). A tubular drain was placed and the bag with the stone was removed through the 12 mm port. The operative time was 120 min and the warm ischaemia time 16 min. Estimated blood loss was less than 100 mL. There were no intraoperative or postoperative complications. On the second postoperative day, the drain was removed and the patient was discharged from hospital.

OUTCOME AND FOLLOW-UP

After 1.5 years of follow-up, the patient is asymptomatic and kidney ultrasound reveals no stones or diverticular images.

DISCUSSION

Although endourological techniques have been used as first-line options to treat caliceal diverticular calculi,² there are well-selected cases that require a different approach. In cases of anterior located large kidney stones or failure of conventional procedures, laparoscopic surgery has been reported as an alternative.^{3–9} Laparoscopy has shown a high stone-free rate with low morbidity, allowing the simultaneous management of the diverticulum and stone removal; however, it demands an experienced laparoscopic surgeon and may be a very challenging procedure. So far, there is no consensus about the best management

of the diverticulum after the stone removal. While some authors prefer to close the diverticular neck and fulgurate (or excise) the epithelium, others are favourable to its marsupialisation. To fill the renal defect, perirenal fat or gelatin resorcinol formaldehyde glue has been described (table 1).

The robotic system provides a magnified three-dimensional vision and increases the surgeon's precision and dexterity, making complex cases safer and more feasible. To the best of our knowledge, we are the first to report successful robotic-assisted laparoscopic management of a caliceal diverticular calculus, showing one more application of this emerging technology. There were no complications and in a mid-term follow-up our patient remains asymptomatic with no stone in the control image examination.

Koopman and Fuchs¹⁰ reported their experience with RIRS to treat stones secondary to infundibular stenosis and caliceal diverticulum. They reported 90% and 75% stone-free rates (fragments <2 mm) for stones <2 cm and between 2 and 3 cm, respectively. For stones between 2 cm and 3 cm, RIRS was combined with SWL and for stones >3 cm PCNL or laparoscopy surgery was performed based on the stone location. These authors proposed an algorithm for the treatment of the condition, suggesting the laparoscopic surgery for all anterior located stones unsuccessfully managed by endourology or for all anterior located stones >3 cm. Miller *et al*⁷ reported the largest case series of laparoscopic management of caliceal diverticular calculi and also proposed an

Figure 2 (A) Initial aspect of the caliceal diverticulum. (B) Renal stone in the caliceal diverticulum. (C) Fulgurated diverticulum. (D) Final aspect.

Table 1 Laparoscopic management of diverticular caliceal calculi

Author	Year	Number of cases	Access	Diverticulum management	Stone-free rate (%)	Diverticulum recurrence (%)	Follow-up (months)
Ruckle ³	1994	1	Transperitoneal	Diverticular fulguration and marsupialisation	100	No	2
Harewood ⁴	1996	3	Retroperitoneal	Diverticular fulguration and marsupialisation+fat to fill the defect (2 of 3 cases)	100	33	3–5
Hoznek ⁵	1998	3	Retroperitoneal	Diverticular fulguration and gelatin resorcinol formaldehyde glue application	100	No	6
Curran ⁶	1999	1	Retroperitoneal	Diverticular fulguration and marsupialisation	100	No	4
Miller ⁷	2002	5	Retroperitoneal	Diverticular neck closure, epithelium fulguration and fat to fill the defect	100	No	NR
Tera ⁸	2004	2	Retroperitoneal	Diverticular fulguration and marsupialisation+fat to fill the defect	100	50	6
Wyller ⁹	2005	1	Retroperitoneal	Excision of the diverticulum and diverticular neck closure	100	No	9

NR, not reported.

algorithm for managing this condition. These authors were more liberal in the laparoscopic indication, suggesting it for all cases with no significant overlying renal parenchyma on the stone. We agree with these authors and propose the robotic-assisted laparoscopic approach to auxiliary in complex cases.

Learning points

- The robotic-assisted laparoscopic approach to caliceal diverticular calculi is feasible and safe.
- It allows simultaneous nephrolithotomy and diverticulum treatment even for diverticulum in challenging locations.
- It should be added to the stone surgery armamentarium.

Competing interests None.

Patient consent Obtained.

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