

Percutaneous Nephrolithotomy in Patients with Solitary Kidney- Experience in a Tertiary Health Care Centre

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Abstract

The Current study was done to evaluate the safety, efficacy and functional out come of PCNL in the setting of solitary kidney with nephrolithiasis .This prospective observational study evaluated 34 patients with solitary kidneys who underwent PCNL in our institute from Jan 2013 to June 2015. Demographic data, stone size, number and site of accesses, operative time, blood transfusion rates, ancillary procedures, hospital stay, complications and stone free rates were recorded. Serum creatinine was recorded preoperatively and one month postoperatively. 34 patients with solitary kidneys underwent PCNL . The mean operative time was 79 min(56-123). Blood transfusion was done in 4(11.76%) patients. Amongst complications, 3(8.82%) patients had bleeding . One patient required angioembolisation to control the bleeding. Five(14.70%) patients had fever postoperatively. None of the patients had pleural violation or adjacent organ injury. The stone free rate was 88.23% at the end of one month. Twenty three(67.64%) patients had normal creatinine preoperatively whereas 11 patients(32.35%) had elevated creatinine(>1.5mg%). Renal function remained stable in patients who had normal creatinine preoperatively whereas there was significant improvement in renal function in patients with elevated creatinine preoperatively, one month after surgery. Despite potentially devastating complication of renal loss associated with PCNL, which could result in anephric state in the setting of solitary kidney, PCNL in solitary kidneys is safe with excellent stone free rates, if performed cautiously in a tertiary health care setting where large volume of stone patients is treated.

Key Words

Nephrolithiasis, Solitary Kidney, Percutaneous Nephrolithotomy

Introduction

PCNL has replaced open surgery for majority of large stones in the kidney. This is largely attributable to the fact that large, multiple and staghorn stones in the kidney can be cleared in a short time, with minimal morbidity and cost effectiveness using PCNL(1,2). PCNL causes minimal nephron loss and does not affect the renal function on long term followup (3,4,5). However PCNL in solitary kidney is always challenging for a urologist. The main complication following PCNL is bleeding as kidney is a highly vascular organ (6,7). Delayed bleeding following PCNL can occur because of pseudoaneurysm or arteriovenous fistula formation (8). In majority of cases with bleeding following PCNL settles with conservative means such as blood transfusion. In 0.8% cases the bleeding may necessitate angioembolisation to control it (9). Rarely partial or total nephrectomy may be required to control the bleeding (10). The fact that nephrectomy in a patient with solitary kidney though rare can result in

anephric state, is the main cause of anxiety for any urologist who is performing PCNL for such patients. With refinement of instruments, surgical technique and imaging technology, PCNL has become safer and is increasingly being performed in more complex situations such as solitary kidney (11-13).

Material and Methods

The present prospective observational study was performed in the urology department of GMC Jammu from Jan 2013 to June 2015. Selection criteria were stones in those with congenitally single kidney, nephrolithiasis in previously nephrectomised patients and nephrolithiasis with contra lateral non functioning kidney Unilateral nephrectomy after trauma, cancer, secondary to the complications of nephrolithiasis and its treatment or kidney donation results in solitary kidney. In addition to taking history and performing thorough physical examination, routine preoperative tests were done. Intravenous

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urogram was done for patients with normal renal function. DTPA scan and plain CT scan was done for patients with creatinine more than 2mg%. Patients with positive urine culture were treated with appropriate antibiotics before taking up for surgery. Patients with deranged renal function due to obstructive stones were either stented or subjected to percutaneous nephrostomy to improve the renal function and were taken up for surgery once the serum creatinine stabilized. Informed consent was taken from all the patients. All the procedures were performed under general anesthesia. Ureteric catheter was placed in lithotomy position. Patient was turned prone for the procedure. Initial puncture was performed under fluoroscopic guidance after injecting contrast/air from ureteric catheter. Terumo 0.035 Guide wire was placed in the collecting system/ureter. Tract was dilated with serial metallic alken dilators. Cook disposable amplatz sheath was placed and 19 F storz nephroscope was used for the procedure. Stone was fragmented with swiss lithoclast and stone fragments were cleared with graspers. Additional tracts were made where ever required. Stone clearance was confirmed under image intensifier. D/J stent and nephrostomy was placed in all the patients at the end of the procedure. X-Ray KUB was performed to confirm stone clearance 48 hours after surgery. Nephrostomy tube was removed 72 hours after surgery if there were no residual fragments. D/J stent was removed 3 weeks after surgery. Patients were followed up in outpatient clinic 2 weeks and 1 month after surgery with creatinine and X-Ray KUB.

