

Original Article

Ultrasound Guided Percutaneous Nephrostomy: Experience at Ahmadu Bello University Teaching Hospital, Zaria

M Ahmed, AT Lawal, A Bello, A Sudi, M Awaisu, S Muhammad, N Oyelowo, M Tolani, BK Hamza, HY Maitama

Department of Surgery,
Division of Urology,
Ahmadu Bello University,
Ahmadu Bello University
Teaching Hospital, Zaria,
Kaduna State, Nigeria

ABSTRACT

Background: Obstructive uropathy is a common problem in urologic practice; temporary relief of obstruction in the upper tract poses a significant challenge. Ultrasound-guided percutaneous nephrostomy (PCN) is an option for upper tract drainage; compared to fluoroscopic guidance, it is readily available, affordable, and not associated with radiation exposure. We present our experience with ultrasound-guided PCN. **Patients and Methods:** We studied all patients who had ultrasound-guided PCN in our center between January 2013 and January 2017. Information obtained included the patients' demographics, clinical details, primary pathology, indications, outcome, and complications within 30 days. Relevant data were extracted and analyzed using descriptive statistics. **Results:** A total number of 35 PCNs were performed in 26 patients within the period of study. The median age was 44.5 years. There were 17 females and 9 males. About 88.2% of the females had ureteric obstruction from advanced carcinoma of the cervix while the predominant cause of obstruction in the males was advanced carcinoma of the bladder. Kidney access under ultrasound guidance required well dilated collecting systems for success and ease of puncture. The most common complication was hematuria, which resolved within 24–48 h in all patients uneventfully. **Conclusion:** PCN is an important and common procedure for temporary relief of upper urinary tract obstruction. While fluoroscopic guidance provides superior image guidance, ultrasound guidance is comparatively reliable, albeit with a longer learning curve. Adequate training, careful patients selection, and patience are key to success.

KEYWORDS: *Experience, obstructive uropathy, percutaneous nephrostomy, ultrasound guidance*

Date of Acceptance:
06-Nov-2017

INTRODUCTION

Obstruction to the urinary tract is a common occurrence in urologic practice. Although commoner in the lower urinary tract, it can occur at any level. Often upper tract obstruction is a consequence of lower urinary tract pathology. Temporary relief of obstruction is relatively easy in the lower urinary tract, however, relief of obstruction in the upper tract possess a formidable challenge. Temporary relief of obstruction of the upper tract is commonly indicated in the event of an acute or chronic obstruction for which definitive treatment is not immediately feasible. This may be due to various reasons including; urosepsis, marked obstructive nephropathy, terminal/advanced malignancy, or a surgically unfit patient.^[1]

Percutaneous nephrostomy (PCN) is an established method of upper tract drainage; it was first described by Goodwin in 1955 and has since become routine practice.^[1] It has the advantages of being fast, can be done in the outpatient setting with minimal need for anesthesia and few complications. There are different methods of image guidance for PCN, which include; fluoroscopy, ultrasound, computed tomography, and

Address for correspondence: Dr. M Ahmed,
Department of Surgery, Division of Urology,
Ahmadu University, Ahmadu Bello University Teaching Hospital,
Zaria, Kaduna State, Nigeria.
E-mail: darm313@yahoo.com

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: Ahmed M, Lawal AT, Bello A, Sudi A, Awaisu M, Muhammad S, *et al.* Ultrasound guided percutaneous nephrostomy: Experience at ahmadu bello university teaching hospital, Zaria. *Niger J Clin Pract* 2017;20:1622-5.

Access this article online	
Quick Response Code:	Website: www.njcponline.com
	DOI: 10.4103/njcp.njcp_138_17

magnetic resonance imaging.^[2-4] Traditional image guidance for PCN is with fluoroscopy because it provides very good image guidance, kidney punctures can be accurately made with views from multiple angles, it facilitates excellent puncture needle and guide wire visibility and tract dilatation can be easily visualized.^[5,6] The use of fluoroscopy for image guidance is limited by certain inherent disadvantages, which include; the need for expensive equipment, thus, it is not readily available in resource-poor centers, the risk of radiation exposure to patient and operator, and the need for radiographic contrast.^[7] The advent of high-resolution ultrasound has slowly found use in image guidance for a number of interventional radiologic procedures including PCN.^[8,9] Ultrasound has the advantages of availability, affordability, absence of radiation exposure, PCN can be done as a bedside procedure, and it does not require radiographic contrast media. The major shortcomings of ultrasound in guidance for PCN include; poor needle and guide wire visualization, it only provides two-dimensional image, which makes kidney puncture difficult and it has a longer learning curve.^[8,10]

We report our experience with ultrasound-guided PCN at the urology unit of Ahmadu Bello University Teaching Hospital, Zaria.

