

Nephrostomy Tube after Percutaneous Nephrolithotomy: Large-Bore or Pigtail Catheter?

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ABSTRACT

Background and Purpose: A nephrostomy tube is an integral part of any percutaneous renal surgery. Commonly, a nephrostomy tube that is 2F to 3F smaller than the percutaneous tract is used after percutaneous nephrolithotomy (PCNL). In our experience, quite a few patients have pain at the nephrostomy tube site, and many patients complain of a prolonged urinary leak after tube removal when a large nephrostomy tube is used. This prospective study was planned to document whether these symptoms could be attributed to the size of the nephrostomy tube and whether a small pigtail catheter could reduce these problems without increasing complications.

Patients and Methods: Forty well-matched patients in whom a one-stage PCNL was done for calculus disease were studied prospectively. Alternate patients had a 28F nephrostomy tube or a 9F pigtail catheter placed at the end of the procedure. Patients were observed for the duration of hematuria, number of analgesic injections needed, and the duration of urinary leak after tube removal.

Results: The groups were comparable in the amount and duration of hematuria after PCNL. There was a statistically significant difference in the analgesic need and the duration of urinary leak after tube removal, both of which were less in patients having a pigtail catheter.

Conclusions: A pigtail catheter nephrostomy tube after PCNL reduces the hospital stay by reducing the duration of the urinary leak. The postoperative course is smooth, as patient has less pain and needs less analgesic support. There is no statistically significant increase in the postoperative bleeding secondary to use of a pigtail catheter. Second-look nephroscopy was easy in the one patient with a pigtail nephrostomy catheter who needed the procedure.

INTRODUCTION

PERCUTANEOUS NEPHROLITHOTOMY (PCNL) has a definite place in the management of urinary calculus disease, especially for the treatment of the large and complex renal calculi. Although there are individual variations in the technique of PCNL, most urologists place a nephrostomy tube. This tube serves many purposes.¹ The most important among them is to drain the pelvicaliceal system at the end of the procedure. The tube also serves as an access to the pelvicaliceal system if a second-look nephroscopy is needed for the residual calculi. Also, the nephrostomy tube is considered a way to tamponade the percutaneous tract to control bleeding.

With so many advantages, a nephrostomy tube is considered an integral part of percutaneous renal surgery. Most urologists place a tube that is 2F to 3F smaller than the nephrostomy tract¹ at the end of PCNL. We noticed a few problems with the placement of a large nephrostomy tube. Some patients develop prolonged urinary leakage after the removal of this tube. This leak usually lengthens the hospital stay. A few patients complain of significant pain at the site of the tube.

This prospective study was planned to determine whether these problems could be attributed to the large size of the nephrostomy tube and whether a small tube could be substituted for the large-bore tube without increasing nephrostomy-related complications.

PATIENTS AND METHODS

Patient Selection

From July 1998 to February 1999, 40 patients needing PCNL were alternately placed in two groups. Twenty patients had a 28F catheter as a nephrostomy tube, whereas in the others, a 9F pigtail catheter was inserted. All these patients had a one-stage PCNL done by making a fluoroscopy guided 30F tract using Alken's telescopic dilators.

We selected for this study young patients (20–40 years age). Only patients with a good renal cortical thickness (>2 cm on ultrasonography) and good renal function on intravenous urography were selected for this study. We excluded patients needing multiple tracts or Y tracts. These exclusion criteria helped to rule out other causes of bleeding or prolonged leak after nephrostomy tube removal. It is a common experience to have a prolonged urinary leak after nephrostomy tube removal in elderly patients and patients with thin renal parenchyma (based on our as yet unreported study). Similarly, multiple or Y tracts may cause an increase in the tract bleeding. These exclusions also helped to have uniformity in the two groups. All PCNL operations were done by a single author (PNM).

An independent observer was engaged to look for the proper matching of the groups and to exclude selection bias. It was the role of the independent observer to see to it that the two groups were comparable in regard to the stone size and the length of the procedure.

The aim of this study was to compare the postoperative course of the two groups on the basis of their nephrostomy tubes. Hence, only those patients in whom PCNL was done through one subcostal tract to clear a <3 cm calculus were included.

Placement of Large-Bore Catheter

At the end of PCNL, an end-hole 28F catheter was placed through the Amplatz sheath in the collecting system under fluoroscopic control. We used a Teflon drainage tube with a radiopaque marker. The catheter was fixed to skin by a suture.

Placement of Pigtail Catheter

The placement of the pigtail catheter was done over a guidewire. At the end of PCNL, a J-tipped guidewire was advanced into the pelvicaliceal system. The Amplatz sheath was removed, keeping the guidewire in place. Under fluoroscopic guidance, the pigtail catheter was positioned in the collecting system over this wire and fixed to the skin by a suture. A nephrostogram was done at the end of the procedure to document the correct position of the catheter.

