

Original Research Article

## Complications of Ultrasound Guided Percutaneous Nephrostomy-A Hospital based study

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**Abstract:** The objective is to estimate the frequency of complications in Ultrasound guided percutaneous nephrostomy and to identify frequent sources of error. The study was carried out in Department of Urology, in a tertiary care hospital. Patients who required ultrasound guided (USG) percutaneous nephrostomy (PCN) for any indication from August 2015 to June 2017, of all age groups between 14 and 80 years were included. Six month follow-up was performed. SPSS 12 was used for statistical analysis. One hundred patients were included in the study. USG guided PCN was done. The complications were categorized as early and late complications. Early complications were sepsis in 3 (3%) patients, retroperitoneal hematoma in 2 (2%) patients, bleeding requiring transfusion in 2 (2%) and urinoma in 1 (1%). Late complications included catheter blockage in 7 (7%) patients, and dislodgement of catheter in 15 (15%), ureteric stricture in 1 (1%) and retained tip of catheter in 1 (1%). Total early complications were noted in 9 (9%) patients, and there were 23 (23%) late complications. Percutaneous nephrostomy is a safe and simple procedure to deal with obstructive uropathy and other conditions requiring temporary urinary diversion. The procedure has low morbidity without major life threatening complications.

**Keywords:** Percutaneous nephrostomy, Obstructive uropathy, Hydronephrosis, Pyonephrosis, Retained PCN catheter.

### INTRODUCTION

Access to the kidney by percutaneous nephrostomy (PCN) has largely replaced the decreasing and less popular open technique. In 1955, Goodwin introduced a technique for draining obstructed hydronephrosis percutaneously with a needle and 10 years later Bartley introduced long-term percutaneous drainage of the pelvis using a modified Seldinger technique [1]. In 1974, the first ultrasound-guided percutaneous nephrostomy (PCN) was reported [2]. Ultrasound-guided nephrostomy is now a well-established interventional procedure for diverting urine from the renal collecting system, in ureteric obstruction, or as a prelude to interventional procedures such as percutaneous stone extraction, endoscopy, or stent placement. Obstructive uropathy is defined as a condition occurring due to blockage of urine flow, resulting in increased pressure within the collecting

system and destruction of the parenchyma of the kidney, in which there is loss of renal function. Once the diagnosis is suspected, treatment is to decompress the Pelvicalyceal system. Currently available surgical drainage methods include operative nephrostomy, retrograde stenting and percutaneous nephrostomy (PCN) [3]. PCN decompression has been shown to be valuable in improving renal function and survival [4]. PCN is also useful when the determination of functional reserve capacity of an obstructed kidney is uncertain in benign conditions like severe pelvi-ureteric junction (PUJ) obstruction or primary mega-ureter. PCN alone is usually sufficient to allow small post-surgical leaks to heal.

Open nephrostomy cannot be done in a critically ill patient as general anesthesia is needed, which they cannot tolerate because of associated several

electrolyte imbalances, hyperglycemia, sepsis, cardiac and pulmonary diseases. But despite all of these comorbidities, PCN can be performed as initial life-saving procedure as it only requires local anesthesia and is minimally invasive. With the realization that needles and catheters could be safely and quickly used on the kidney, the method of PCN became the window into the organ for a variety of interventional uro-radiological and endo-urological procedures [5]. PCN has significantly reduced the morbidity and mortality rates, with high success rate in adults and pediatric cases. Nevertheless, significant complications may occur even after minimally invasive procedure. The present study was designed to assess the frequency of complications in image-guided percutaneous nephrostomies, and to identify common sources of error.

**MATERIAL AND METHODS**

The prospective study was carried out at the Department of urology, in a tertiary care hospital, with 100 patients attending to urology department from August 2015 to July 2017. These patients required USG guided percutaneous nephrostomy to relieve obstructive uropathy, quantify renal function in PUJ obstruction with equivocal DTPA renogram or to treat urinary tract fistulas or leaks. Patients with Uncorrected coagulopathy were excluded from study.