PATIENTS AND METHODS

Study design

We studied all patients who had ultrasound-guided PCN in the outpatient unit of the division of urology of Ahmadu Bello University Teaching hospital from January 2013 to January 2017. All patients who presented or were referred to the urology unit and required PCN for temporary upper tract urinary diversion were enrolled. Patients with uncontrolled bleeding disorder were excluded from the study. Information of all consecutive patients who had ultrasound-guided PCN were recorded and the variables include the demographics, clinical details, primary pathology, indications, outcome, and complications within 30 days.

Procedure for percutaneous nephrostomy

Materials

The following materials were required for the PCN; a complete disposable PCN set, high resolution Ultrasound machine with a curvilinear ultrasound probe (3 MHz), Surgical gloves, local anesthetic (Xylocaine), sutures, basic surgical instruments, drapes, antiseptics, and gauze. An additional 14F Malecot or Lofric catheter may be required.

Procedure

All the procedures were done in the ultrasound room of our outpatient clinic. Two consultant urologists, who had been trained on PCN, assisted by urology residents,

performed all procedures. Patients were placed in prone position, strict asepsis was ensured and after routine cleaning and draping of patients with exposure of the desired loin, the kidney was visualized with the aid of the ultrasound. An appropriate puncture site was chosen and kidney puncture was made with size 18-G puncture needle [Figure 1], a flexible tip guide wire was passed into the renal pelvis and the tract dilated serially up to 14F with the plastic dilators contained in the nephrostomy pack. A self-retaining catheter (Malecot) was passed and further secured to skin with sutures as shown in Figure 2.

Data analysis

Data collected were analyzed with descriptive statistics, tables, and percentages.

RESULTS

A total number of 35 PCNs were done in 26 patients within the period of study. The median age was 44.5 years (range 4–65 years). There were 17 females and 9 males. 88.2% of the females had ureteric obstruction from advanced carcinoma of the cervix while the predominant cause of obstruction in the males was advanced carcinoma of the bladder, which accounted for 77.8 of the causes in males. Other details are shown in Table 1.

Two urologists, who were trained in the PCN, performed all the procedures. We used local anesthesia in all the patients, and there was no need for sedation or general anesthesia. Majority of the puncture attempts were successful however we recorded five failures in which the procedure had to be abandoned after prolonged and repeated punctures. The observed reasons for failures were; inadequately dilated pelvicalyceal system, technical difficulty, or termination of the procedure due to patient's discomfort or pain from failed multiple



Figure 1: Successful Percutaneous Ultrasound guided kidney puncture showing the ultrasound probe and puncture needle insitu and draining urine

Table 1: Summary of patients' demographic and clinical characteristics, primary pathologies, procedures, and complications

Variable	Value	Percentage
Sex		
Male	9	34.6
Female	17	65.4
Total	26	100
Age (years)		
Mean	42.8	
Median	44.5	
Range	4-65	
Pathology		
Carcinoma of the cervix	15	57.7
Carcinoma of the bladder	7	26.8
Intra-abdominal mass	2	7.7
PUV	1	3.9
Pyonephrosis	1	3.9
PCN		
Unilateral	17	48.6
Bilateral	18 (9×2)	51.4
Total	35	100
Outcome		
Successful	30	83.3
Failed	5	16.7
Total	35	100
Complications		
Hematuria	7	43.6
Infection	2	12.5
Catheter blockage	6	37.5
Catheter displacement	1	6.3
Total	16	100

PCN=Percutaneous nephrostomy; PUV=Posterior urethral valve

**Figure 2:** Shows Nephrostomy tube secured in place with sutures and connected to urine bag

puncture attempts, inadvertent entry into a segmental renal vessel with significant bleeding and restless or uncooperative patient. The commonest complication was hematuria, which all resolved within 24–48 h

uneventfully and without the need for transfusion. The overall complication rate was as shown in Table 1.

DISCUSSION

Obstructive uropathy constitutes a major workload in urologic practice and can affect all age groups and any part of the urinary tract. Although obstruction can occur anywhere along the urinary tract, lower urinary tract obstruction is particularly common in men due to pathologies of the prostate and urethra. There are many causes of upper urinary tract obstruction, however, most upper tract obstruction with significant impairment in renal function and often requiring temporary urinary diversion are secondary to lower urinary track pathologies.^[11]

The patients in this study were predominantly in their 5th or 6th decades of lives with a median age of 44.5 years, range 4–69 years. Majority of patients are usually beyond the fourth decade of life because it coincides with the period of onset of common causes of severe obstruction requiring temporary drainage, which are usually advanced pelvic (gynecologic and urologic) malignancies.^[7] Consequently, the common indications for nephrostomy observed in this study were advanced pelvic malignancies, which accounted for more than 92%. We observed that advanced carcinoma of the cervix was the predominant cause of obstruction in 88.2% of the female patients. Although other gynecologic malignancies can obstruct the urinary tract, carcinoma of the cervix happens to be the most common gynecologic malignancy in our environment^[12,13] and only second to breast cancer among all cancers. Among our male patients, the predominant cause of obstruction was carcinoma of the bladder occurring in 77.8% of the patients.