Postoperative Follow-Up

All patients had a postoperative radiograph to document stone clearance. Nephrostomy tubes were removed once the hematuria cleared. The patients had their nephrostomy tubes for an average of 36 to 42 hours. A nephrostogram was done in all patients to document that there was no extravasation of urine from the pelvicaliceal system and that the patient was stone free.

Patients were observed for the duration of hematuria, pain

at the nephrostomy site, and duration of leak after nephrostomy tube removal. Hematuria was defined as the presence of any red color in the nephrostomy urine. Pain was quantified according to the amount of analgesic injections needed in the 48 hours after PCNL. A non-narcotic analgesic (diclofenac sodium) was given to the patients on demand. To quantify the duration of leak, the dressing was changed every 2 hours until two consecutive dressings were dry.

Ultrasonography was done in all these patients prior to discharge from the hospital. None of the patients in either group showed any significant renal or perirenal hematoma or urine collection.

Statistical Analysis

Statistical analysis was done using the unpaired *t*-test for equal and unequal variances, with a 5% alpha error level. Mean, standard deviation, *t* value, and *P* values were calculated to determine the statistical significance of all the variables.

RESULTS

The two groups were comparable in the distribution of patients according to their age (Table 1). The mean age in the two groups was around 34 to 36 years. The difference in age in the two groups was not statistically significant ($P = 0.393$).

The difference in the duration of hematuria after PCNL was also not statistically significant ($P = 0.135$). In both the groups, patients had red urine for an average of 24 hours. As the duration of hematuria was found to be equal in these two well-matched groups, it was concluded that the type of nephrostomy tube had no bearing on the duration of hematuria. None of the patients in either group needed postoperative blood transfusion.

TABLE 1. RESULTS ACCORDING TO TYPE OF NEPHROSTOMY TUBE

	Mean	SD	t value ^a	p value ^a
Age				
LBC ^b	36	7.78	0.864	0.393
PTC	34	6.84		
Duration of hematuria (h)				
LBC	24	8.13	-1.526	0.135
PTC	28.5	10.38		
Analgesic need ^c				
LBC	6.4	1.43	9.215	<0.0001
PTC	2.8	1.01		
Duration of leak ^d				
LBC	25.5	11.64	7.254	<0.0001
PTC	6.2	2.48		

^aUnpaired *t*-tests with equal variances.

^bLBC = large-bore catheter; PTC = pigtail catheter.

^cNumber of injections in 48 hours after PCNL.

^dUnpaired *t*-tests with unequal variances.

Patients who had a large nephrostomy needed more analgesic support in the postoperative period. This indicated that a large tube produced more pain than the pigtail catheter. This difference was found to be statistically significant ($P < 0.0001$).

One of the significant advantages noticed in the pigtail catheter group was that there was a very short leakage period after nephrostomy tube removal. This could be because the tract collapsed around the pigtail catheter, whereas the large catheter kept the tract open for a longer time. As the leak stopped early, patients could be discharged from the hospital sooner. Early stoppage of leak led to reduced morbidity and prompt convalescence. Although patients can be discharged from the hospital once the nephrostomy tube is removed, our patients prefer to stay in the hospital until the leak reduces or stops completely.

The two groups were not compared for the extent of renal functional loss. It was presumed that the functional nephron loss would depend predominantly on the extent of tract dilatation and not on the size of the nephrostomy tube.

All the patients had their nephrostomy tubes for an average of 36 to 42 hours. None of these patients had any episode of nephrostomy tube blockage postoperatively.

We also compared the ease of second-look nephroscopy in the two groups. Four patients needed a second nephroscopy for residual calculi. In the three patients who had a large catheter, placing the Amplatz sheath was easy and straightforward. A guide rod was placed under fluoroscopic guidance through the nephrostomy tube, and over that, an Amplatz dilator and sheath were inserted. One patient who had a pigtail catheter needed a second-look nephroscopy. Here, to place an Amplatz sheath, a guidewire was threaded through the catheter. Over that, placement of a guide rod and one-step dilatation to 30F by Amplatz dilator was very smooth. In all four patients, the nephrostomy tube was not replaced at the end of the procedure. The Amplatz sheath was removed, and a compression dressing was applied. The procedures were accomplished under intravenous sedation.

DISCUSSION

Percutaneous nephrolithotomy is frequently done for large and complex renal calculi. Although the technique of this procedure is standardized, there are many variations in the choice of the postprocedure nephrostomy tube. With no definite guidelines about the tube, there are individual perceptions about the need, safety, and the type to be used.

