Simultaneous bilateral tubeless percutaneous nephrolithotomy: A report of 2 cases and review of the literature

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Abstract

Percutaneous nephrolithotomy (PCNL) is currently the standard of care to remove large renal calculi. Traditionally, a large-bore nephrostomy tube is placed postoperatively. However, the necessity of this practice has been recently challenged. Theoretically, bilateral tubeless PCNL offers advantages of lower postoperative discomfort, shorter hospital stay and thus lower cost. We review the literature and present two cases of simultaneous bilateral tubeless PCNL from two patients who were referred to a tertiary stone centre from remote areas.

Introduction

Percutaneous nephrolithotomy (PCNL) is currently the standard of care for the removal of large renal calcul.[1] Simultaneous bilateral PCNL has been reported.[2,3] Usually, a large-bore nephrostomy tube is placed post-PCNL to tamponade the nephrostomy tract, provide unimpeded drainage of infected urine, allow second-look nephroscopy for residual fragments and prevent urinoma.[4] Recently, the necessity of postoperative nephrostomy tube placement has been challenged. Unilateral tubeless PCNL has been shown to offer several advantages over nephrostomy tube placement, including decreased postoperative analgesic requirement, recovery time, hospital stay and cost.[5-8] We present two cases of simultaneous bilateral tubeless PCNL and review the literature.

Technique

The perineum was prepped and draped after we administered broad spectrum antibiotics and induced general anesthesia. While the patients were in the supine position, flexible cystoscopy was performed to place bilateral ureteral catheters and remove the indwelling ureteral stents. These ureteral catheters were secured to an indwelling 18F Foley catheter. The patients were then turned to the prone position and all of the pressure points were secured with foam. Both sides of the back were prepped and draped. The right side was addressed first. Using an 18G diamond-tipped needle, we obtained a single percutaneous renal access (mid-pole calyx in case 1 and lower pole calyx in the case 2). After placing a safety wire, we dilated the tract to 30F using X-Force Balloon (Bard, Oakville, ON) and a 30F Amplatz sheath was placed. Using the indirect nephroscope, we fragmented large stones using the Swiss LithoClast Ultra (Microvasive Urology, Boston Scientific, Natick, MA). Stone fragments were then removed using atraumatic graspers. Flexible nephroscope was used to inspect all of the calyces and remove stone fragments using a zero-tip basket. When stones were too large to be basketed, they were fragmented using the Holmium laser at a setting of 1J and 10Hz. The inspection of all calyces was performed using flexible cystoscopy to confirm stone-free status. Antegrade indwelling ureteral stent (6F × 26 cm in case 1 and 6F × 28 cm in case 2) was inserted under fluoroscopic guidance. Once the Amplatz sheath was removed, pressure was applied to the wound for tamponade. The wound was then infiltrated with 10cc of 0.25% bupivacane. The skin was closed with 4-0 monocryl suture and steri strips were applied. Since stone-free status was achieved with minimal blood-loss, it was decided to proceed with the left side. The fluoroscopy unit was moved to the contralateral side. Next, access to the left side was obtained (mid-pole calyx for case 1 and upper pole calyx in case 2). PCNL was performed in the same way as the right side. At the end of the procedure, pressure dressing was applied bilaterally and acetaminophen 1.3 g suppository was given prior to turning the patient supine and waking the patient from general anesthesia. Total operative times for case 1 and case 2 were 135 minutes and 290 minutes, respectively. Total fluoroscopy times for case 1 and case 2 were 174 seconds and 330 seconds, respectively. Estimated

blood losses were 250 mL and 500 mL, and postoperative hematocrits were 40% and 31%, respectively. Postoperative chest x-rays were normal.

