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Assessment of post operative complications in patients who underwent percutaneous nephrolithotomy surgery

[1]Dr. MS Uppal, [2]Dr. Sidharth Khullar, [3]Dr. Ramandeep Singh

[1]Professor, [2]Assistant Professor, [3]3rd Year Post Graduate, Department of General Surgery, Sri guru ram das institute of medical sciences and research, Sri Amritsar, Punjab, India

Corresponding author
Dr. Ramandeep Singh
3rd Year Post Graduate, Department of General Surgery, Sri Guru Ram Das University of Health Sciences, Sri Amritsar, Punjab, India

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Abstract

Background: Percutaneous nephrolithotomy (PCNL) is the gold standard treatment of large and staghorn kidney stones. The aims and objectives of the present study were to study the post op complications in patients who underwent percutaneous nephrolithotomy surgery.

Materials & Methods:100 patients presenting in IPD/OPD of Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar in the age group of 20-60 yearswho need to undergo PCNL as the procedure of choice to clear the renal / ureteric calculi were enrolled in this study. The post operative complications in patients undergoing percutaneous nephrolithotomy surgery was recorded.

Results: Among 100 patients studied from age group of 20 to 60 years old. Mean age of the study group was 46.43±10.10 years. Total number of patients in age group of 20-30, 31-40, 41-50,51-60 years were 8, 18, 37, 37 respectively.31 patients were females and 69 patients were male. Complications were noted in 79 percent of the study population most common being fever (38%) followed by bleeding (19%), Residual stones 6%, Complications related to stone removal (9%), Infective complications /sepsis (12%), extrarenal migration of fragments of stone was noted in 6% of patients, nephrostomy leakage was seen in 37% of patients. Persistent urinary fistula, AV Fistula/ pseudoaneurysm and Gastrointestinal complications were not seen in any patient.

Conclusion: Most of the complications were common in patients who had larger calculi. Patients with stone size of 31-40 mm, 62.5% had fever3 7.5% had bleeding 25% had residual stones 37.5% had complications related to stone removal and 37.5% had sepsis/infective complications. Prevalance of Nephrostomy leakage (41.2%)was highest in patients with stone size 10-20mm. Extra renal migration of stone fragments were most common in patient (7.3%) who had stone size 21-30mm.

Key words: Percutaneous nephrolithotomy, kidney stones, complications

Introduction

Percutaneous nephrolithotomy (PCNL) is the gold standard treatment of large and staghorn kidney stones. Despite technological progress and improvement of PCNL technique, this procedure is associated with complications and in some cases remain a challenge for surgeon.[1]The treatment of urolithiasis has undergone a paradigm shift in the past decade. Management of urolithiasis necessitates a balance between stone clearance and morbidity related to the procedure.Of the minimally invasive treatment strategies, the PCNL procedure

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is simply based on the creation of a proper percutaneous renal access, through the most appropriate part of the kidney, dilation of this tract and fragmentation and removal of the stone fragments using the nephroscope through the access sheath.[2] It has been reported that PCNL can be performed safely and effectively to achieve a higher stone-free rate and allow a short treatment period in most patients.[3]PCNL is a technique used to remove certain stones in the kidney or upper ureter.

PCNL is currently the procedure of choice for removing large and complex renal and upper ureteric calculi. It is a minimally invasive procedure to remove stones by a small puncture wound through the skin.Even though pericutaneous renal surgery is less invasive than an open procedure, complications may occur.PCNL attains stone free rates of upto 95%. AUA guidelines recommend PCNL as a treatment of choice for staghorn calculi. Larger stones in the lower pole are best managed by PCNL as the first treatment option. PCNL is considered to be a gold standard in management of calyceal renal stones.[4] Complication such as fever, bleeding, residual stone, complications related to stone removal- infection and urosepsis, intravascular fluid overload, extravasation of fluid, post percutaneous nephrolithotomy bleeding, infective complications such as sepsis, extrarenal migration of stone fragments, nephrostomy leakage, injury to renal collecting system, infundibular stenosis, persistent urinary fistula, AV Fistula/Pseudoaneurysm, gastrointestinal complications such as spleen injury, gall bladder injury, colon injury, bowel injury etc. are common.[5]The aims and objectives of the present study were to study the post operativecomplications in patients who underwent percutaneous nephrolithotomy surgery.

Materials & Methods

The study was conducted on 100 patients presenting in IPD/OPD of Sri Guru Ram Das Institute of Medical Sciences and Research, Sri Amritsar in the age group of 20-60 years. Patients were evaluated and those who need to undergo PCNL as the procedure of choice to clear the renal / ureteric calculi were enrolled in this study, after obtaining their full informed consent.100 patients in the age group 20 -60 years, subjected to PCNL between March 2021 to June 2022 were evaluated.

