Journal of Pioneering Medical Sciences
Received March 08, 2024 Accept May 05, 2024 Publish July 30, 2024.
Volume 13, Issue 4, Pages 124-127

DOI https://doi.org/10.61091/jpms202413419

Renal Function Tests (Blood Urea and Serum Creatinine) Pre-and Post-Operative Treatment for Tubeless Percutaneous Nephrolithotomies and Standard Treatment

Mohamed Zewita[1,*], Mahmoud M. Shalaby[2], Atef M. Abdlatif[2] and M.Atef Abdalziz[2]
[1]Department of Urology, Faculty of Medicine, Portsaid University,Portsaid, Egypt.
[2]Department of Urology, Faculty of Medicine, Assuit University, Assuit, Egypt.

Corresponding author: Mohamed Zewita (e-mail: researchint@yahoo.com).

Abstract From September 2016 to September 2019, this study was carried out at the Urology and Nephrology University Hospital at Assiut University in Assiut, Egypt. On sixty individuals were divided into two therapy groups, each comprising thirty patients. The first group underwent a traditional percutaneous nephrolithotomy (PCNL), while the second group underwent a tubeless procedure. The average blood loss before and after the procedure, changes in hemoglobin, and creatinine levels did not differ statistically significantly between the two groups, according to the results. These findings demonstrates that the tubeless group had a longer surgical length, a difference that was statistically significant (P-value = 0.034*). However, there were no significant differences between the two groups with respect to the number of tracts or methods of access. Following the procedure, the patient was randomly assigned to have either a nephrostomy tube or have the tract closed without the need for a tube. The patient was randomly assigned to get either a nephrostomy tube or have the tract closed without the need for a tube.

Key Words blood, nephrolithotomies, renal disorders, urea, urinary lithiasis

1. Introduction

Urinary lithiasis is an old health problem and has significant morbidity [1]. Its estimated prevalence is 2–3%, with a peak incidence between the third and fourth decades. Between 10 and 15% of cases will require surgical intervention. The recurrence rate is up to 50% without medical follow-up [2]. The incidence is high in countries with low socio-economic status and in countries with high temperatures and a warm climate, like the Middle East [3]. However, the prevalence of kidney stones is estimated at 1% to 15% [4], [5]. The primary goal while treating renal stones is to achieve a maximum clearance rate with minimal morbidity. The selection of treatment modality like shockwave lithotripsy (SWL), percutaneous nephrolithotomy (PNL), and retrograde intrarenal surgery (RIRS) depends on various factors related to stone, patient, and anatomical factors [6]. Fernstrom and Johansson performed the first percutaneous nephrolithotomy (PCNL) in 1976 for the removal of large renal stones [7]. Percutaneous nephrolithotomy (PNL) is accepted as the procedure of choice for the treatment of large or complex renal calculi Preminger et al., [8].

In 1955, Willard Goodwin put a needle into the collecting system of a hydronephrotic kidney and performed the first antegrade nephrostogram while trying to perform a renal arteriogram. He left a tube to drain the kidney, thereby placing the first nephrostomy tube. By 1976, Fernström and Johansson [7] were the first to describe extracting renal calculi through a percutaneous nephrostomy. In 1978, Arthur Smith [4] performed the first antegrade stent placement through a percutaneous nephrostomy in a patient with a reimplanted ureter [9]. Percutaneous nephrolithotomy (PCNL) is a complex major operation, patient preparation and preoperative assessments are essential steps to ensure best results for the patients and to go through safe surgery and anesthesia. There are two principle components for patient preparation. The first is a safety check generally performed on the day of surgery by the surgeon and anesthetist. The second component is the preoperative assessment to prepare patients to improve outcomes and decrease perioperative risk [10]. Full history and physical examination to ensure the need for the procedure. Blood tests: Full blood count and differential, Renal profile, Albumin, Coagulation screen and blood grouping screen to identify certain systemic problems and to assess a patient's current renal-function status and the metabolic risk for future stone formation.