Case 1

A 56-year-old healthy woman with no medical history of nephrolithiasis presented with bilateral flank pain to a community hospital (87 km away from a tertiary care centre). A computed tomography (CT) scan revealed multiple bilateral renal stones ranging from 1.1 to 1.5 cm causing intermittent obstruction at the level of ureteropelvic junction (UPJ). These stones were radio-opaque, with Hounsfield units of 985 on the right and 1180 on the left kidney, respectively. She had bilateral indwelling ureteral stents placed and her care was transferred to our tertiary care centre for bilateral PCNL (Fig. 1a). Her preoperative creatinine level was 125 µmol/L, and hematocrit was 37%. She had an American Society of Anaesthesiologists (ASA) score of 2 and a body mass index (BMI) of 20 kg/m^2. She underwent simultaneous bilateral tubeless PCNL as described above. A postoperative kidney-ureter-bladder (KUB) radiography confirmed stone-free status (Fig. 1b). On postoperative day 2, urine was clear. She had successful trial of void and was discharged after a total hospital stay of 43 hours. She did not require narcotics during hospitalization or after discharge. Indwelling ureteral stents were removed serially on postoperative days 10 and 18.

The stone analysis showed 100% carbonate apatite bilaterally. Her metabolic stone workup showed urine volume of 2.5 L/day with pH of 7.0. All other investigations, including parathyroid hormone levels, were normal. She was advised to continue drinking more than 2 L of water per day and to maintain a low salt, low oxalate and low animal protein diet. Furthermore, she was treated prophylactically with trimethoprim-sulfamethoxazole.

Case 2

A 61-year-old man with a history of ulcerative colitis, ileostomy and recurrent renal stones presented with acute renal failure with creatinine of 1643 µmol/L, potassium of 5.7 mmol/L, and metabolic acidosis with a venous blood gas pH of 7.17. An abdominal CT scan revealed a 5-cm right staghorn calculus causing UPJ obstruction, and a 2.9-cm left obstructing UPJ stone. Both stones were radiolucent with Hounsfield units of 482. After urgent medical correction of his metabolic acidosis, the patient had bilateral indwelling ureteral stents placed. He was admitted to the intensive care unit. One month after recovery from this acute renal failure, his creatinine stabilized at 280 µmol/L, potassium at 5.0 mmol/L, and his hematocrit was 33%. Since this patient resided in a rural community 688 km away from a tertiary stone centre, a simultaneous bilateral tubeless PCNL approach was offered. At the time of surgery, the patient has an ASA score of 2, and a BMI of 23.1 kg/m^2. Simultaneous bilateral tubeless PCNL was performed. The patient was admitted for 34.5 hours and received a total of 22.5 mg of morphine equivalents. The stone analysis showed 60% uric

