Are Emergently Placed Nephrostomy Tubes Suitable for Subsequent Percutaneous Endoscopic Renal Surgery?

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OBJECTIVE To determine the percentage of emergently placed nephrostomy tubes (NT) that were subsequently deemed usable for definitive percutaneous nephrolithotomy or percutaneous antegrade ureteroscopy in patients presenting with nephrolithiasis.

METHODS A multi-institutional retrospective database review was completed to identify patients who underwent emergent NT placement and then subsequent percutaneous nephrolithotomy or percutaneous antegrade ureteroscopy. Demographic, operative, and postoperative data were collected. Complications were classified using the Clavien-Dindo system.

RESULTS A total of 36 patients with 41 NTs met inclusion criteria. Indications for emergent NT placement were: obstruction with evidence of urinary tract infection/pyelonephritis (61%) and obstruction with acute kidney injury (39%). After recovery from the acute event and NT placement and during subsequent percutaneous surgical procedures, 9 NTs (22%) were sufficient without need for additional percutaneous access, 2 NTs (5%) were partially sufficient and were used in conjunction with an additional percutaneous access tract, and 30 NTs (73%) were unusable.

CONCLUSION In this multi-institutional review, only 22% of NTs placed for emergent indications were sufficient for subsequent percutaneous surgery without the creation of additional percutaneous tracts. Urologists should be prepared to obtain additional access during definitive percutaneous renal surgery in patients who have had a tube placed under emergent conditions. UROLOGY 126: 45–48, 2019. © 2019 Elsevier Inc.

Percutaneous nephrostomy tube (NT) drainage of the kidney is a commonly performed procedure to establish adequate renal drainage, most commonly in the setting of urinary tract obstruction. In the acute setting, this is commonly due to obstruction due to nephrolithiasis. Indications for *emergent* NT drainage include: urinary tract obstruction with UTI, obstruction with acute kidney injury and/or a combination of the obstruction with UTI and acute kidney injury.[1,2] Unlike percutaneous renal access performed at the time of percutaneous nephrolithotomy (PCNL), the goal of emergent NT placement is efficient renal drainage in order to treat the aforementioned acute events—not necessarily for ideal position for future surgical treatment. Many patients in whom an emergent NT is placed will go on to require future PCNL or percutaneous antegrade ureteroscopy to treat renal stones and/or stricture disease which caused the original obstruction event. These PCNL or percutaneous antegrade ureteroscopy procedures often occur several weeks after the placement of the emergent NT, in order to allow the patients to recover from their significant infection and/or acute kidney injury. The ultimate utility of the NT for definitive treatment will help guide surgical planning (need for additional equipment or IR availability) and patient counseling. This is particularly important for urologists who do not routinely obtain their own access. The purpose of the current study was to review our experience with emergently placed NTs to evaluate how often they are suitable for future PCNL or percutaneous ureteroscopy.

METHODS

A multi-institutional retrospective review was performed over 4 years at the George Washington University Hospital and 18 months at Massachusetts General Hospital to identify

Financial disclosures: None.

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Submitted: September 13, 2018, accepted (with revisions): January 5, 2019

PCNL or percutaneous antegrade ureteroscopy procedures performed in patients which required emergently placed NTs for acute indications prior to definitive percutaneous surgery. Acute indications for emergently placed NT included infection in the setting of obstruction, and obstruction with acute kidney injury. All PCNLs and percutaneous antegrade ureteroscopies were performed by 2 endourology fellowship trained urologists trained in percutaneous renal access. Demographic, operative and postoperative data were collected, including the size in centimeters of the largest stone seen on imaging. Complications were classified using the Clavien-Dindo system. Stone treatment completion was determined by either clinician decision that no further surgical treatments were required or CT confirmation of stone free status. Medians were compared using the Wilcoxon rank sum test. Statistical analyses were performed utilizing JMP, Version 14.0 and results considered significant when $P < .05$.

CLASSIFICATION OF NT TRACTS

NT tracts were classified as "usable" if during the subsequent percutaneous surgery the NT tract was dilated and no additional percutaneous tracts were created. NT tracts were classified as "partially usable" if the tract was dilated and used, but an additional tract was also required to complete the surgery. NT tracts were classified as "unusable" if they were deemed unsuitable for dilation, were not dilated, and an additional separate tract was created to complete the surgery. Tract usability was determined intraoperatively at time of definitive surgery utilizing non-contrast and contrast enhanced fluoroscopy imaging via injection of contrast through the NT or a retrograde ureteral catheter placed at time of surgery to help better define collecting system anatomy.