Data such as name, age, gender etc. was recorded. Patients were evaluated for following symptoms during hospital stay, pain, fever, nausea/ vomiting, hematuria, pyuria, lithuria, dysuria, burning micturition, palpable mass or swelling, obstructive/ voiding or Irritative/storage symptoms, presence of renal failure, symptoms of renal failure i.e. in the form of fluid overload or uremia were evaluated. Symptomatic presentation, incidental, renal failure or sepsis was recorded. All were subjected to urine analysis &urine culture, biochemical &hematologicalinvestigation. All the patient underwent X-ray KUB region & Ultrasonographic examination. Some specific imaging like IVP (intravenous pyelogram) and CT (plain or contrast) were done if required.

Data thus obtained were subjected to statistical analysis. P value < 0.05 was considered significant.

Results

Table I Age distribution

Age group (years)	No. of patients	%age
20-30	8	8.0
31-40	18	18.0
41-50	37	37.0
51-60	37	37.0
Total	100	100.0

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Among 100 patients studied from age group of 20 to 60 years old. Mean age of the study group was 46.43±10.10 years. Total number of patients in age group of 20-30, 31-40, 41-50,51-60 years were 8, 18, 37, 37 respectively.

Table II Gender distribution

Sex	No. of patients	%age
Female	31	31.0
Male	69	69.0
Total	100	100.0

Among 100 patients who underwent surgery, 31 patients were females and 69 patients were male.

Table III Complications

Complications	Absent		Present	
	No.	%age	No.	%age
Fever	62	62.00	38	38.00
Bleeding	81	81.00	19	19.00
Residual stones	94	94.00	6	6.00
Complications related to stone removal	91	91.00	9	9.00
Infective complications/Sepsis	88	88.00	12	12.00
Extrarenal migration of stone fragments	94	94.00	6	6.00
Nephrostomy leakage	63	63.00	37	37.00
Persistent urinary fistula	100	100.00	0	0.00
AV Fistula/ pseudoaneurysm	100	100.00	0	0.00
Gastrointestinal complications	100	100.00	0	0.00

Complications were noted in 79 percent of the study population most common being fever (38%) followed by bleeding (19%), Residual stones 6%, Complications related to stone removal (9%), Infective complications /sepsis (12%), extrarenal migration of fragments of stone was noted in 6% of patients, nephrostomy leakage was seen in 37% of patients. Persistent urinary fistula, AV Fistula/ pseudoaneurysm and Gastrointestinal complications were not seen in any patient.

Table IV Association of complications with age

Complications	Age group								p-value (Chi Square)
	20-30 (n=8)		31-40 (n=18)		41-50 (n=37)		51-60 (n=37)		
Fever									
• **Absent**	6	75.0	13	72.8	27	73.0	16	43.3	0.010
• **Present**	2	25.0	5	27.2	10	27.0	21	56.7	
Bleeding									
• **Absent**	8	100.0	13	72.2	31	83.8	29	78.4	0.372
• **Present**	0	0.0	5	27.8	6	16.2	8	21.6	
Residual stones									
• **Absent**	6	75.0	16	88.9	36	97.3	36	97.3	0.061
• **Present**	2	25.0	2	11.1	1	2.7	1	2.7	
Complications related to stone removal									
• **Absent**	8	100.0	18	100.0	34	91.9	31	83.8	0.175
• **Present**	0	0.0	0	0.0	3	8.1	6	16.2	
Infective complications/Sepsis									

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• **Absent**	8	100.0	15	83.3	32	86.5	33	89.2	0.661
• **Present**	0	0.0	3	16.7	5	13.5	4	10.8	
Extrarenal migration of stone fragments									
• **Absent**	8	100.0	17	94.4	36	97.3	33	89.2	0.432
• **Present**	0	0.0	1	5.6	1	2.7	4	10.8	
Nephrostomy leakage									
• **Absent**	5	62.5	13	72.2	24	64.9	21	56.8	0.722
• **Present**	3	37.5	5	27.8	13	35.1	16	43.2	
Persistent urinary fistula									
• **Absent**	8	100.0	18	100.0	37	100.0	37	100.0	-
• **Present**	0	0.0	0	0.0	0	0.0	0	0.0	
AV fistula/ Pseudoaneurysm									
• **Absent**	8	100.0	18	100.0	37	100.0	37	100.0	-
• **Present**	0	0.0	0	0.0	0	0.0	0	0.0	
Gastrointestinal complications									
• **Absent**	8	100.0	18	100.0	37	100	37	100.0	-
• **Present**	0	0.0	0	0.0	0	0.0	0	0.0	

