

# Safety and Efficacy of Bilateral Simultaneous Percutaneous Nephrolithotomy

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## ABSTRACT

**Background:** To evaluate the safety and efficacy of bilateral simultaneous percutaneous nephrolithotomy in one tertiary hospital in Nepal.

**Methods:** Retrospective study was done for all patients that underwent bilateral simultaneous percutaneous nephrolithotomy in our center from January 2010 to December 2017. The study included 36 male and 16 female patients with total of 104 renal units at an average age of 37 years (range 3 -65 years). Five patients were planned for bilateral simultaneous Percutaneous nephrolithotomy, but intraoperatively the procedure was aborted after completion of only one side due to various factors. All PCNL were performed in prone position under general anesthesia.

**Results:** In 91.2% of the patients, bilateral simultaneous percutaneous nephrolithotomy could be performed as planned. Average time required for bilateral simultaneous percutaneous nephrolithotomy was  $94 \pm 38.8$  mins (range 25 – 170 mins) with average hemoglobin drop of  $1.85 \pm 1.30$  gm% (range 0.1 - 4.2 gm%) and no significant change in serum creatinine levels. Multiple access tracts (>1) had to be created in 3 renal units. Most of the renal stones were Guy's stone score (GSS) 1 and 2 whereas 15.4% were GSS of 3 and 4. Overall stone free rate was 94% with significant residual stones (>4mm) in 6 renal units which were subjected to extracorporeal shockwave lithotripsy (SWL) on a later date (Clavien-Dindo Grade: III-a). Bladder clot evacuation was done in one patient (Clavien-Dindo Grade: III-b). Blood transfusion was required in two patients and two patients developed postoperative sepsis (Clavien-Dindo Grade: II). One patient developed hydrothorax which was managed successfully (Clavien-Dindo Grade: III-a).

**Conclusions:** Bilateral simultaneous Percutaneous nephrolithotomy is feasible and safe procedure, given that the patients are appropriately selected based upon Guy's stone score, stone burden, pelvi-calyceal anatomy and overall health status.

**Keywords:** Bilateral simultaneous; endourology; percutaneous nephrolithotomy; urolithiasis.

## INTRODUCTION

Percutaneous nephrolithotomy (PCNL) remains the standard procedure for large renal stones.<sup>1</sup> It has become the cornerstone in stone management with high stone free rate (SFR) even after a single procedure and increasing safety with technological advancement in the recent times, especially with miniaturization. Bilateral renal stones, when deemed suitable for bilateral PCNL presents a unique dilemma to the endourologist, whether to perform the surgery as a single or staged procedure. Few have reported about feasibility, efficacy and cost effectiveness of bilateral simultaneous PCNL.<sup>2-10</sup> We conducted this study to evaluate the safety and efficacy of bilateral simultaneous PCNL (BS-PCNL) done in B&B Hospital, a tertiary level hospital located in Lalitpur, Nepal.

## METHODS

Retrospective study was done by reviewing data from all cases that underwent BS-PCNL under same general anesthesia from January 2010 to December 2017. A total of 1074 PCNL records were found among which 52 patients with 104 renal units had undergone BS-PCNL. Information was collected on age, gender, co-morbidities, length of hospital stay and operative time, postoperative hemoglobin fall, change in serum creatinine, stone burden, Guy's stone score<sup>11</sup> (GSS), accessed calyx and early postoperative complications with Clavien-Dindo grade<sup>12</sup>. Descriptive data analysis was done using SPSS<sup>®</sup> Version 20.

Although 57 patients were planned for BS-PCNL, only 52 patients underwent the procedure due to various

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factors such as safety concerns from anesthesiologist given medical co-morbidities, anticipated operative time of greater than 120 mins on single side and/or risk of intraoperative bleeding. Only patients who had an uneventful PCNL on first side were chosen to undergo PCNL on the contralateral side, following pre-operative counselling with the patient and his/her caregivers.

Patients were explained that PCNL would be done on one kidney and if there was high stone clearance and no immediate intraoperative risks then the procedure would be repeated on the next kidney. BS-PCNL was done in one patient with concurrent chronic kidney disease with bilateral obstructive uropathy due to large impacted stones in both renal pelvis. Bilateral PCNL was done first to relieve the obstruction followed by BS-PCNL (and bilateral double J stenting) after 6 weeks. Dilatation of the same PCN tracts were done to gain access to the stones. All PCNL were done under general anesthesia. Cystoscopy was done in lithotomy position and ureteral catheter of 4F/6F (depending upon the age of patient) were placed in both the ureters over guidewire under C-arm (fluoroscopy) guidance. Ureteral catheters of different color (blue/green) were used for easy identification later. The patient was then turned over to prone position. Although both sides were prepared, the kidney which had larger stone burden or the one demonstrating greater obstruction in the radiographic films was dealt with first.