RESULTS

A total of 36 patients with 41 indwelling NTs placed emergently who went on to subsequent PCNL or percutaneous ureteroscopy were identified. Demographics, stone location, and laterality for the cohort are included in Table 1. Median age and body mass index were similar between those that had usable and unusable tubes. Median largest stone size was higher in the cohort of tubes that were deemed unusable by 0.8 cm. NTs were placed for acute indications including: 25 patients with evidence of UTI sepsis and obstruction, 16 patients with evidence of obstruction and acute kidney injury, and 4 patients with a combination of obstruction, acute kidney injury and UTI. Of these NTs, 9 (22%) were usable and effective for percutaneous endoscopic surgery and were dilated as the sole access tract for the procedure; 2 NTs (5%) were partially sufficient and were dilated and used in conjunction with an additional percutaneous access tract, and 30 NTs (73%) were unusable and were not dilated at the time of surgery requiring a completely separate puncture tract to be created and dilated to accomplish the percutaneous surgery.

Emergently placed NTs were deemed unusable due to: indirect/poor access to target stone (46.6%), placement directly into the renal pelvis (36.7%), placement into proximal ureter, renal infundibulum, (3.3% each respectively), unable to pass guidewire into renal pelvis (3.3%), encrustation prohibiting manipulation of the tract (3.3%), and dislodgement from kidney (3.3%; Table 2).

Due to the retrospective nature of the study, no standard protocol to determine stone free rate was completed. Stone treatment completion was determined either by clinician decision that no further surgical treatments were required or CT confirmation of stone free status. A total of 23 patients (63.9%) required 1 stage for stone treatment, 12 patients (33.3%) required 2 stages for stone treatment, and 1 patient required 3 stages (2.8%). Of the 9 usable emergently placed NT tracts, 7 patients were completed in a single stage, and 2patients were completed in 2 stages. Of the 30 unusable emergently place NT tracts, 15 patients were completed in a single stage, 14 patients were completed in 2 stages, and 1 patient required 3 stages to be rendered stone free.

A total of 9 patients experienced complications of all grades following their definitive stone procedure. In this cohort, 2 patients (8%) experienced grade ≥3 complications, with no complications grade 4 or higher. Six patients experienced clavien grade II complications, all of which were related to transfusion in the intraoperative or postoperative period. Of note, all of these patients were anemic preoperatively. Of the 2 clavien grade IIIb complications, one was due to evidence of renal

Table 1. Clinical details of study cohort

		Total	Usable	Unusable	
N	Tracts	41	11 (27%)	30 (73%)	
	Patients	36	9 (25%)	27 (75%)	
Age (y)		59 (IQR 47.5-73)	55 (IQR 29-62)	59.5 (IQR 48.8-74)	$P = .2759$
Sex	Female	19	3	16	
	Male	17	6	11	
BMI			20.7 (IQR 19.4-34.5)	29 (IQR 24.2-36.9)	$P = .1216$
Laterality	Right	22	6	16	
	Left	14	5	9	
	Bilateral	5	0	5	
Stone location	Renal	28	7	21	
	Ureteral	2	1	1	
	Both	8	2	6	
	Not available	3			
Largest stone size (cm)			1.25 (IQR 0.95-1.93)	2.05 (IQR 1.83-2.05)	$P = .0042$

Table 2. Reasons NT tracts were not usable

41 Total NT Tracts (36 Patients)*			
11 Usable NT tracts — 2 Patients (2 tracts) Required Additional Access for Procedure	26.8%	30 Unusable NT Tracts	73.2%
		— 14 indirect/circuitous access	46.6%
		— 11 directly into the pelvis	36.7%
		— 1 proximal ureter	3.3%
		— 1 infundibulum	3.3%
		— 1 unable to access renal pelvis	3.3%
		— 1 encrusted	3.3%
		— 1 dislodged from renal pelvis	3.3%

* 1 patient with 2 NTs in unilateral renal unit, 4 patients bilateral NTs.

obstruction postoperatively, thus requiring ureteral stent placement under anesthesia. The second was due to arteriovenous fistula requiring embolization. The majority of complications (8 out of 9, 88.8%) occurred in patients which had unusable emergently placed NT tracts and required new access at the time of definitive surgery.

DISCUSSION

The purpose of our study was to evaluate the usability of the access in patients who have had NTs placed for emergent indications and require subsequent PCNL or percutaneous ureteroscopy for definitive treatment of their nephrolithiasis. The typical circumstances surrounding emergent placement of a NT requires rapid drainage of the kidney to treat a patient's evolving infection and/or acute kidney injury. In that circumstance, the NTs are placed without necessarily considering position for optimal future PCNL or percutaneous surgery—rather, they are placed optimally for drainage of the kidney in the emergent setting. We hypothesized that the majority of these NTs would not be suitable as the sole percutaneous tract for percutaneous surgery. The findings of our study corroborated this hypothesis as 22% or approximately 1/5 NTs placed emergently were usable for future procedures without establishment of a separate tract while with 78% of patients required the creation of at least 1 additional separate percutaneous tract to complete stone treatment. These findings are corroborated by a prior study by Tomaszewski et al who noted that in their series, all patients with previously placed emergent NTs required the establishment of at least 1 additional new percutaneous access tract at the time of PCNL.[3] While median body mass index was not different between the 2 cohorts, median stone size was larger in the cohort of tubes that were deemed unusable. This seems counterintuitive as larger stone burden may be more easily reached via the initial percutaneous access tract. However, this may be related to technical issues at the time of IR PCN placement. In patients with large stones and/or staghorn calculi, percutaneous calyceal placement of a wire for access could be more difficult when there is limited space for passage of the wire past the stone or adequate space to coil the wire into the calyx. In these scenarios, it may be more likely to directly puncture the renal pelvis for the goal of urgent decompression of the collecting system.

