# Laparoscopic management of a large staghorn stone

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## Abstract

Urinary calculi are prevalent and result in significant morbidity, with a marked economic impact. Various therapeutic options exist, from medical to surgical management according to stone size. Laparoscopic pyelolithotomy is a viable option for significant staghorn renal stones. We report the case of a laparoscopic pyelolithotomy performed on a 48-year-old man with a left recurrent staghorn renal stone secondary to an ureteropelvic junction obstruction following a grade IV renal trauma several years ago.

## Introduction

A trend toward minimally invasive treatment for the management of renal calculi has occurred with the development of newer techniques, such as extracorporeal shockwave lithotripsy (ESWL), percutaneous nephrolithotomy (PCNL) and ureteroscopy (URS). With the arrival of these techniques, open procedures have become almost obsolete.[1] However, minimally invasive procedures may be suboptimal in certain circumstances, such as with large staghorn renal calculi.[1] In these circumstances, laparoscopic surgeries [laparoscopic pyelolithotomy (LP), laparoscopic-assisted PCNL (LAP) or laparoscopic anatrophic nephrolithotomy (LAN)] may be valid options by combining the effectiveness of open surgery while being minimally invasive.[2] We present a case of the largest staghorn stone ever removed by LP and a review of the literature.

## Case report

A 48-year-old obese male with a history of renal stones was referred to our clinic for chronic left flank pain. A detailed medical history revealed a blunt grade IV left renal trauma in 2001 with a secondary ureteropelvic junction obstruction (UPJO). Two unsuccessful UPJO treatments were performed: an endopyelotomy in 2002 and an open pyeloplasty in 2003. The open surgery failed due to extensive fibrosis which inhibited the identification of the UPJO. During the follow-up period, the patient developed an 18-mm left kidney stone for which he had serial imaging, until he was lost to follow-up in 2005. During a follow-up visit in 2009, a controlled computed tomography (CT) scan showed a left staghorn calculus measuring over 10 cm (Fig. 1) and a dimercaptosuccinic acid (DMSA) renal scan showed a 45% left renal differential function. Due to the significant stone burden associated with a UPJO, a laparoscopic pyelolithotomy and pyeloplasty were offered to the patient.

Under general anesthesia, the patient underwent a left ureteral catheter insertion via cystoscopy; he was then repositioned in a right lateral decubitus with the genitalia in the operative field. The laparoscopic pyelolithotomy was performed by using a four-port (two 5-mm and two 10-mm) transperitoneal approach with the first port, a Xcel bladeless trocar (Ethicon Inc, Somerville, NJ) being inserted under direct visual entry with a 10 mm 0-degree lens placed lateral to the rectus muscle at 5-cm above the umbilical level. The colon was mobilized to expose the renal pelvis. The UPJO could not be identified because of the extensive fibrosis. The renal pelvis was clearly identified and opened to remove the staghorn stone. Initially, an attempt to fragment the stone using lithoclast lithotripsy was unsuccessful so it was removed en bloc using laparoscopic graspers. The staghorn stone was placed into a 15-mm Endo Catch bag (Covidien Plc, Loughlinstown, Dublin, Ireland) and extracted by extending the 12-mm port incision (Fig. 2). The renal pelvis was then thoroughly inspected for residual stones and copiously irrigated. The ureteral catheter, placed initially in a retrograde manner, was dislodged during repositioning of the patient and impossible to reinsert antegradely through the UP junction. A flexible cystoscopy was performed to pass a guidewire retrogradely and it was pulled out from a 5-mm trocar on which a 6Fr × 26 cm double J stent was slid down

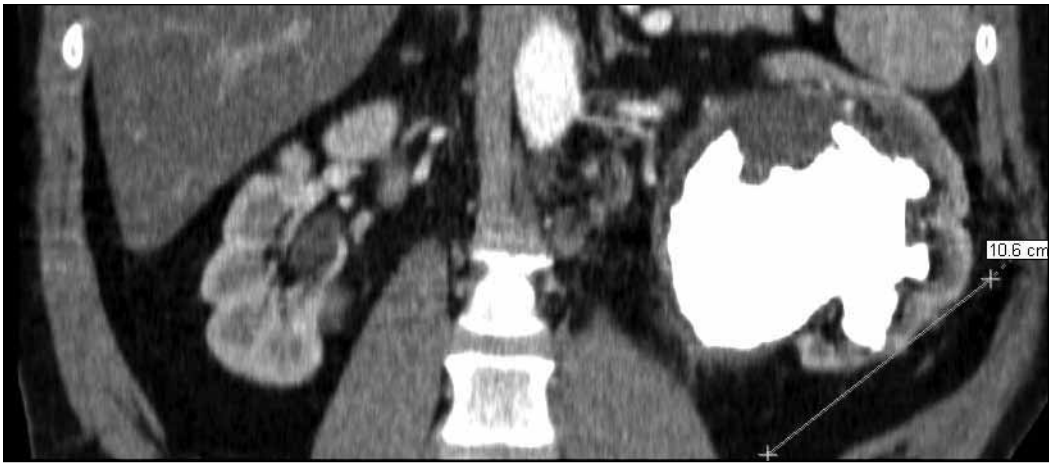


***Fig. 1.*** A computed tomography scan showing the staghorn calculus.

into the bladder where the distal end was confirmed endoscopically. As stated, the pyeloplasty was deemed impossible to perform since the UPJO was unidentified. The pelvis was finally closed with two half-running 3.0 polyglactin sutures. A closed suction drain was left through the lowest 5-mm port. The remaining ports were then removed under direct vision and the wounds were closed. The surgical time was 390 minutes and the blood loss was estimated to be less than 300cc.

