

## Ultrasound Guided Percutaneous Nephrostomy, Feasibility in Lateral Position

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### ABSTRACT

**Background:** ultrasound guided percutaneous nephrostomy was reported in various positions to different indications. **Objectives:** this study was conducted to determine the feasibility of Percutaneous Nephrostomy (PCN) in lateral position.

**Patients and methods:** this study was conducted during the period from March 2018 to November 2018. Fifty patients with urinary tract obstruction who were candidate for percutaneous nephrostomy at El-Hussein and Bab El-sharia hospitals were enrolled in the present study. **Results:** out of 50 patients who underwent percutaneous nephrostomy in lateral position (56%) were males, 44% were females. Success rate for fixation of PCN was 90%. Total number of patients with marked hydro nephrosis before the procedure represented 58% of total patients and 42% with moderate hydro nephrosis. Complication of technique : no complication represented 80% ,minor complications were 20%,9% showed transient hematuria, single patient with pain 2.2%, 4.4% showed catheter related complications, 4.4% showed Inflammation of skin at the side of the wound. Cause of obstruction, pregnant females were 10%, PUJ causes were 18%, ureteric causes were 46%, urinary bladder mass was 14%, single case was emphysematous pyelonephritis, others were 10%.

**Conclusion:** ultrasound guided percutaneous nephrostomy in lateral position is feasible and equal to standard technique but recommend PCN in lateral position in, pregnant female, obese patients, ascetic patients and patient with special difficulties in breathing.

**Keywords:** ultrasound, percutaneous nephrostomy, lateral position.

### INTRODUCTION

(PCN) Percutaneous nephrostomy is a passageway that is introduced percutaneously into the renal pelvicalyces that can later be maintained by a tube, stent or catheter <sup>[1]</sup>. Following its introduction by Wickbom in 1954 who described percutaneous puncture of the renal pelvis as a diagnostic procedure, Goodwin and Casey first described its therapeutic use for relief of urinary tract obstruction the following year in 1955 <sup>[2]</sup>. **Mahmood *et al.*** stated that its good safety profile, percutaneous nephrostomy is the preferred technique for treatment of various urological conditions and its pioneering role for relief of urinary tract obstruction remains in good use until today <sup>[3]</sup>.

They added that PCN has traditionally been performed with the patient in the prone position, probably to reduce the risk of injury to adjacent visceral organs, particularly the colon. The prone position, however, is associated with disadvantages such as patient discomfort and circulatory and ventilatory difficulties, particularly in obese patients <sup>[4]</sup>.

**Gofrit *et al.*** described a technique of percutaneous nephrostomy with the patient in the lateral position using local anesthesia and ultrasound-guided puncture is usually performed with the patient in the prone position. Morbid obese patients do not tolerate this position

well and may suffer from ventilator and cardiovascular compromise as a result of increased intra-abdominal pressure. Patients with severe kyphosis cannot be placed in the prone position.

We present patients suffering from either morbid obesity, ascites and pregnant female who underwent PCN successfully in the lateral decubitus position <sup>[5]</sup>.

### PATIENTS and METHODS

This study was performed in Urology Outpatient Clinics of Al-Azhar University Hospitals at El-Hussein and Bab El-sharia Hospitals who were candidate for percutaneous urinary diversion in cases of urinary tract obstruction, which may be secondary to intrinsic or extrinsic ureteral obstruction during the period from March 2018 to November 2018. This was a prospective interventional non control study.

**The study was approved by the Ethics Board of Al-Azhar University.**

**Exclusion criteria:** patients with uncorrectable bleeding disorders and patients with known renal vascular malformations or arterial aneurysm uncooperative patient.

**Pre procedure assessment:** after detailed medical, surgical history and complete

general examination calculation of BMI, abdominal girth urine analysis, blood chemistry tests included: blood urea, serum creatinine and coagulation profile, Complete Blood Count (CBC) (Pre and post-operative) urinary tract imaging by pelvi-abdominal ultrasonography, once patient candidates for percutaneous urinary diversion patients was informed and consented about the study and patients have been given a prophylactic antibiotic.