There are reports in the literature of "tube-less" percutaneous surgery in a selected group of patients.^{2,3} In contrast, there have been ample case reports⁴ and experiences with the severe complications and morbidity when PCNL is performed without a nephrostomy tube or when the tube is prematurely removed. The majority of urologists feel that a nephrostomy tube is an integral part of a percutaneous renal procedure.^{1,2}

The type and size of the nephrostomy tube used after PCNL is not standardized. Hunter¹ has advised the use of a tube that is 2F to 4F smaller than the Amplatz sheath. He believes this helps if there is bleeding or when a second-look procedure is planned. For a similar reason, at our center, we have been using a 28F nephrostomy tube after PCNL done through a 30F tract.

We noticed that patients had a prolonged post-tube-removal leak and significant pain at the nephrostomy tube site. This study was done to evaluate the use of pigtail catheter as a post-PCNL nephrostomy tube. This is one of the only studies we have come across where a pigtail catheter is used as a post-PCNL nephrostomy tube. We have found this tube useful, safe, and well tolerated.

CONCLUSION

After this experience, we revised our indications for the choice of the nephrostomy tube. In most of our patients, a pigtail catheter is placed at the end of PCNL. We have reserved large-bore nephrostomy tubes for patient who suffer mucosal or renal trauma during tract dilatation or patients who have pyonephrosis, poorly functioning kidney, or a large dilated pelvicaliceal system. We also still prefer large-bore catheters in patients in whom multiple or Y tracts have been made.

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EDITORIAL COMMENT

This is a prospective evaluation of 40 patients undergoing percutaneous nephrolithotomy (PCNL), with alternating placement of a standard 28F nephrostomy tube or a 9F pigtail catheter at the end of the procedure. The authors demonstrate that the duration of hematuria was no different in the two groups. However, less analgesia was needed and the duration of urinary leak after tube removal was shorter in the pigtail catheter group. On

the basis of these findings, the authors concluded that the 9F catheter is a "useful, safe, and well-tolerated" alternative to a large nephrostomy tube after PCNL. Since performing this study, the authors report that they now choose the type of nephrostomy tube selectively. In most of their patients, the smaller pigtail catheter is placed at the end of the procedure, but in patients who have suffered mucosal or renal trauma or who have pyonephrosis, a poorly functioning kidney, or a dilated collecting system, a standard large nephrostomy tube is used.

Although the assignment of patients to the two groups was not randomized, the technique of selecting alternate patients for the two different types of tubes likely minimizes bias. The exact stone size and duration of the operative procedures are not reported, but we are told that an independent observer verified their comparability. Additionally, this study was limited to percutaneous nephrostolithotomies in young patients, using a single subcostal tract and for a stone <3 cm. With 20 patients in each group, it is likely that the demographics are fairly well matched.

With recent studies shedding light on the limitations of extracorporeal shockwave lithotripsy for some renal calculi, particularly those in the lower pole, there has been renewed interest in ureteroscopy and PCNL. The flexible ureteroscopes and small lithotrites that are currently available allow treatment of almost any stone in the collecting system, although occasionally, lower-pole calculi can be problematic. Additionally, for larger stones, ureteroscopy can be quite laborious, and the percutaneous technique is well suited here. Efforts have thus been directed to minimizing the morbidity of PCNL. Because many of us suspect that the pain suffered by the patient in association with the procedure is in large part attributable to the sizable nephrostomy tube, there have been several reports of "tubeless" PCNLs.¹⁻⁴ Although the studies were not performed in a randomized or even "pseudo-randomized" fashion, as in this manuscript, the results have all suggested that dispensing with the nephrostomy tube is usually safe and will reduce the patient's pain postoperatively. Others have taken the route of making a smaller tract initially, described as the "mini-perc" technique.⁵ Following the mini-perc, which is performed with small endoscopes through a 13F sheath, an 8F nephrostomy tube is placed. The present report suggests that a middle ground, using full-size percutaneous instrumentation followed by place-

ment of a smaller nephrostomy tube, is also effective. Despite initial enthusiasm for the "tubeless" PCNL technique at our institution, most recently, we have been choosing the postoperative percutaneous nephrostomy tube selectively, similar to the plan indicated by Dr. Maheshwari and associates. If the tract is particularly bloody, if multiple accesses have been used, or if the collecting system is complicated, then we place a 24F percutaneous nephrostomy tube. Otherwise, we use an 8F to 10F tube. I have been impressed by the comfort of patients with the smaller tube, which subjectively appears to be greater than that experienced by patients with a 24F tube and not significantly different from that experienced by the patients in whom we had placed no nephrostomy tube. However, we have not studied this approach systematically, as was done in the preceding report. Other urologists have indicated to me that they have adopted to a similar technique, with generally satisfactory results.

The preceding study provides us with some objective evidence to support the practice of reducing the morbidity of PCNL by placing a smaller nephrostomy tube. The entire purpose of offering percutaneous stone extraction rather than open surgical nephrolithotomy is to reduce morbidity; it is a natural progression that we should further attempt to reduce the morbidity of the percutaneous procedure.

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