Fever was observed in 2 (25%) patient in age group of 20-30 years 5(27.2%) patient in age group of 31-40 year 10(27%) in age group of 41-50 years and 21 (56.7%) patient in age group of 50-60 year. Bleeding was seen in 5 (27.8%) patient of 31-40 years age group 6 (16.2%) patient of 41-50 year age group and 8 (21.6%) patient of 51-60 year. Patient in age group of 20-30 years had no bleeding complication.Residual stones were seen in 2 (25%) patient of 20-30 year age group 2 (11.1%) patient of 31-40 year age group 1 (2.7%) patient of 41-50 year and 1 (2.7%) patient of 51-60years age group.6(16.2%) patient of 51-60 year age group and 3 (8.1%) patient of 41-50 years age group had complications during removal of stones.

Sepsis/ infective complication was most common in age group of 31-40 years (3 patient) (16.7%), 5 (13.5%) patient of age group 41-50 year and 4 (10.8%) patient of age group 51-60 year had sepsis. Patient of 20-30 years age group had no infective complication.Extra renal migration of stone fragments was seen in 1 (5.6%) patient of (31-40 yrs) age group 1 (2.7%) patient of 41-50 years age group 4(10.8%) patient of 51-60 years age group and 20-30 years age group patient had no complication.Nephrostomy leakage was seen in 3 (37.5%) patient in age group of 20-30 year 5 (27.8%) in age group of 31- 40 year 13 (35.1%) patient of age group of 41-50 year and 16 (43.2%) patient in age group of 51-60 year. Some complications like urinary fistula, AV Fistula/ Pseudoaneurysm and gastrointestinal complication were not seen in any patient.

Table V Association of complications with gender

Complications	**Sex**				**p-value (Chi Square)**
	Female (n=31)		**Male (n=69)**		
Fever					
• **Absent**	15	48.3	47	68.1	0.060
• **Present**	16	51.7	22	31.9	
Bleeding					
• **Absent**	24	77.4	57	82.6	0.541
• **Present**	7	22.6	12	17.4	
Residual stones					

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• **Absent**	30	96.8	64	92.8	0.434
• **Present**	1	3.2	5	7.2	
Complications related to stone removal					
• **Absent**	28	90.3	63	91.3	0.874
• **Present**	3	9.7	6	8.7	
Infective complications/Sepsis					
• **Absent**	26	83.9	62	89.9	0.394
• **Present**	5	16.1	7	10.1	
Extrarenal migration of stone fragments					
• **Absent**	29	93.5	65	94.2	0.899
• **Present**	2	6.5	4	5.8	
Nephrostomy leakage					
• **Absent**	24	77.4	39	56.5	0.045
• **Present**	7	22.6	30	43.5	
Persistent urinary fistula					
• **Absent**	31	100.0	69	100.0	-
• **Present**	0	0.0	0	0.0	
AV fistula/ Pseudoaneurysm					
• **Absent**	31	100.0	69	100.0	-
• **Present**	0	0.0	0	0.0	
Gastrointestinal complications					
• **Absent**	31	100.0	69	100	-
• **Present**	0	0.0	0	0	

Among 100 patients 31 patients were females and 69 patients were male. Fever was seen more in females (51.7%) than males (31.9%). 16 females and 22 males had fever. 7 (22.6%) females and 30 (43.5%) males had leakage at nephrostomy. Correlation of Fever and nephrostomy leakage with gender was statistically significant. Complications like bleeding, extrarenal migration of stone fragments, sepsis/infection and complications related to stone removal were seen more in females than males. Bleeding was seen in 7 (22.6%) females and 12 (17.4%) males. Extra renal migration of stone fragmentswere seen in 2(6.5%) females and 4 (5.8%) males. Infective complication/sepsis were seen in 5 (16.1%) females and 7 (10.1%) males. Complications related to stone removal were noticed in 3 (9.7%) females and 6 (8.7%) males. Residual stones were seen more in males. 5 (7.2%) male and 1 (3.2%) female had seen residual stones after surgery. Gastrointestinal complications, AV fistula/pseudoaneurysm and urinary fistula were not seen in any patient.