**The procedure:**

- a-The patient was positioned in the lateral decubitus position.
- b-A supporting pillow was put under the flank on the opposite side of the patient.
- c-The target kidney was reimaged and reassessed by ultrasonography. The used ultrasound is B-K medical 2102Hawk at El Hussein Hospital and Affiniti 50G at Bab El Sharea Hospital.
- d-The target renal calyx was identified and a planned approach should be clearly delineated.
- e-The puncture site was identified and marked at this stage of the procedure. The target renal calyx’s position relative to the diaphragm during respiration was observed, and ideally, a subcostal approach targeting Brodel’s line should be utilized.
- f-Patient cleaning and rapping using sterile methods.
- g-Puncture site infiltration anesthesia using 1% the xylocaine.
- h-General anesthesia is used in child cases h-the operator asked the patient to hold a breath while

a puncture needle is used to puncture the skin, then advanced posteroanteriorly at an angle towards the intended calyx.

- i-Amecath pigtail percutaneous nephrostomy set was used sizes at 8 and 10,12 fr total number of 12 fr tubes was 30 patients,18 patients with fixed 10 fr and lastly two case used 8 fr.
- j-A 0.018 or 0.038- inch guide wire was then passed through the needle to enter the renal pelvis and placed as distally into the ureter as possible to stabilize the tract.
- k-Over the guide wire, the tract was dilated to an appropriate size with a dilator assembly to later receive nephrostomy catheters.
- l-Dilatation is done by Teflon dilators, or metallic alkane dilators Teflon dilatoers size 8,10,12,14,16 fr
- m-The nephrostomy catheter was then inserted over the guide wire. n-Once adequately placed, the catheter was secured externally with tention sutures.

**RESULTS**

**1- Demographic data**

Fifty patients had been recruited in the present study, 28 were males (56%) and 22 were females (44%). The 22 female patients included 5 pregnant women (10%).The mean age of studied patients was 49.25 ± 18.3 years with a range of 4.5 – 75 years. Eleven patients (22%) were diabetic while, the remaining thirty nine (78%) were non diabetic. The BMI of studied patients ranged between 20.3 – 42.3 with a mean ± SD of 27.1 ±4.7

**Table 1- BMI in the studied patients**

Description	Number of Patients	Percentage %	Range
Normal weight	22	44 %	18.5 – 25
Over Wight	17	34 %	25-30
Obese	10	20 %	30 -40
morbid obese	1	2 %	>40
Total	50	100	

Ten patients (20%) were obese, morbid obesity was recorded in only one patient (2%), twenty two patients (44%) had normal weight, while seventeen patients (34%) had over Wight (**Table 1**). Twenty out of the 50 studied patients (40%) had presented with high temperature (>38c°) before the procedure.

## 2- Preoperative Assessment

### A. Clinical Diagnosis

Seventy percent of the studied patients (35 patients) had presented with pyonephrosis, twenty two patients (44%) presented with picture of pyonephrosis and normal renal function, five patients (10%) with elevated serum creatinine in addition to the pyonephrosis, while eight patients (16%) had oliguria with impaired renal function and pyonephrosis.

Fifteen patients (30%) were presented with infected hydronephrotic pictures either alone in five patients (10%), two of them with single kidney and the remaining three patients had single functioning kidney

The hydro nephrosis was associated with elevated serum creatinine in eight patients (16%), while two patients (4%) presented with oliguria, impaired renal functions and hydro nephrosis.

**Table 2-** Indications for PCN

Diagnosis	Number of Patients	Percentage %
Pyonephrosis	35	70 %
a- With normal renal function.	22	44%
b- + impaired renal function.	5	10%
c- + impaired renal function + oliguria	8	16 %
Hydro nephrosis	15	30 %
a- With normal renal function.	5	10 %
b- + impaired renal function.	8	16 %
c- + impaired renal function + oliguria.	2	4 %
Total	50	100 %

### 3- Operative data

Operative time: the mean operative time for the procedure was  $24.62 \pm 3.624$  minutes with a range of 15 - 31 minutes.