Results

A total number of 34 patients having solitary kidney with stones underwent PCNL from Jan 2013 to June 2015. Twenty five(73.52%) were males and nine(26.47%) were females. Six(17.64%) patients had congenitally single kidney, 17(50%) patients had undergone previous nephrectomy and 11(32.35%) patients had nonfunctioning kidney on the other side. The mean age of the patients was 42yrs(23-57). The mean maximum stone diameter was 3.1cm(2.2-4.6). Fifteen patients(44.11%) had single stones, 14(41.17%) had multiple stones whereas five(14.70%) had staghorn stones. Six(17.64%) patients had history of previous intervention in form of either, PCNL, open surgery, or ESWL in the past. D/J stenting/ PCNL was performed to optimize the renal function in 8(23.52%) patients (Table-1). The mean operative time was 79 min(56-123). Twenty five(73.52%) patients had single whereas 9(26.47%) had multiple access during PCNL to clear the stone. Blood transfusion was done in 4(11.76%) patients. Staged PCNL was done in 5(14.70%) patients. Mean

hospital stay was 8 days (4-13). One patient in whom residual stone fragments had migrated to the ureter, underwent ureterorenoscopy to clear the residual fragments. Thirty patients(88.23%) were stone free at the end of one month (Table-2). Three(8.82%) patients had bleeding preoperatively. One patient required angioembolisation to control the bleeding. Four(11.76%) had fever postoperatively. None of the patients had pleural violation or adjacent organ injury (Table-3). Twenty three(67.64%) patients has normal creatinine preoperatively whereas 11(32.35%) patients had elevated creatinine(>1.5mg%). Mean preoperative creatinine in patients with normal renal function was 1.1mg%(0.8-1.4)and in those with deranged renal function was 3.1mg%(1.6-4.6). One month post operatively the mean creatinine in those with normal renal function and in those with deranged renal function was 1mg%(0.8-1.3) and 1.9mg%(1.1-2.8) respectively (Table-4). Renal function remained stable in patients who had normal creatinine preoperatively whereas there was significant improvement in renal function in patients with elevated creatinine preoperatively, one month after surgery.

Discussion

Amongst 34 patients who had solitary kidney with stones, 73.52% were males and 26.47% were females. This increased incidence in males can be explained by the fact that congenital renal agenesis affects approximately twice as many males as females (14). Previous nephrectomy due to trauma, stone disease or renal cell cancer occurs more in males as compared to females as the incidence of renal trauma, renal cell carcinoma and stone disease is more in males (15,16).

Significant number of patients(17.64%) had previous intervention in form of open stone surgery, ESWL or PCNL. Nephrolithiasis is recurrent disease. In patients who do not receive prophylaxis following the first attack, recurrence rates are reported as 10% in the first year, 35% in the next 5 years, and 50% in 10 years (17,18). Majority of the patients with solitary kidney had undergone nephrectomy in the past and in this group nephrolithiasis(complications or treatment) was the leading cause of nephrectomy.

Mean operative time was 79 minutes(56-123). The The Clinical Research Office of the Endourological Society(CROES) Percutaneous Nephrolithotomy Global Study reported a mean operative time of 75minutes (55-120) in 189 Patients with Solitary Kidneys who underwent PCNL (19). Where ever the stone burden was large, keeping in view the solitary kidney status the PCNL was staged to prevent the complications.

Blood transfusion was done in 4 patients(11.76%).