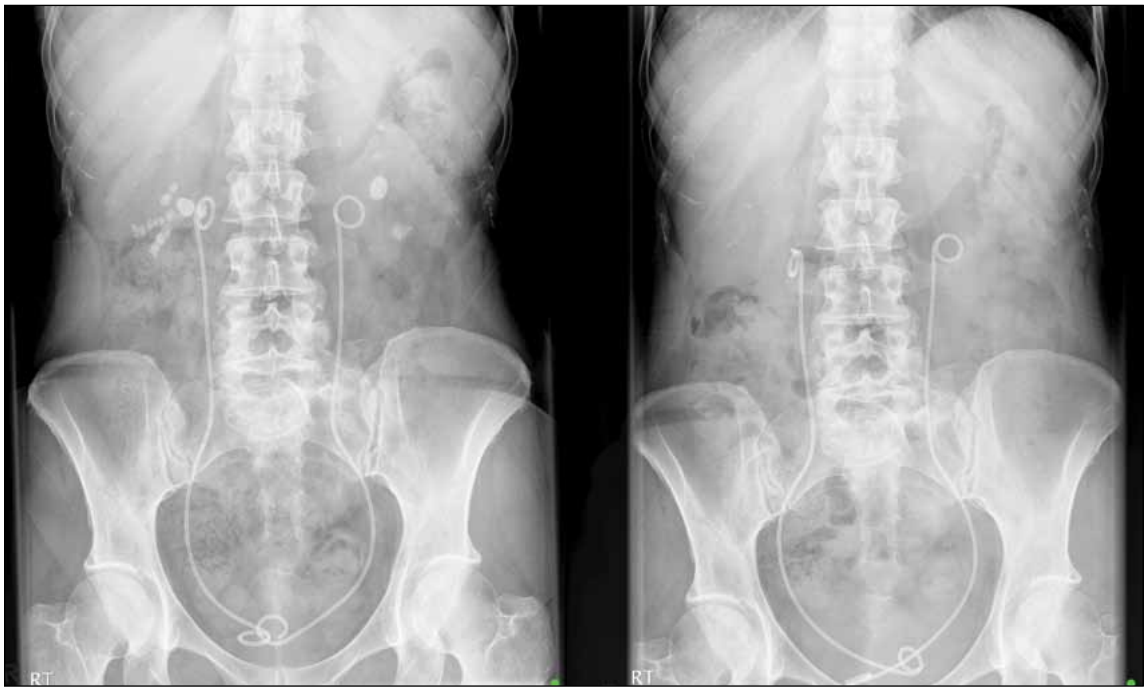

Fig. 1. Kidney-Ureter-Bladder plain films of the first case (a) preoperative with bilateral indwelling ureteral stents and (b) post-simultaneous bilateral tubeless percutaneous nephrolithotomy.

Table 1. Review of literature on simultaneous bilateral tubeless PCNL

Reference	No. patients	Estimated stone burden (mm^2)	Technical differences	Operative time (min)	Average length of hospital stay (hrs)	Average postoperative analgesia requirements	Complications
Weld et al.[11]	1	Right: 225 mm^2 Left: 212.5 mm^2	• Tracts were balloon dilated to 30F • 34F Amplatz sheaths were used • 6F stents inserted on completion of procedure • Wound closed with 0 chromic sutures	42	24	N/A	N/A
Gupta et al.[12]	1	Right: 84 mm^2 Left: 108 mm^2	• Tracts were dilated to 30F • 30/34F Amplatz sheaths were used • Stones were fragmented with pneumatic lithotripter • 6F stents inserted on completion of procedure	74	23	N/A	N/A
Istanbulluoglu et al.[13]	6	524.5 mm^2	• 7F ureteral catheters were placed bilaterally • Tracts were dilated with Amplatz dilators • 30 F Amplatz sheaths were used • 26F rigid nephroscope was used • Stones were fragmented with pneumatic lithotripter • No antegrade stents inserted post-PCNL	87.5	43.2	Tenoxicam 20 mg	1 patient had postoperative anuria treated with bilateral indwelling ureteral stents at postoperative hour 16
Shah et al.[14]	10	Right: 356.1 mm^2 Left: 1043.9 mm^2	• Tract dilated with telescoping metal dilators • Stones were fragmented with pneumatic lithotripter • 6F stents inserted on completion of procedure • Wound was strapped with a pressure dressing	90.1	40.2	Morphine 16.6 mg	4 patients presented with post-PCNL residual stone fragments; one required SWL
Wang et al.[15]	50	4624.64 mm^2	• Tracts were dilated using Amplatz dilators • 30F Ampltz sheaths were used • Stones were fragmented with pneumatic lithotripter • Percutaneous tract cauterized using roller ball resectoscope for haemostasis. • 7F stents inserted on completion of procedure • Wound closed with 3-0 Nylon sutures	244.9	86.9		9 patients required postoperative SWL
Present study	2	Case 1: 121 to 225 mm^2 Case 2: Right: 2500 mm^2; Left: 841 mm^2	• Tracts were balloon dilated to 30F • 30F Amplatz sheaths were used • Stones were fragmented using combined pneumatic and ultrasonic lithotripter with rigid nephroscope and Holmium laser with flexible nephroscope. • 6F stents inserted on completion of procedure • Wound closed with 4-0 monocryl sutures	212.5	38.7	Diclofenac 127.5 mg	1 patient presented with stone recurrence 2 months post-PCNL, treated with ureteroscopy and holmium laser lithotripsy

PCNL: Percutaneous nephrolithotomy; SWL: shock wave lithotripsy.

acid dihydrate and 40% uric acid bilaterally. His metabolic stone workup showed reduced urinary volumes of 1.4 and 1.6 L/day, acidic urine pH of 5.5, hyperuricosuria and secondary hyperparathyroidism. He was advised to increase his fluid intake to more than 2 L/day and follow low purine diet.