Ultrasonography guided PCN insertion in lateral decubitus position among our studied group of patient was successful in 45 cases (90%), while we had failed to complete the procedure successfully in 5 patients (10%) (**Table 3**). One of these 5 patients had poor visualization of the right kidney in lateral position and puncture line was difficult due to presence of hepatomegaly. The guide wire had been kinked during the track dilation in 2 cases leading to abortion of the procedure.

For the remaining two patients the procedure failed due to ultrasound machine dysfunction.

**Table 3-** Success rate of PCN in the lateral position.

Description	Number of patients	Percentage %
Successful	45	90
Failed	5	10
Total	50	100

The procedure was successful from the first puncture in 15 (30%) of cases, while the multiple punctures were necessary in the remaining, 30 patients (60%) (**Table 4**).

**Table 4-** Number of puncture trial for PCN

Number of trials	Number of patients	Percentage %
Single trial	15	30
Multiple trial	30	60
Failed puncture	5	10
Total	50	100

o **Intra –operative complication:**

Intraoperative complications were recorded in the present study.

**4- Outcome of PCN**
**a) Laboratory parameters**
**Table 5- Change in the laboratory data**

Variables		Preoperative mean $\pm$ SD	Postoperative mean $\pm$ SD	P-value
CBC	Hb	10.00 $\pm$ 1.58	10.39 $\pm$ 1.31	0.2
	WBCs	13.54 $\pm$ 2.64	8.80 $\pm$ 1.44	<b>0.008**</b>
KFTs	Creat	4.00 $\pm$ 1.0	2.00 $\pm$ 0.20	<b>&lt; 0.001*</b>
	Urea	86.12 $\pm$ 4.13	49.70 $\pm$ 2.81	<b>&lt; 0.001*</b>
ABG	Ph	7.36 $\pm$ 0.07	7.38 $\pm$ 0.04	0.06
	HCO <sub>3</sub>	18.31 $\pm$ 3.33	20.56 $\pm$ 2.07	<b>&lt; 0.001*</b>
	K	4.32 $\pm$ 1.06	3.76 $\pm$ 0.76	<b>0.003**</b>

\*: p-value < 0.001 was considered highly significant

\*\* : p-value < 0.05 was considered significant

**Table 5** showed that there was a significant statistical difference between the pre and post procedure laboratory results, among the studied patients regarding improvement in the renal function, blood gases and leukocytosis.

**B-Descending nephrostogram**
**Table 6- Causes of obstructive uropathy**

Description	Number of patients	Percentage %
PUJ stone	3	6
PUJ Obstruction	6	12
stone at the upper ureter	4	8
stone at the lower ureter	11	22
stricture at the lower ureter	4	8
stricture at the upper ureter	3	6
Urinary Bladder mass	7	14
Ureteric mass	2	4
emphysematous pyelonephritis	2	4
Others	3	6
Total	45	90

Descending nephrostogram performed 2 weeks after the PCN among the studied patients, except pregnant women, revealed the cause of obstruction as following: Ureteric stones in 15 patients (30%), PUJ stones in 3 patients (6%), PUJ obstruction in 6 patients (12%), stricture ureter in 7 patients (14%), urinary bladder mass in 7 patients (14%), ureteric mass in 2 patients (4%) and the

remaining 3 patients, had metastatic cancer cervix in one and the second patient had cancer head of pancreas causing extramural ureteric obstruction while the third patient had history of hemicolectomy and radiotherapy for cancer colon with enlarged

lymph node compressing the right ureter, two cases were diagnosed as emphysematous pyelonephritis.

### Complication of the technique

The procedure was completed without complications for 36 patients (80%), transient hematuria was demonstrated among 4 patients (9%) which had been resolved spontaneously, one patient

(2%) experienced sever loin pain that necessitated narcotic analgesic.

Two patients (4.4%) had catheter related complications in the form of obstruction (2 cases), and slippage in a single patient. Two patients (4.4%) had wound infection. No patients had neither abdominal visceral injury, nor lung or plural injury (**Table 7**).