The stone analysis revealed a 115 × 85 × 75 mm mix of struvite and hydroxyapatite stone. The patient was discharged on day 5 with the Foley catheter and the closed suction drain in place because of a urinary pelvis leak. The Foley catheter was removed on day 10 and the drain on the following day, since no drainage occurred once the catheter was removed. An abdominal x-ray showed residual stones, varying from 3 to 18 mm.

Six weeks later, the ureteral stent was removed and a retrograde pyelography revealed a narrowing of the left UPJO. A second endopyelotomy and PCNL were later performed. The residual stones were extracted while a 13-mm calcification seen on the abdominal x-ray was in the renal parenchyma. The patient is currently asymptomatic and and the double J stent was removed six weeks later.

## Discussion

Although several reports have demonstrated its safety and feasibility,[1-3] LP to treat renal stones is still not clearly defined, partly because PCNL and ESWL are well-established minimally invasive, effective treatments.[4] The indications of LP are essentially the same as open surgery. However, with the high success rate of the other minimally invasive procedures, open surgery is now considered a last resort mainly due to its higher morbidity. The most accepted clinical indication for LP is the concomitant management of kidney stones and UPJO, which are present in about 20% of cases;[5] but it has also been used in many other situations, such as with a large stone burden and stones in ectopic kidneys.

Several authors have reported their series with laparoscopic pyelolithotomy with or without concomitant pyeloplasty (Table 1). To our knowledge, the largest stone burden ever removed by a laparoscopic technique was a 9.0-cm staghorn stone.[6] Goel and Hemal[7] compared the role of LP to PCNL. They performed 18 LPs and 12 cases of PCNL and concluded that PCNL was better: it caused less morbidity and was easier to perform, while the LP should be reserved for patients who need adjunctive procedures.

Other laparoscopic procedures for large stone burden have been reported, such as the LAN. In 2003, Kaouk and colleagues were the first to demonstrate the feasibility of LAN using the porcine model.[8] Later that year, Deger and colleagues reported the first case of LAN in a human.[9] Simforoosh and colleagues published their five case series with LAN in 2007.[10] Although they confirmed the feasibility of LAN, only three patients were stone-free (60%). Unlike LP, LAN involves clamping of the renal hilum and incision of the renal parenchyma, which is associated with loss of functional parenchyma and renal insufficiency.[11] Despite the fact that LAN has proven efficacy in open procedures, we believe that further investigation and follow-up is necessary before recommending it instead of LP. In our case, the extra renal pelvis was technically easier to incise than the renal

**Table 1. Cases series of documented laparoscopic pyelolithotomies**

| First author, year of publication | No. cases | Mean stone burden, cm | Largest stone removed by LP, cm | Stone-free rate, % |
|---|---|---|---|---|
| Micali, 1997[22] | 17 | 1.4 | 6.0 | 88 |
| Ramakumar, 2002[15] | 19 | 1.4 | - | 90 |
| Goel, 2003[7] | 16 | 3.6 | - | 100 |
| Meria, 2005[23] | 16 | 2.5 | 3.3 | 88 |
| Srivastava, 2008[24] | 20 | 1.5 | 2.5 | 75 |
| Stein, 2008[4] | 15 | 0.6 | 1.0 | 80 |
| Salvadó, 2009[14] | 9 | 2.9 | - | 100 |
| Nadu, 2009[6] | 13 | - | 9 | 77 |
| Chander, 2010[3] | 184 | 2.9 | 4.0 | 100 |

LP : laparoscopic pyelolithotomies.

***Fig. 2.*** The 11.5-cm extracted staghorn calculus.

parenchyma. Furthermore, the large stone burden would have made the surgery nearly impossible to perform with a reasonable warm ischemia time.

Nephrolithiasis in ectopic kidneys presents a challenge to the endourologist due to the higher risk of bowel injuries. To overcome this difficulty, LAP has been performed. It was first reported by Eshghi and colleagues in 1985,[12] and has been performed many times since then. One of the largest related series was presented in 2007 by El-Lappany and colleagues.[13] They treated five patients using LAP with an 80% stone-free rate. Although LAP represents an option for these patients, LP has the advantage of avoiding vascular complications secondary to renal parenchyma puncture. However, it remains more time-consuming and technically more challenging.

URS and PCNL are the favoured treatments for large stone burden,[14] but they usually require multiple access sites or procedures which are not free of consequences. In those rare circumstances in which renal stone burden cannot be effectively removed in a reasonable number of endoscopic procedures, or in situations in which ESWL, URS and PCNL have failed, LP could be considered part of the therapeutic arsenal. The stone-free rate of LP is quite high (75% to 100%),[4,6,15,16] which is comparable to open surgery[17] and to PCNL which has a stone-free rate of 85% to 100% (Table 1).[18-20] Thus, in selected patients, laparoscopic surgery can certainly be a reasonable therapeutic option.[21] However, these laparoscopic procedures should only be practiced in centres with expertise in laparoscopy as they are technically challenging. They are also associated with a long learning curve and are somewhat time-consuming.

## Conclusion

As far as we know, this is the largest staghorn calculus ever removed by laparoscopic surgeries. Laparoscopic pyeloplasty was aborted, similar to the patient's open pyeloplasty a few years ago, due to the extensive fibrosis around the UPJO. In cases involving renal stones associated the UPJO, laparoscopic pyelolithotomy and pyeloplasty are the treatments of choice. Longer follow-up and reports will be necessary to better determine the place of laparoscopy in the management of urinary stone disease. LP is certainly safe and feasible in experienced hands, but should not replace PCNL, which remains the gold standard for kidney stones greater than 2 cm. These procedures are technically challenging and should only be performed by experienced laparoscopic surgeons.

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