Table VI Association of complications with site

Complications	**Site**								**p-value (Chi Square)**
	Calyx (n=13)		**Pelvis(n=43)**		**PUJ (n=8)**		**Ureter(n=36)**		
Fever									
• **Absent**	8	61.5	24	55.8	4	50.0	26	72.2	0.550
• **Present**	5	38.5	19	45.2	4	50.0	10	27.8	
Bleeding									
• **Absent**	8	61.5	36	83.7	5	62.5	32	88.9	0.084
• **Present**	5	38.5	7	16.3	3	37.5	4	11.1	
Residual stones									
• **Absent**	13	100.0	38	88.4	7	87.5	36	100.0	0.105

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• **Present**	0	0.0	5	11.6	1	12.5	0	0.0	
Complications related to stone removal									
• **Absent**	12	92.3	37	86.0	6	75.0	36	100.0	0.062
• **Present**	1	7.7	6	14.0	2	25.0	0	0.0	
Infective complications/Sepsis									
• **Absent**	13	100.0	36	83.7	6	75.0	33	91.7	0.235
• **Present**	0	0.0	7	16.3	2	25.0	3	8.3	
Extrarenal migration of stone fragments									
• **Absent**	13	100.0	42	97.7	6	75.0	33	91.7	0.062
• **Present**	0	0.0	1	2.3	2	25.0	3	8.3	
Nephrostomy leakage									
• **Absent**	10	76.9	27	62.8	5	62.5	21	58.3	0.701
• **Present**	3	23.1	16	37.2	3	37.5	15	41.7	
Persistent urinary fistula									
• **Absent**	13	100.0	43	100.0	8	100.0	36	100.0	-
• **Present**	0	0.0	0	0.0	0	0.0	0	0.0	
AV Fistula/pseudoaneurysm									
• **Absent**	13	100.0	43	100.0	8	100.0	36	100.0	-
• **Present**	0	0.0	0	0.0	0	0.0	0	0.0	
Gastrointestinal complications									
• **Absent**	13	100.0	43	100	8	100.0	36	100.0	-
• **Present**	0	0.0	0	0	0	0.0	0	0.0	

Fever was seen in 4(50%)patients who had stone at pelvic ureter junction 19 (45.2%) patient Who had stone at pelvis 10 (27.8%) patient who had stone in upper ureter and 5(38.5%) patients who had stone in calyx.Bleeding was noticed in 5 (38.5%) patient who had calculi in calyx 7 (16.3%) patientswho had calculi at pelvis and 3 (37.5%) patients who had calculi at PUJ and 4 (11.1%) patients who had upper ureteric calculi.Some complications like extra renal migration of stone fragments and residual stones were not seen in patients who had stone in calyx. Migration of stone fragments was seen in 1 (2.3%) patient with calculi in pelvis 2 (25%) patientswho had calculi at PUJ and 3 (8.3%) patientswho had upper ureteric calculi. Residual stone was seen in 5 (11.6%) patientswho had calculi in pelvis and 1 (12.5%) patient who had calculi at PUJ.Complications during stone removal was noticed in 1 (7.7%) patient who had calculi in calyx 6 (14%) patientswho had calculi in pelvis 2 (25%) patientswho had calculi at PUJ.Sepsis /infection was noticed in 7 (16.3%) patient who had calculi in pelvis 2 (25%) patientswho had calculi at PUJ and 3 (8.3) patientswho had upper ureteric calculi.Leakage at nephrostomy was seen in 15 (41.7%) patientswho had upper ureteric calculi 3 (37.5%) patientswho had calculi at PUJ 16 (37.2%) patientswho had calculi in pelvis and 3 (23.1%) patientswho had calculi in calyx.Some complications like gastrointestinal complication urinary fistula and AV Fistula/ pseudoaneurysm, were not seen in any of the patients.

Table VII Association of complications with size of stone

Complications	**Size (mm)**						**p-value (Chi Square)**
	10-20 (n=51)		**21-30 (n=41)**		**31-40 (n=8)**		
Fever							
• **Absent**	40	78.4	19	46.3	3	37.5	0.011