Table 1. Patient Characteristics

Total Patients	34
Male/Female	25(73.52%)/9(26.47%)
Mean Age, yr(range)	42(23-57)
Mean maximum stone diameter, cm(range)	3.1(2.2-4.6)
Previous Intervention(Total)	6(17.64%)
Open Surgery	3
Eswl	1
PCNL	2
Congenital Solitary Kidney	6(17.64%)
Previous Nephrectomy	17(50%)
Contra lateral Non functioning Kidney	11(32.35%)
Pre operative Intervention	6(17.64%)
D/J Stenting	2
PCN	4
Number of stag horn stones	5(14.70%)
Number of single stones	15(44.11%)
Number of multiple stones	14(41.17%)

Table 2. Intra Operative and Post operative Characteristics

Mean Operative time, min(range)	79min(56-123)
Number of Access, Single/Multiple	25(73.52%)/9(26.47%)
Staged PCNL	5(14.70%)
Ancillary Procedure	1
URS	1
Mean Hospital stay(range)	8days(4-13)
Stone free one month postoperatively	30(88.23%)
Blood transfusion	4(11.76%)

Table 3. Complications

Complication	Number	Intervention
Bleeding	3(8.82%)	Blood Transfusion, angio-embolisation in one pt
Fever	4(11.76%)	Change of antibiotics

Table 4. Renal Functional Characteristics

	Number	Mean Preoperative creatinine	Mean Postoperative creatinine at 1 month
Normal Renal function Creatinine<1.5mg%	23(67.64%)	1.1mg%(0.8-1.4)	1.0mg%(0.8-1.3)
Deranged Renal function Creatinine>1.5mg%	11(32.35%)	3.1mg%(1.6-4.6)	1.9mg%(1.1-2.8)

Blood transfusion is required in 1% to 11% of patients who undergo PCNL. However in those with stag horn calculi the blood transfusion rate is 2% to 53% (7,20-25). CROES global PCNL study on solitary kidneys reported blood transfusion in 10.1% out of 189 cases (19-25).

Mean hospital stay in the study group was 8days (4-13). Yanbo wang *et al* in their study reported a similar median hospital stay of 9.08 (6-11) (26). The long hospital stay in our study is a consequence of staged PCNL in those with large stone burden where more than one sitting was required to clear the stone. Thirty patients(88.23%) were stone free one month postoperatively. Hosseini MM *et al* achieved a stone free rate of 91.3% in 412 cases of solitary kidney undergoing PCNL (27). One needs to cautious while planning the number of accesses into the kidney to clear the stone. In staghorn stones and multiple stones, more than one access may be required to make the patient stone free. However in solitary kidney situation multiple accesses can put the kidney at risk of bleeding or injury (28). Therefore balance should be struck between risk reduction and stone clearance. There are studies to suggested that a high stone free rate can be

achieved with minimal complications (11). Bleeding during PCNL can result from injury to interlobar and segmental vessels during puncture, dilatation, stone fragmentation, intrarenal nephroscope manipulation. In majority of the cases the bleeding stops after placing and clamping the nephrostomy. Significant amount of bleeding can occur postoperatively due to the formation of arteriovenous fistula or pseudo aneurysm. Most of the cases of bleeding post PCNL are managed conservatively by blood transfusion. Angioembolisation may be required in 0.8% of cases with uncontrollable bleeding. Bleeding was noticed in three patient(8.84%) in the present study. CROES global PCNL study on solitary kidney reported bleeding in 10.2% out of 189 cases. Bleeding settled with blood transfusion in two cases, however angioembolisation was required in one. Fever was recorded in 4 patients (11.76%), it settled with change of antibiotics. Hosseini MM *et al* reported fever in 8.2% out of 412 cases whereas CROES global PCNL study on solitary kidneys reported fever in 13.3% out of 189 cases (19,27). Presence of obstructive stones in solitary kidney can result in elevated creatinine. There were 11

patients(32.35%) who had deranged renal function preoperatively in the present study. Six patients out of these 11 patients underwent preoperative D/J stenting/ PCN to optimize the renal function. The mean creatinine in these 11 patients declined from 3.1mg%(1.6-4.6) to 1.9mg%(1.1-2.8) one month postoperatively. Renal function remained stable one month postoperatively in those with normal creatinine preoperatively. This observation has been supported by a number of studies (11,13,29).

Conclusion

PCNL in solitary kidneys is safe and effective with minimum complications and excellent stone free rates. Renal function is well preserved in those with normal renal function and improved in those with deranged renal function. However considering the potentially dangerous complications of PCNL in solitary kidneys, it should be performed in tertiary care, high volume centre by an experienced team.

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