These data are especially important as urologists as a whole may be obtaining less renal access. Lee et al and Bird et al conducted survey studies to evaluate practice patterns for renal access among practicing urologists.[4] These investigators found that 11%-27% of urologists regularly performing PCNL obtained their own renal access.[4,5] Jayram et al reviewed American Board of Urology case logs for urologists who certified or recertified between 2004 and 2013. Fifty-three percent of newly-certified urologists were performing PCNL compared with 41% and 29% of urologists in the first and second recertifying group. Only 66% of fellowship-trained urologists were performing PCNL.[6] Performing an internet-based study of members of the Endourological Society, Sivalingam et al found that 71% of all respondents obtained their own access while 21% performed their procedures following IR NT access. Among fellowship trained endourologists, 82% obtained access while 13% routinely deferred access to IR.[7]

The implications of the limited value of an emergently placed NT in the performance of PCNL extend to the proficiency requirement of the performing urologist for the safe and effective access of a new percutaneous renal access tract tract in the majority of patients. It is important to understand this general trend, as there is a paucity of data in the Urology literature regarding cases per year that are required for maintaining this skill set. Three studies using various measures of outcome have shown the number of cases needed to obtain proficiency at renal access is 60 and that 100 or more cases are generally recognized to achieve excellence.[8-10]

Our study is limited by its retrospective design. A total of only 36 patients with 41 indwelling emergently placed NTs prior to PCNL represent a relatively small sample size when comparing it to other PCNL studies of similar design, however, very few studies have stratified patients according to indication for NT placement. Our study is also limited by surgeon preference. The data represents patients under the care of 2 different fellowship trained endourologists as well as IR departments at 2 separate

institutions. It is possible that their individual techniques, preferences, and definitions of successful access may differ from that of the average practicing urologist. While stone free rate was not the primary study outcome, all patients did not undergo post procedure axial imaging. Therefore, stone treatment completion is again deemed by the individual surgeons. This study could be enhanced by increasing the number of surgeons, institutions included as well as conducting a standard prospective protocol to allow determination of stone free rate.

CONCLUSION

The current study indicates that the majority of percutaneous nephrostomy tubes established for emergent indications, are not satisfactory for subsequent, effective percutaneous nephrolithotomy. The patient, the surgeon, and the surgical team should be prepared for the necessity to obtain further renal access at the time of definitive antegrade stone treatment.

References

1. Pearle MS, Pierce HL, Miller GL, et al. Optimal method of urgent decompression of the collecting system for obstruction and infection due to ureteral calculi. *J Urol*. 1998;160:1260–1264. PubMed PMID: 9751331.
2. Yossepowitch O, Lifshitz DA, Dekel Y, et al. Predicting the success of retrograde stenting for managing ureteral obstruction. *J Urol*. 2001;166:1746–1749. PubMed PMID: 11586215.
3. Tomaszewski JJ, Ortiz TD, Gayed BA, Smaldone MC, Jackman SV, Averch TD. Renal access by urologist or radiologist during percutaneous nephrolithotomy. *J Endourol/Endourol Soc*. 2010;24:1733–1737. PubMed PMID: 20919919.
4. Bird VG, Fallon B, Winfield HN. Practice patterns in the treatment of large renal stones. *J Endourol/Endourol Soc*. 2003;17:355–363. PubMed PMID: 12965059.
5. Lee CL, Anderson JK, Monga M. Residency training in percutaneous renal access: does it affect urological practice? *J Urol*. 2004;171:592–595. PubMed PMID: 14713766.
6. Jayram G, Matlaga BR. Contemporary practice patterns associated with percutaneous nephrolithotomy among certifying urologists. *J Endourol/Endourol Soc*. 2014;28:1304–1307. PubMed PMID: 25036914.
7. Sivalingam S, Cannon ST, Nakada SY. Current practices in percutaneous nephrolithotomy among endourologists. *J Endourol/Endourol Soc*. 2014;28:524–527. PubMed PMID: 24367974.
8. de la Rosette JJ, Laguna MP, Rassweiler JJ, Conort P. Training in percutaneous nephrolithotomy—a critical review. *Eur Urol*. 2008;54:994–1001. PubMed PMID: 18394783.
9. Tanriverdi O, Boylu U, Kendirci M, Kadihasanoglu M, Horasanli K, Miroglu C. The learning curve in the training of percutaneous nephrolithotomy. *Eur Urol*. 2007;52:206–211. PubMed PMID: 17229522.
10. Allen D, O'Brien T, Tiptaft R, Glass J. Defining the learning curve for percutaneous nephrolithotomy. *J Endourol/Endourol Soc*. 2005;19:279–282. PubMed PMID: 15865512.