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• **Present**	11	21.6	22	53.7	5	62.5	
Bleeding							
• **Absent**	45	88.2	31	75.6	5	62.5	0.117
• **Present**	6	11.8	10	24.4	3	37.5	
Residual stones							
• **Absent**	51	100.0	37	90.2	6	75.0	0.009
• **Present**	0	0.0	4	9.8	2	25.0	
Complications related to stone removal							
• **Absent**	51	100.0	35	85.4	5	62.5	0.001
• **Present**	0	0.0	6	14.6	3	37.5	
Infective complications/Sepsis							
• **Absent**	48	94.1	35	85.4	5	62.5	0.030
• **Present**	3	5.9	6	14.6	3	37.5	
Extrarenal migration of stone fragments							
• **Absent**	48	94.1	38	92.7	8	100.0	0.727
• **Present**	3	5.9	3	7.3	0	0.0	
Nephrostomy leakage							
• **Absent**	30	58.8	27	65.9	6	75.0	0.601
• **Present**	21	41.2	14	34.1	2	25.0	
Persistent urinary fistula							
• **Absent**	51	100.0	41	100.0	8	100.0	-
• **Present**	0	0.0	0	0.0	0	0.0	
AV FISTULA/Pseudoaneurysm							
• **Absent**	51	100.0	41	100.0	8	100.0	-
• **Present**	0	0.0	0	0.0	0	0.0	
Gastrointestinal complications							
• **Absent**	51	100.0	41	100.0	8	100	-
• **Present**	0	0.0	0	0.0	0	0	

Maximum complications were seen in age group 31-40 years ($P < 0.05$).

Discussion

Currently, Percutaneous Nephrolithotomy (PCNL) has emerged as the established standard of care for treating calculi in the upper ureter and kidney. Over time, the technique has been refined and standardized, leading to improved outcomes worldwide. The procedure has been widely adopted and has proven to be effective in managing renal stones. In comparison to traditional open surgery, PCNL is linked to a lower incidence of complications. As a result, it reduces the risk of morbidity and allows for shorter hospital stays, making it the preferred treatment option.[6]

Nevertheless, it is important to note that PCNL procedures are not completely free of complications. While these complications have been mentioned in medical literature, their exact frequency or occurrence rates have not been well quantified. At our tertiary care center hospital, we perform an average of 20 PCNL surgeries per month. Given this scenario, we believe it would be valuable to study the profile of complications associated with PCNL. This information would enable us to implement appropriate measures aimed at reducing their incidence and ultimately improving the quality of healthcare provided.[7]

In our study, we aimed to investigate the outcomes and demographics of patients who underwent elective percutaneous nephrolithotomy (PCNL) surgery. A total of 100 patients were included in the study, and their characteristics were analyzed.In terms of age

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distribution, we found that the majority of patients (54%) belonged to the 40-60 years age group. This indicates that PCNL is a commonly performed procedure in middle-aged patients. These findings are consistent with the study conducted by Sahin A *et al.*[8], who also reported a significant proportion of patients in the same age range.

Complications observed in our study at different site, majority of patients (50%) suffered from fever who had stone at pelvic ureter junction, followed by 45.2%, 27.8% and 38.5% had stone at pelvis, upper ureter and calyx respectively. Leakage at nephrostomy was reported in 41.7% having upper ureteric calculi, 37.5% having calculi at PUJ, 37.2% having calculi in pelvis and 23.1% having calculi in calyx. Bleeding was noticed in 38.5% having calculi in calyx, 16.3% having calculi at pelvis and 37.5% with upper ureter calculi and 11.1% with upper ureteric calculi. Some complications like extra renal migration of stone fragments and residual stones were not seen in patients having stone in calyx. Migration of stone fragments was seen in 2.3% with calculi in pelvis, 25% having calculi at PUJ and 8.3% having upper ureteric calculi. Residual stone was seen in 11.6% having calculi in pelvis and 12.5% having calculi at PUJ. Sepsis /infection was noticed in 16.3% having calculi in pelvis, 25% having calculi at PUJ and 8.3% having upper ureteric calculi. Complications during stone removal was noticed in 7.7% patient having calculi in calyx, 14% patient having calculi in pelvis, 25% patient having calculi at PUJ. Some complications like urinary fistula, AV Fistula/ pseudoaneurysm and Gastrointestinal complications were not seen in any of the patients.

These findings align with similar studies by Roth RA *et al.*[9], Lee WJ *et al.*[10]and Patterson DE *et al.*[11], which also highlight hemorrhage as the most frequent complication of this procedure. Reddy SV *et al.*[12], emphasized the importance of accurate reporting of complications in surgery, specifically in the context of percutaneous nephrolithotomy (PCNL). They highlighted that accurate and standardized reporting is crucial for critical appraisal and promoting innovation in surgical practices.

Conclusion

Mean size of the stone taken is 20.59±6mm. Most of the Complications were common in patients who had larger calculi. Patients with stone size of 31-40 mm, 62.5% had fever 37.5% had bleeding 25% had residual stones 37.5% had complications related to stone removal and 37.5% had sepsis/infective complications. Prevalance of Nephrostomy leakage (41.2%)was highest in patients with stone size 10-20mm. Extra renal migration of stone fragments were most common in patient(7.3%)who had stone size21-30mm.

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