2. Methods

This is a prospective randomized study aiming to determine the safety and efficacy of tubeless PNL in patients at Asyut University Urology and Nephrology Hospital. Postoperative pain score, Postoperative fever and blood loss, Urinary leakage, Length of hospitalization, need for re-hospitalization, and stone-free rate.

Study type and Target Population: This is a prospective, randomized, self-controlled hospital-based clinical study that was conducted at Urology and Nephrology University Hospital, Assiut University, Assiut, Egypt, during the period from September 2016 until September 2019. Sample size: 60 patients.

- Patient Selection criteria:
- Inclusion criteria:
- Patients over 18 years old.
- Patients with obstructing renal or upper ureteric stones > 2 cm, lower calyceal stones > 1 cm, or failure of shockwave therapy.
- Patients with any body mass index (BMI) were included in our study. Postoperative care and follow up:
- Inpatient:
- Day of the surgery:

Both groups; clinical observation of the vital signs as blood pressure, pulse, temperature, urine output in catheters (amount and color), laxity of the abdomen, and passage of the flatus. Abdominal ultrasonography to exclude intra-abdominal collection in suspicious conditions as well as lengthy operative time. 1st post-operative day: Group (A);

- Opening the nephrostomy tube with close follow-up.
- Abdominal ultrasonography for residual stone detection.
- Complete blood picture with concern for the Hgb level and serum creatinine.

Group (B);

- Removing the ureteral catheter if no urinary leakage or hematuria were detected.
- Abdominal ultrasonography for residual stone detection.

Complete blood picture with concern for the Hgb level and serum creatinine 2nd post-operative day:

Group (A); Removal of the nephrostomy tube if there were no residual stones and no need for a second look, but not the ureteral catheter. Group (B); If no complications were reported, all patients were discharged to follow up in two weeks. 3rd post-operative day: Removal of the ureteric and urethral catheters for the group (A) patients and clinical observation of urinary leakage, loin pain, and body temperature before discharge the next day. All patients in our study at the time of discharge had the following recorded:

- Complete blood picture pre- and post-
- Pre- and post-operative serum creatinine
- Pain score and the total dose of analgesic:

The Numerical Rating Pain Scale was used to assess the need for analgesics and the severity of pain. The simplest and most commonly used scales. The numerical scale is most commonly 0 to 10, with 0 being no pain and 10 being the worst pain in imaginable." The patient picks the number that best describes the pain intensity. Advantages of NRSs include simplicity, reproducibility, and easy comprehensibility. Children as young as 5 years old who have some concept of numbers may use this scale (Iohom, 2006).

- Post-operative urine leakage
- Postoperative fever and blood
- Stone free

Statistical analysis: All statistical analyses will be performed with SPSS (Statistical Package for the Social Sciences), Vet 20.0.

- P value < 0.05 is considered statistically significant.
- Mann-Whitney the U test was used for comparing non-normally distributed numeric samples.
- Student t test for comparing continuous
- Chi square test and Fisher exact test for comparing categorical

3. Results

This study was conducted at the Urology and Nephrology University Hospital, Assiut University, Assiut, Egypt, during the period from September 2016 until September 2019. On 60 patients.

The total number of patients included in our study was initially 84, divided into 2 groups of 42 patients each. 3 patients in group A were excluded due to intraoperative bleeding, and 2 patients in group B had the same complications. 2 patients had PCS perforation in group A, and 1 patient had PCS perforation in group B. 2 patients in group A with anomalous kidneys were excluded, and 3 patients in group B also had anomalous kidneys. 4 patients failed to complete follow-up in group A compared to 6 patients in group B. The remaining 60 patients were assigned and allocated into two treatment groups of 30 patients.

- 1st group with conventional percutaneous nephrolithotomy (PCNL).
- 2nd group with tubeless

As shown in Figure 1, comparing the demographic data of the patients in both groups. There were no statistically significant differences.

Figure 2, There were no statistically significant differences between the 2 groups (P-value > 0.05) regarding the side of the stones, the number of stones, or the stone burden.