Although he had bilateral uric acid stones, maximal medical therapy could not be initiated due to his chronic renal failure with creatinine of 212 μmol/L and potassium

of 5.3 mmol/L. Therefore, he was discharged on allopurinol 100 mg daily without alkalinizing agents. Since he had bilateral impacted UPJ stones and chronic renal failure, the indwelling ureteral stents were kept longer and removed serially on postoperative days 24 and 27. After the removal of the bilateral ureteral stents, creatinine level was repeated and was found to be stable at 146 μmol/L and potassium level at 4.2 mmol/L. Therefore, allopurinol was increased to 200 mg/day and potassium citrate was started at a dose of 10 mEq orally three times a day. A month later (two months after the simultaneous bilateral PCNL), a follow-up CT scan revealed right hydroureter secondary to a 6-mm right distal ureteral stone in addition to several new right renal stones (measuring 1.5 cm each). His medical therapy was further maximized with allopurinol increasing to 300 mg/day and potassium citrate increasing to 20 mEq orally three times a day. A repeat CT scan showed that he passed the ureteral stone with a residual 1.5-cm right upper calyceal stone. Therefore, right ureteroscopy and holmium laser lithotripsy were performed to render him stone-free. On follow-up his creatinine stabilized at 141 μmol/L and his potassium stabilized at 4.5 mmol/L while on allopurinol 300 mg and potassium citrate of 20 mEq three times a day. He was referred to his local nephrologist for further follow-up.

Discussion

Nephrostomy tube placement post-PCNL is currently the standard of practice. In unilateral PCNL, studies have shown that omitting postoperative tube placement is associated with lower postoperative discomfort, lower analgesic requirement, shorter hospital stay and, consequently, decreased cost.[5-9] In addition, there were no differences in haemorrhage, infection,[7] and stone-free rates.[6,7] When compared with staged unilateral PCNL, simultaneous bilateral PCNL using the standard approach of postoperative nephrostomy tubes has been associated with comparable operative bleeding and stone-free rates, while providing the advantages of solitary anaesthesia and shorter recovery time.[2,3] In addition to the advantages of simultaneous bilateral tubeless PCNL (as previously listed), it is a suitable option for patients who reside in remote areas with difficult access to tertiary care centres, as the procedure spares the patient a second trip for the contralateral PCNL. Indwelling ureteral stents could then be removed by local community urologists once the patient returns home.

Although there have been five reports of simultaneous bilateral tubeless PCNL, only one case is reported from North America (Table 1). One of the limitations of tubeless PCNL is the inability to perform second-look nephroscopy for residual fragments. Recently, Raman and colleagues have shown that 43% of patients with clinically-insignificant fragments larger than 2 mm are associated with stone-related events at a median of 32 months post-PCNL.[10] Therefore, in case 2 (in our present study) it is plausible that there may have been residual uric acid stone fragments that grew over a period of two months. Because of his renal failure, medical therapy could not have been maximized post-PCNL to dissolve residual fragments and prevent recurrences. Once his renal function improved, medical therapy was maximized and he remains stone-free.

It is important to note that despite international evidence that bilateral tubeless PCNL can be performed safely and effectively, it is an option rarely employed by North American urologists. Here we present the second and third reported cases of simultaneous bilateral PCNL performed in North America. Simultaneous bilateral tubeless PCNL is an option that can be explored in highly selected patients with bilateral large renal stones who are referred to tertiary stone centre from remote areas.

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