**Table 7-** Complications of PCN in the study group

Description	Number of patients	Percentage %
No complication	36	80%
Transient Hematuria	4	9%
Pain	1	2.2%
Catheter related complication	2	4.4%
Wound infection	2	4.4%
Total	45	100%

## DISCUSSION

First described in 1955 by **Goodwin *et al.*** as a minimally invasive treatment for urinary obstruction causing marked hydro nephrosis, percutaneous nephrostomy (PCN) placement quickly found use in a wide variety of clinical indications in both dilated and non-dilated systems, and PCNs still play an important role in the treatment of multiple urologic conditions <sup>[6]</sup>. Prompt drainage is indicated for obstructive uropathy if renal function is damaged, or obstruction is accompanied by acute infection, especially pyonephrosis. PCN catheters are preferred treatment of choice. In the published literatures, most of studies announced that PCN which had a higher success rate, lower failure rate, less complication, shorter period of administration of antibiotics and better quality of life <sup>[7-10]</sup>. In our study, USG pc was usually performed while the patient was in prone as standard position. Sometimes the patient can't tolerate the prone position and supine position is preferred alternatively it has also some limitations. We studied the feasibility and safety of USG PCN insertion, while patient in the lateral decubitus position, they were fifty patients, 28 (56%) of them were male and 22 (44%) were female. **Karim *et al.*** studied 126 patients for whom PCN was attempted in slandered prone position where the male patient comprised 72(57%) and female patient were 54 (43%) <sup>[11]</sup>. The mean age of the studied group patients 49.25 ± 18.1 years which similar to the age of the

group of patients studied by **Karim *et al.*** (47years) <sup>[11]</sup> and **Basiri *et al.*** (47.13 ±24.31 years) <sup>[12]</sup>. The MBI of the present study patients was 27.1 ± 4.7 which is comparable to those of **Cui *et al.*** (24.17 ±8.85) <sup>[13]</sup> and **Lodh *et al.*** (24.17±4.68) <sup>[14]</sup>. In the present study 11 patients (22%) were diabetic, prevalence of diabetes in adults was 15.1% according to the International Diabetes Federation (IDF) of Middle East and North Africa (MENA). Seventy percent of our studied patients had presented with pyonephrosis while, in the other studies the incidence of pyonephrosis as an indication for PCN was 27.88% **Lodh *et al.*** <sup>[14]</sup>. In the present study, thirty percent of our patients presented with hydro nephrosis were either infected HN with normal renal function (10%), with impaired renal function (16%) or associated with oliguria in (4%). **Pedersen *et al.*** reported that eight patients (29%) with hydro nephrosis with impaired renal function and three patients (12.5%) with infected hydro nephrosis <sup>[15]</sup>. **Lee *et al.*** reported that oliguric state in 18 patients (11%) <sup>[16]</sup>. The cause of obstructive uropathy necessitated PCN placement among our group of patients including benign cause in (74%) of patients and malignant cause among the remaining (26%) of studied group. The calcular obstructive uropathy was encountered in 36% of our patients in comparison to 40.64% of the group of **Radecka and Magnusson** <sup>[17]</sup>. PUJO comprised 12% of the cause of obstructive uropathy in the present study which is similar to the incidence of **Karim *et al.*** (11.9%) <sup>[11]</sup>. The incidence

of stricture ureter among our series is 14%, which is higher than that mentioned by **Radecka and Magnusson** which was 9.9%.<sup>[17]</sup> Pregnancy cause obstructive uropathy in 5 female patients (10%) in the present study while, the incidence of ureteric obstruction in pregnancy in another studies it was 0.748%, 3.1 and 33% in **Radecka and Magnusson**<sup>[17]</sup>, **Efesoy et al.**<sup>[18]</sup> and **Epelboym et al.**<sup>[19]</sup> respectively. Malignant causes were 26%, urologic cause were 20%, bladder mass was reported in 14% of cases in other study and carcinoma urinary bladder was 23.01%<sup>[11]</sup>. Ureteric mass was found in 4% of patients, prostatic adenocarcinoma single case 2% in other study prostate cancer was 12.2%<sup>[18]</sup>. Non urological cause was 6%, cancer cervix single case (2%), cervical cancer was 16.1%<sup>[18]</sup> which illustrated by large sample size and long time of study, cancer head of pancreas and malignant ascites in single case(2%),cancer colon in single case which underwent hemicolectomy followed by radiation therapy(2%),The obstruction was due to advanced malignancies in 65 (52%) regardless the type of malignancy either urological or non-urological<sup>[11]</sup>.