Figure 3 shows no statistically significant differences between the 2 groups as regards changes in hemoglobin pre- and post-procedure.

Figure 5 shows no statistically significant differences between the two groups with regard to average blood loss.

Personal data	Conventional (n= 30)		Tubeless (n= 30)		P-value
	No.	%	No.	%	
Sex:					
Male	24	80.0%	27	90.0%	0.472
Female	6	20.0%	3	10.0%	
Age: (years)					
Mean ± SD	38.70 ± 12.84		44.97 ± 13.23		0.068
Range	20.0-60.0		18.0-65.0		
Weight:					
Mean ± SD	77.83 ± 12.65		77.37 ± 13.73		0.892
Range	55.0-110.0		55.0-110.0		

Figure 1: Demographic data

Clinical data	Conventional (n= 30)		Tubeless (n= 30)		P-value
	No.	%	No.	%	
Side:					
Right	13	43.3%	15	50.0%	0.605
Left	17	56.7%	15	50.0%	
No. of stones:					
Single	15	50.0%	14	46.7%	0.796
Multiple	15	50.0%	16	53.3%	
Stone burden: (mm) SA=L*W*P*.25					
Mean ± SD	580 ± 162		512 ± 135		0.085
Range	300-900		250-836		

Figure 2: Stone criteria

HB	Conventional (n= 30)	Tubeless (n= 30)	P-value[1]
Pre-operative:			
Mean ± SD	12.98 ± 1.10	13.25 ± 1.55	0.440
Range	11.0-15.4	11.3-16.7	
Post-operative:			
Mean ± SD	11.07 ± 1.21	11.45 ± 1.26	0.239
Range	8.5-13.8	10.0-14.3	

Figure 3: Pre and post-operative Hemoglobin level change

Table (4): Creatinine level

Creatinine level	Conventional (n= 30)	Tubeless (n= 30)	P-value[1]
Pre-operative:			
Mean ± SD	1.05 ± 0.27	1.09 ± 0.16	0.485
Range	0.6-2.3	0.9-1.8	
Post-operative:			
Mean ± SD	1.07 ± 0.35	1.01 ± 0.16	0.395
Range	0.6-2.7	0.6-1.4	
P-value[2]	0.693	0.082	

Figure 4: shows no statistically significant differences between the 2 groups with regard to changes in creatinine levels pre- and post-procedure

ABL (ml)	Conventional (n= 30)	Tubeless (n= 30)	P-value
Mean ± SD	837.47 ± 323.49	761.17 ± 239.92	0.501
Median (Range)	764.5 (287.0-1632.0)	748.0 (366.0-1313.0)	

Figure 5: Average blood loss

Intra-operative data	Conventional (n= 30)		Tubeless (n= 30)		P-value
	No.	%	No.	%	
Duration of surgery: (min)					
Mean ± SD	120.50 ± 18.26		133.17 ± 26.21		0.034*
Range	90.0-165.0		60.0-180.0		
No. of tract:					
One	25	83.3%	29	96.7%	0.195
Two	5	16.7%	1	3.3%	
Access:					
Sub-costal	28	93.3%	29	96.7%	1.000
Supra-costal	2	6.7%	1	3.3%	

Figure 6: Intra-operative data

ABL= [EBV x (Hi-Hf)]/Hi EBV calculation: body wt (kg) x average blood volume (ml/kg Where: EBV=Estimated Blood Volume Hi= initial hemoglobin Hf= final hemoglobin Average blood volumes Adult Men 75 mL/kg Adult Women 65 mL/kg

Figure 6 shows that the duration of surgery was longer in the tubeless group, which was a statistically significant difference (P-value = 0.034*), but there were no statistically significant differences between both groups as regard to the to the number of tracts or the type of access.