We encountered technical challenges and difficulties especially in the first few procedures done, which include multiple attempts at needle punctures to secure initial access and failed needle access leading to discontinuation of the procedure. However, these challenges were gradually overcome as more procedures were done. The poor needle visualization and the two-dimensional image inherent with the use of ultrasound were the main reasons for difficult or failed catheter placement. Some patient-related factors also contributed to these difficulties, which were; insufficiently dilated collecting systems, obese body habitus, and an uncooperative patient. This emphasizes the need for careful patients selection to improve success in catheter placement. PCN in patients with insufficiently dilated collecting systems is likely to be more successful under fluoroscopic guidance.

Complications following PCN are few and most are insignificant and self-limiting. We found hematuria to be the most common complication followed by catheter

blockage, stoma site infection, and catheter displacement. All cases of hematuria resolved uneventfully within 24–48 h and without the need for transfusion. Clot plug from hematuria was the cause of all recorded catheter blockage.

Recommendations for success

To improve success in ultrasound-guided PCN, there is a need for technical expertise and experience in the use of ultrasound, careful patients selection, avoiding patients with insufficiently dilated collecting systems, obese, and uncooperative patients. Other measures include; a good ultrasound machine with excellent image resolution, adequate local anesthetic infiltration, and patience on the part of the physician.

Improvisations

Although the nephrostomy kits are designed for one use, in our environment with high prevalence of poverty and the fact that health-care cost is borne majorly by out of pocket payments due to absent or inadequate health insurance, we are often compelled to reuse some of these kits either for the same patient or another patient after sterilization. In the case of patients who require bilateral PCN, a single kit can be used for both sides, and we improvise with Nelaton's catheter or size 10F NG tube in place of the nephrostomy tube.

If the kit is to be sterilized and reused, chemical sterilization is most appropriate, but it should be done just before the procedure. Soaking the set in chemicals overnight or for long periods of time significantly weakens the plastic dilators, and they become malleable and ineffective for fascial dilatation.

CONCLUSION

PCN is an important and common procedure for temporary relief of upper urinary tract obstruction. While fluoroscopic guidance provides superior image guidance, ultrasound guidance is comparatively reliable, albeit with a longer learning curve. Ultrasound also has the advantage of being cheap, readily available and radiation and radiocontrast free. Adequate training, careful patients selection, and patience are key to success.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Dagli M, Ramchandani P. Percutaneous nephrostomy: Technical aspects and indications. *Semin Intervent Radiol* 2011;28:424-37.
2. Zegel HG, Pollack HM, Banner MC, Goldberg BB, Arger PH, Mulhern C, *et al.* Percutaneous nephrostomy: Comparison of sonographic and fluoroscopic guidance. *AJR Am J Roentgenol* 1981;137:925-7.
3. Kariniemi J, Sequeiros RB, Ojala R, Tervonen O. MRI-guided percutaneous nephrostomy: A feasibility study. *Eur Radiol* 2009;19:1296-301.
4. Pedersen H, Juul N. Ultrasound-guided percutaneous nephrostomy in the treatment of advanced gynecologic malignancy. *Acta Obstet Gynecol Scand* 1988;67:199-201.
5. Farrell TA, Hicks ME. A review of radiologically guided percutaneous nephrostomies in 303 patients. *J Vasc Interv Radiol* 1997;8:769-74.
6. Rana AM, Zaidi Z, El-Khalid S. Single-center review of fluoroscopy-guided percutaneous nephrostomy performed by urologic surgeons. *J Endourol* 2007;21:688-91.
7. Stables DP, Ginsberg NJ, Johnson ML. Percutaneous nephrostomy: A series and review of the literature. *AJR Am J Roentgenol* 1978;130:75-82.
8. Rock BG, Leonard AP, Freeman SJ. A training simulator for ultrasound-guided percutaneous nephrostomy insertion. *Br J Radiol* 2010;83:612-4.
9. Nicolaou S, Talsky A, Khashoggi K, Venu V. Ultrasound-guided interventional radiology in critical care. *Crit Care Med* 2007;35:S186-97.
10. von der Recke P, Nielsen MB, Pedersen JF. Complications of ultrasound-guided nephrostomy. A 5-year experience. *Acta Radiol* 1994;35:452-4.
11. Singh I, Strandhoy JW, Assimos DG. Pathophysiology of urinary tract obstruction. In: Kavoussi LR, Partin AW, Novick CA, editors. *Campbell-Walsh Urology*. 10th ed. Philadelphia: Elsevier Saunders; 2012. p. 1087-121.e10.
12. Louie KS, de Sanjose S, Mayaud P. Epidemiology and prevention of human papillomavirus and cervical cancer in sub-Saharan Africa: A comprehensive review. *Trop Med Int Health* 2009;14:1287-302.
13. Thomas JO, Herrero R, Omigbodun AA, Ojemakinde K, Ajayi IO, Fawole A, *et al.* Prevalence of papillomavirus infection in women in Ibadan, Nigeria: A population-based study. *Br J Cancer* 2004;90:638-45.