All punctures were made under C-arm guidance after retrograde injection of diluted contrast through corresponding ureteral catheter and visualization of pyelogram. Access sheath size and calyx puncture was selected based on infundibular width, position and burden of stone. Until 2011, all access sheath used were of 24-30F size, but from 2012 access sheath of 16-20F (mini PCNL) were also used due to availability of mini nephroscope in the center. Furthermore starting in 2017, an access sheath of 14F (ultramini PCNL) was also used. The changing trend towards miniaturization of PCNL in our center has been shown in Figure 1. Stones were fragmented using either pneumatic lithotripter or holmium:YAG laser. Nephrostomy tube and double J stent were kept as per surgeon's decision considering intraoperative and patient factors like bleeding, residual fragments, moderate to severe hydronephrosis, infective calculus. After completion of the first side, C-arm and urologist switch sides to start procedure on the contralateral kidney. Patient were evaluated for postoperative hemoglobin drop, change in creatinine level, length of hospital stay, perioperative complications, residual stone and requirement of any secondary procedures. A

drop of hemoglobin of more than 2mg/dl on the second postoperative day, increase in creatinine more than upper normal range were considered significant. Stone free status was assessed intraoperatively under C-arm fluoroscope, postoperatively on 2nd day by X-ray KUB and/or ultrasonography KUB during follow-up. Stone size of less than 4mm in ultrasonography was considered insignificant. Residual stone of more than 5mm which were probable of causing urinary obstruction and were managed by extracorporeal shock wave lithotripsy (SWL) during follow-up after 2 weeks.

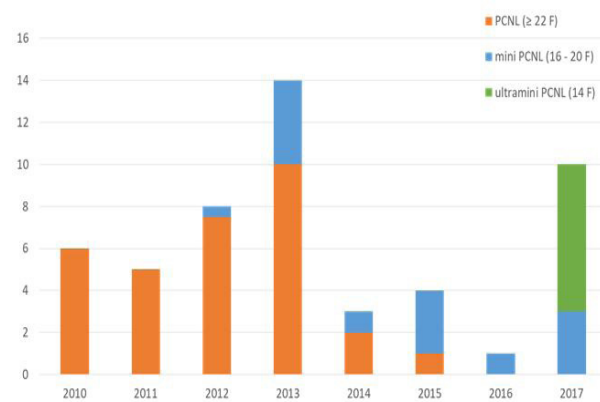


Figure 1. Moving towards miniaturization of PCNL in our center.

RESULTS

The patient demographics is tabulated below in Table 1. Out of a total of 52 patients 36 were male and 16 female, at an average age of 37 years (range 3 -65 years). Forty percent of patients had Guy's stone score of 1, 44% had score of 2, 8% had 3 and 8% had score of 4. One patient had chronic kidney disease (CKD) and not under dialysis. Stone burden on the two kidneys were comparable.

Table 1. Demographics of patients undergoing BS-PCNL.

Total patients (Renal Units)	52 (104)
Male / Female	36 / 16
Average age (years)	37.24 ± 13.45 (Range 3 - 65)
Co-morbidities	
Diabetes mellitus	5 (9.6%)
Hypertension	3 (5.7%)
Chronic kidney disease	1 (1.9%)
Average Serum Creatinine (mg/dl)	1.04 ± 0.76 (Range 0.25 - 5.6)

Guy's stone score <sup>11</sup>	
Score 1	42 (40.3%)
Score 2	46 (44.3%)
Score 3	8 (7.7%)
Score 4	8 (7.7%)
Average Stone burden (mm)	
Left kidney	23.6 ± 12.4
Right kidney	22.1 ± 11.9

As outlined in Table 2, the average operating time was 95 ± 38.79 mins (range 25 - 170 mins). Total of 103 access tracts were created, 53 on the right and 50 on left. Double J stenting was done in 29 renal units. Nephrostomy tubes were kept in 90 access tracts. Total tubeless PCNL was done in 3 patients.

<b>Table 2. Operative summary of patients undergoing BS-PCNL.</b>	
Performed as planned	91.2% (52/57 cases)
Operating time (minutes)	94 ± 38.8 (Range 25 - 170)
Hemoglobin drop (gm%)	1.85 ± 1.30 (Range 0.1 - 4.2)
Creatinine change (mg/dl)	0.09 ± 0.35
Increase in	28/52 cases
Decrease in	14/52 cases
Puncture	
Right	Total 55
Upper calyx	7
Middle calyx	24
Lower calyx	24
Left	Total 52
Middle calyx	24
Lower calyx	28
Access	
Double ports	3 renal units
Nephrostomy tubeless	17renal units
Bilateral total tubeless	5 cases
Double J stenting	
Left kidney	14/52renal units
Right kidney	15/52renal units
Stone free rate (SFR)	94%
Second procedure	
SWL	6 renal units

Stone free rate was 94%, while 6 patients had small but significant residual stonepost-operatively. Mean drop in hemoglobin level was 1.85 ± 1.30 gm% (range 0.1 - 4.2 gm%). There was no significant postoperative change in serum creatinine level. Postoperative complications have been shown in Table 3. Two patients developed postoperative fever (temperature >100° F) due to urinary tract infection and was managed with intravenous antibiotics. Two patients experienced a significant drop in hemoglobin level less than 8gm% and required blood transfusion and one patient required bladder clot evacuation. One patient developed hydrothorax after right upper calyx puncture and was promptly diagnosed and managed with intercostal drain tube.