The renal access was performed in the operation room for all patients under general anesthesia; our approach consisted of prone positioning, fluoroscopic guidance, cystoscopy and ureteral catheter insertion, retrograde pyelography, renal puncture, tract dilatation using balloon dilators, then placing a 30-Fr access sheath, rigid nephroscopy (26F), pneumatic disingration, forceps extraction of the fragment, and a and a flexible ureteroscope was used for unreachable sites by rigid nephroscope. When necessary, additional access was made following the same principles. At the end of the procedure, the renal access was performed in the operation room for all patients under general anesthesia; our approach consisted of prone positioning, fluoroscopic guidance, cystoscopy and ureteral catheter insertion, retrograde pyelography, renal puncture, tract dilatation using balloon dilators, then placing a 30-Fr access sheath, rigid nephroscopy (26F), pneumatic disingration, forceps extraction of the fragment, and a and a flexible ureteroscope was used for unreachable sites by rigid nephroscope. When necessary, additional access was made following the same principles. At the end of the procedure, the patient was randomized to either a nephrostomy tube or the closure of the tract without a tube being inserted. patient was randomized to either a nephrostomy tube or the closure of the tract without a tube being inserted.

4. Discussion

Percutaneous nephrolithotomy has now been considered the standard procedure for the management of large renal stones Stables et al. [11]. Since then, efforts have been made to improve the technique, aiming to decrease trauma to the kidney and percutaneous tract and also reduce post-operative morbidity and hospital stay. Classically, drainage after PNL has been recommended using a nephrostomy tube for several reasons, to name a few. It provides proper drainage of the PCS, serves as a tamponade to the fresh percutaneous renal tract, and also maintains access to the renal collecting system in case a secondary percutaneous procedure is required. However, nephrostomy tubes contribute to postoperative pain and morbidity despite these obvious and important advantages, especially if near the rib [12].

Modifications such as decreasing the NT calibre or eliminating the use of the tube were made aiming to improve the outcome of PCNL. Kader et al. [13] reported that hospitalization could be shortened and the dose of analgesics could be reduced by using a small-diameter nephrostomy tube after PNL, with no difference from the large-diameter tubes regarding changes in the hemoglobin level.

Author suggested that placing a nephrostomy tube at the end of a PNL procedure is not necessary. In a study on 50 patients, the nephrostomy tube was replaced with a double-J stent, and the hospital stay, analgesia requirements, cost, and times to return to normal activities were found to be significantly lower with this technique. They concluded that tubeless PNL is a safe procedure that has numerous advantages over the standard placement of a nephrostomy tube. Since then, tubeless PNL has become popular in many centers.

In our study, there were no significant differences between the two groups regarding the patients age, gender, and body mass index. Istanbulluoglu et al., [14] reported similar findings to our study, with no significant differences in stone size, hemoglobin levels, or blood transfusion between totally tubeless PCNL and standard PCNL. Also, Ibrahim et al. reported that patient gender, stone characteristics (configuration, location, and burden), previous renal surgery, and surgical position did not impact the outcome of PCNL [15].

Crook randomized 50 patients with renal stones to standard PNL and totally tubeless PNL and reported that there were no significant differences between the 2 groups as regard hemorrhage, infection, or blood transfusion; however, the hospitalization time was shorter in the totally tubeless PNL group than in the standard PNL group [16].

In our study, we blindly randomized 60 patients into 2 groups: the 1st standard PCNL with nephrostomy tube drainage and a ureteric catheter fixed to an external uretheral catheter; the 2nd group was tubeless with no nephrostomy but with a ureteric catheter fixed to an external uretheral catheter. The two groups were compared in terms of blood loss and urinary leakage, need for re-hospitalization, stone-free rate, and change in creatinine and hemoglobin levels pre- and post-operatively.

5. Conclusions

The study found no significant difference in postoperative hemoglobin, creatinine levels, or blood loss between tubeless and regular PNL for treating renal and upper ureteral stones, suggesting potential for tubeless PCNL.PCNL should be performed as usual with a nephrostomy tube left in place for procedures when there is intraoperative uncertainty about residual stones, intraoperative hemorrhage, perforation of PCS, and/or significant consequences suspected (organ injury, hydrothorax).