Obstructive uropathy due to various causes were diagnosed by imaging modalities like ultrasound, computed tomography (CT) scan, plain and contrast studies. All PCNs were performed by trained urologists and six-month follow-up was done. All procedures were done by seldinger technique were an initial puncture of

desired dilated calyx was done by 18 G puncture needle under USG guidance. The 0.032 PTFE j-tip guide wire was placed and tract dilated serially by 8, 10 and 12 Fr Teflon dilators. Pigtail catheter was introduced over the guide wire and secured. Early complications were defined as those noted immediately or within 24 hours of the procedure, including bleeding, infection, retroperitoneal hematoma, extravasations and urinoma, perforation of adjacent viscera like colon, hydrothorax and pneumothorax. Late complications were defined as those noted after 24 hours or later in follow-up, including blockage of catheter, catheter dislodgement, arteriovenous (AV) fistula, pseudo-aneurysm and ureteric stricture. Post-procedure follow-up was done up to six-months, using ultrasound as the basic tool. Antegrade pyelogram, CT scan, and colour Doppler ultrasound were used as secondary tools. Proforma encompassed variables such as procedures, early and late complications along with post-procedure follow-up. The data was entered and analysed on SPSS version 12. Mean  $\pm$  Standard deviation was calculated for the age of the patients. Frequencies and percentages were calculated for early and late complications. Chi-square test was applied for proportion of complications within the group divided on the bases of age and gender. P-values less than 0.05 were considered significant.

**RESULTS**

The 100 patients in the study represented all age groups between 14 and 80 years. The mean age was 41 $\pm$ 16.9 years. There were 63 (63%) male and 37 (37%) female patients. The demographic profile of patients is shown in table 1.

**Table-1:Demographic profile of patients**

Variable	Number of Patients
Age (Year) (Range)	41.5 $\pm$ 16.9(14-80)
<b>Sex</b>	
Male	63
Female	37
<b>Side</b>	
Left	62
Right	38
Bilateral	5

The most common etiology was obstructive uropathy due to stone diseases in 35 (35%) patients. Patients with malignancy made up the second largest group with 29 (29%) patients. Malignancy included carcinoma of the urinary bladder (30%), carcinoma of cervix (45%), prostate cancer (12%), rectal and colonic

malignancy (7%), abdominal lymphoma and retroperitoneal tumors (6%). PCN was also performed in 3 (3%) transplanted kidneys. The list of indications is shown in table 2. The rate of technical success was 95%.

**Table 2: Indications for PCN**

Indication for PCN	No. of patients (n=100)
Obstructing ureteric stone	35
Unknown cause of ureteral obstruction	7
Benign ureteric stricture	5
Postoperative leaking anastomose	1
Ureteric obstruction in pregnancy	1
Pyonephrosis	22
Obstruction due to malignancy	29

Majority of the patients (n=62, 62%) were inpatients mostly admitted through emergency and 38 (38%) were outpatients. Only ultrasound was used in all 100 (100%) patients, all procedures were done under

local anesthesia. Post-PCN complications were divided into early and late complications. The complications are listed in table 3.

**Table 3: Post-PCN complications**

Complications	Number of patients	Percentage of patients
Sepsis	3	3%
Retroperitoneal hematoma	2	2%
Bleeding requiring transfusion	2	2%
Urinoma	1	1%
Catheter blockage	7	7%
Dislodgement of catheter	15	15%
Retained tip of catheter	1	1%
Ureteric stricture	1	1%

Early complications were noted in 8 (8%) patients, while late complications were seen in 24 (24%). Early complications comprised sepsis 3 (3%), retroperitoneal hematoma 2 (2%), hematuria requiring blood transfusion 2 (2%), and urinoma 1 (1%). Complications such as perforation of adjacent viscera and pneumothorax were not observed. Late complications comprised of catheter blockage (7 [7%]), and dislodgement of catheter (15[15 %]). Other complications were retained tip of catheter in one patient and ureteric stricture in another patient. Complications such as AV fistula, pseudo-aneurysm were not seen. The difference of early complications between males and females was insignificant ( $p > 0.5$ ). There was no substantial difference in late complications between the two groups ( $p < 0.5$ ).