<b>Table 3. Complications as per Clavien-dindo grading.<sup>12</sup></b>			
Postoperative UTI/sepsis	Grade II		3.8% (2/52)
Hematuria requiring blood transfusion	Grade II		3.8% (2/52)
Significant residual stone requiring SWL later	Grade III-a		5.7% (6/104)
Iatrogenic hydrothorax requiring drainage	Grade III-a		0.9% (1/104)
Hematuria requiring bladder wash	Grade III-b		1.9% (1/52)

## DISCUSSION

Percutaneous nephrolithotomy (PCNL) is a standard procedure for large stones with minimal morbidity. Conventionally, patients with bilateral stone that were suitable for PCNL on both sides were treated as a staged procedure. However, with growing expertise among endourologists, effective modification of techniques, miniaturization of instruments and access tracts, PCNL has become much safer and BS-PCNL are being done more often. There are many advantages of doing bilateral procedure in a single setting, including reduced need for repeated anesthesia& cystoscopy, reduced total operating time& hospital stay, decreased procedure cost, shorter convalescence, reduced psychological stress, reduced requirement of antibiotics and analgesics.

Stone free rate (SFR) in our study was comparable with other studies done by Holman et al<sup>8</sup> and Desai et al<sup>2</sup>. Wang et al<sup>9</sup> performed BS-PCNL in 100 renal units with GSS 4 and were able to achieve SFR of 72% with slightly increased operating time but similar hemoglobin drop and transfusion rate. The high SFR in this series is because majority of the patients (85%) had GSS 1 and 2 only. The 5 patients in which BS-PCNL could not be performed had GSS ≥ 3. This demonstrates that GSS is an important factor for achieving optimal outcome, and

Table 4. Comparison with reported studies.

Study	Renal units	Time (mins)	Hb drop (gm%)	Transfusion	Stay (days)	SFR (%)
Our study	104	94 ± 38.8	1.85 ± 1.30	4 %	6.2 ± 3.1	94
Holman et al <sup>8</sup>	396	46	1.73	6 %	4.3	95.6
Wang et al <sup>9</sup>	100	244.9 ± 29	1.99 ± 0.52	6 %	3.6 ± 1.03	72
Desai et al <sup>2</sup>	90	107.4 ± 43	2.02 ± 1.19	6.6 %	6.6 ± 1.94	95.5
Bagrodia et al <sup>5</sup>	34	367 ± 123	4.7	0	3.0 ± 2	60
Istanbulluoglu et al <sup>3</sup>	12	87.5	1.55	0	1.8	-
Guyen et al <sup>10</sup>	10	75	0.6	0	4	80

should be considered during patient selection for BS-PCNL.

Hemoglobin drop and blood transfusion rate are overall similar to many studies.<sup>2, 8, 9</sup> Mean hospital stay in our study was 6.2 ± 3.1 days. This is longer than in other studies, and one reason could be because some patients were from outside the Kathmandu valley, so for convenience they were discharged only on or after the fourth post-operative day.

All complications in our series were of Clavien-Dindo Grade<sup>12</sup> II and III (Table 2). Two of the patients developed postoperative fever due to UTI with sepsis and antibiotics had to be upgraded with close monitoring in high dependence unit. Both of these patients had negative urine culture pre-operatively and had received intraoperative antibiotic prophylaxis. Blood transfusion were required in two cases and bladder wash done in one case due to clot retention. Iatrogenic hydrothorax occurred in one patient due to extravasation of irrigation fluid through supracostal upper pole tract into the pleural space. This was diagnosed clinically and through chest X-ray done intraoperatively. Intercostal drain tube was placed before reversal of anesthesia. We routinely perform a chest X-ray in all PCNL cases in which the tract has been created through supracostal puncture to rule out hydrothorax. Portable chest X-ray is done in operating room itself at the end of procedure, after changing the patient to supine position and keeping the chest at 45 degrees while intubated. Fortunately, we had no other complications in this series such as bowel perforation, hemorrhage requiring embolization or death of the patient.<sup>2,7</sup> Comparison of various variables of this study is done with similar studies in Table 4.

## CONCLUSIONS

Bilateral simultaneous PCNL (BS-PCNL) is feasible and does not compromise the safety of the patient. However, patients should be appropriately selected based upon the Guy's stone score, stone burden, pelvi-calyceal anatomy and overall health status.

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