Conflict of interest

The authors declare no conflict of interests. All authors read and approved final version of the paper.

Authors Contribution

All authors contributed equally in this paper.

References

[1] Kafarov, E., Avduev, I., & Lechiev, Z. (2023). Segmental Structure of the Human Kidney: An Innovative Research Algorithm. *Advancements in Life Sciences, 10*(4), 549-554.

[2] Khan, S. R., Pearle, M. S., Robertson, W. G., Gambaro, G., Canales, B. K., Doizi, S., ... & Tiselius, H. G. (2016). Kidney stones. *Nature reviews Disease primers, 2*(1), 1-23.

[3] Shin, S., Srivastava, A., Alli, N. A., & Bandyopadhyay, B. C. (2018). Confounding risk factors and preventative measures driving nephrolithiasis global makeup. *World Journal of Nephrology, 7*(7), 129-35.

[4] Romero, V., Akpinar, H., Smith III, J. J., & Assimos, D. G. (2011). Changing patterns in iatrogenic ureteral injuries. *Reviews in Urology, 13*(4), e179.

[5] Sami, I., Zoory, M. J., & Lefta, S. H. (2024). Employment of the laser-induced breakdown spectroscopy (LIBS) technique for the diagnosis of renal failure in patients with (Fe) deficiency. *Advancements in Life Sciences, 11*(1), 66-71.

[6] Srivastava, A., & Chipde, S. S. (2013). Management of 1-2 cm renal stones. Indian Journal of Urology, 29(3), 195-199.

[7] Fernström, I., & Johansson, B. (1976). Percutaneous pyelolithotomy: a new extraction technique. *Scandinavian Journal of Urology and Nephrology, 10*(3), 257-259.

[8] Preminger, G. M., Assimos, D. G., Lingeman, J. E., Nakada, S. Y., Pearle, M. S., & Wolf, J. S. (2005). Chapter 1: AUA guideline on management of staghorn calculi: diagnosis and treatment recommendations. *The Journal of urology, 173*(6), 1991-2000.

[9] Patel, S. R., & Nakada, S. Y. (2015). The modern history and evolution of percutaneous nephrolithotomy. *Journal of Endourology, 29*(2), 153-157.

[10] Choong, S. K., & Kumar, G. (2020). Preoperative Assessment and Patient Preparation for PCNL Surgery. *Percutaneous Nephrolithotomy,* 37-41.

[11] Stables, D. P., Ginsberg, N. J., & Johnson, M. L. (1978). Percutaneous nephrostomy: a series and review of the literature. American journal of roentgenology, 130(1), 75-82.

[12] Lojanapiwat, B., Soonthornphan, S., & Wudhikarn, S. (2001). Tubeless percutaneous nephrolithotomy in selected patients. *Journal of Endourology, 15*(7), 711-713.

[13] Kader, A. K., Finelli, A., & Honey, R. J. D. (2004). Nephroureterostomy-drained percutaneous nephrolithotomy: modification combining safety with decreased morbidity. *Journal of Endourology, 18(*1), 29-32.

[14] Istanbulluoglu, M. O., Ozturk, B., Gonen, M., Cıcek, T., & Ozkardes, H. (2009). Effectiveness of totally tubeless percutaneous nephrolithotomy in selected patients: a prospective randomized study. *International Urology and Nephrology, 41,* 541-545.

[15] Ibrahim, A., Elsotohi, I., Mahjoub, S., Elatreisy, A., Soliman, K., Mabrouk, M., & Khalaf, I. (2017). Factors determining perioperative complications of percutaneous nephrolithotomy: a single center perspective. *African Journal of Urology, 23*(3), 208-213.

[16] Crook, T. J., Lockyer, C. R., Keoghane, S. R., & Walmsley, B. H. (2008). A randomized controlled trial of nephrostomy placement versus tubeless percutaneous nephrolithotomy. *The Journal of Urology, 180*(2), 612-614.