Complications were thoroughly analysed to identify sources of error. Of the 3(3%) patients with post-procedure sepsis, 2 (2%) already had pyonephrosis that despite of giving IV antibiotics aggravated. One 1(1%) patient had purulent urine on initial puncture but didn't had clinical signs of sepsis before procedure. Out of the 4 (4%) patients having bleeding (retroperitoneal

hematoma 2 [2%] and hematuria 2 [2%]), 2 (2%) patients were in uremic state at the time of PCN; 1 (1%) was having diabetes mellitus and cardiac disease and 1(1%) had chronic liver disease. In all these patients, bleeding was settled with blood transfusion and prolonged tube drainage. Thus comorbidities like diabetes mellitus, cardiac disease, deranged clotting mechanism along with technical factors like, difficulty to identify renal calyx, multiple passes of needle, excessive manipulation during PCN tract dilation and tube adjustment were identified as sources of error in early complication. The late complications were predominantly minor complications related to the catheter. Most of the catheter blockages had pyonephrosis; however 2 (2%) patients had encrustation. Catheter dislodgement was reported in 15 (15%) patients; most of them were either of old age males or females who got catheters accidentally pulled. One patient had retained fragment of PCN catheter. He had underlying horseshoe kidney with pyonephrosis. When the catheter was pulled it fragmented. Infection and prolonged duration for which it remains in the infected system were supposed to be the cause. One patient had ureteric stricture due to direct placement of

PCN into the ureter. It was a pyonephrotic nonfunctional kidney. Patient underwent nephrectomy later. All complications including sepsis, hemorrhage requiring transfusion and urinoma were managed conservatively. Catheter related complications were managed by replacing catheter or doing new PCN.

## DISCUSSION

Because of better imaging modalities, PCN has largely replaced the surgical nephrostomy. PCN can safely be performed in low-risk patients as an outpatient procedure with same-day discharge [6]. PCN is indicated for the preservation of renal function, relief of pain and in most extreme circumstances, drainage of pyonephrosis. In the current study, the technical success rate was 95%. In the literature, the success rate is reported from 84% to 100% [7]. In a retrospective study of 569 radiologically-guided PCN, the success rate was 98% [8]. There were 22 (4%) major complications, including cardiac arrest, bleeding requiring transfusion or embolisation, septicaemia, hydrothorax or pneumothorax. There were 38% minor complications, including urinary tract infection, catheter dislodgement, and catheter obstruction by debris, urinary leakage, and inflammation of the skin at the site of insertion of the percutaneous catheter. Besides, 79 (14%) catheters slipped out unintentionally. In our study, we did 100 PCNs and had 9 (9%) major complications and 23 (23%) minor complications. Complications like cardiac arrest, hydrothorax or pneumothorax did not occur.

A review of radiologically-guided percutaneous nephrostomies in 303 patients reported technical success to be 99%. Overall complication rate was 6.5%, including haemorrhage requiring transfusion (2.8%) [9]. In our study the success rate was 96% and the frequency of haemorrhage 4%. But overall, complication rate was (32%), almost five times. This was because in our study most of complications are minor one and among them is the dislodgement of PCN tube (15%) and that was predominantly in elderly males and females who pulled out PCN accidentally. The Society of Interventional Radiology Quality Improvement (SIR QI) guidelines has reported success rate of 85%-98%, depending upon clinical scenario. The suggested thresholds of major complications of PCN, including septic shock at 4%, septic shock in setting of pyonephrosis at 10%, hemorrhage requiring transfusion at 4%, vascular injury requiring embolisation or nephrectomy at 1%, bowel injury at <1% and pleural complications (pneumothorax, empyema, haemothorax etc.) at 1%. The complication rate is approximately 10% for major and minor complications together and 4-5% for major complications only [10]. The 32%

complication rate in our study appears higher, but the incidence of major complications in our study was 9%, which is twice that of previous studies quoted. Two of our complications were different from the others. One of them is ureteric stricture due to faulty placement of PCN in ureter and other was retained fragment of PCN catheter. In the first case the length of stricture was estimated by simultaneous RGP and nephrostogram. Since the kidney was non-salvageable as on creatinine clearance, so nephrectomy was done. In another patient where the tip of the PCN catheter fragmented and retained, we localized the fragment by C-arm guidance and placed the guide wire around the foreign body. On exploration guide wire was followed till the foreign body and was removed.

## CONCLUSION

PCN is relatively simple and minimally invasive procedure and has great clinical value without significant complications. It is an excellent technique for upper urinary obstruction due to its efficacy, ease of insertion and satisfactory result. No deaths or significant morbidity resulted from the complications. It is a minimally invasive technique which necessitates only the use of local anaesthesia.

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