The procedure complete successfully for 45 patients(90%) with a success rate comparable to that mentioned in the literature for standard PCN in prone position which ranges between (84-99%)<sup>[1,20, 21]</sup>.

**Dagli and Ramchandani** reported complication in 10 % of their series,<sup>[6]</sup> and **Dyer et al.**<sup>[22, 23]</sup>, had found that the incidence of minor complication ranges between 15-25% of their studied group of patients<sup>[22, 23]</sup>.In the present study no major complication were encountered among the studied patient ,while 9 patients (20%) had minor complication, four patients(9%) developed transient hematuria, which is similar to that incidence reported by **Karim et al.**, additionally in our study, a severe loin pain had been experienced by only one patient (2.2%), **the same authors** had found that the incidence of loin pain among their group of present patient was (86%)<sup>[11]</sup>.

Catheter related complication observed in two patients (4.4%) in the present study. The incidence of the catheter related complication with PCN recorded 17.1%, 19% and 3.9% in **Ozden et al.**, **Karim et al.** and **Lodh et al.** studies<sup>[11, 14,24]</sup> respectively. Two patients (4.4%) in the present study had skin inflammation at the site of nephrostomy puncture. This incidence is higher than that mentioned by **Lodh et al.**<sup>[14]</sup> series was 0.56% which may attributed to poor hygiene of the long time fixed nephrostomy tube among our group of patients.

The renal function had been improved in 11 patients (22%) in the present study after PCN placement, and the mean of serum creatinine  $2.00 \pm 1.2$  mg/dl, This incidence is similar to that reported by **Naeem et al.**<sup>[25]</sup> which was 69 patients (88%) with mean of serum creatinine  $1.49 \pm 0.5$  mg/dl.

The mean TLC count before the procedure was 14,700/cu mm which decreased to 8,100/cu mm within three days after the procedure and with parental antibiotics<sup>[26]</sup>. As regard WBCs, the mean WBCs of studied patients was  $13.5 \pm 4.6$  with minimum WBCs of 4.3 and maximum WBCs of 26.3 (range 4.3 – 26). Normal ratio of WBCs in CBC is between 4-11 $\times$ 1000/cu mm, number of patient in our study more than 11000/cu mm was 32 patients before PCN insertion. The mean TLC count before the procedure was 14,700/cu mm which decreased to 8,100/cu mm within 72 hrs after the procedure and with parental antibiotics<sup>[26]</sup>. Total number of patients were with WBCs more than 11000 /cu mm after PCN insertion was three patient only, TLC post operative WBCs ranges from (4.1-8.6) and mean 8.800/cu mm.

The rate of UTI dropped from 70%, 35 patients pre-procedure to 26% 13 patients post nephrostomy fixation demonstrating great important among the studied group of patient in the present study this results is similar to **Naeem et al.** which was 73 patients (93.58%) pre procedure and (25.6%) 20 patients<sup>[25]</sup>. Highly statistical significant difference (p-value < 0.001) between creatinine (pre and post) in our studied patients with a statistically significant difference (p-value < 0.05) between WBCs.

## CONCLUSION

We concluded that PCN in lateral position had the same efficacy and feasibility of other reported techniques.

## RECOMMENDATIONS

PCN in lateral position has a high success rate and low complication rate and it could be recommended for patients who can't tolerate the prone position either due to respiratory or cardiac problems in addition to the pregnant women or those patients with ascites.

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