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Comparative study of the outcome of tubed versus tubeless percutaneous nephrolithotomy

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Abstract. *Percutaneous nephrolithotom (PCNL) is the best choice in treating renal stones currently. The PCNL is followed by placement of nephrostomy tube and stent that help in tamponade of percutaneous tract. Tubeless PCNL is accompanied by less postoperative pain and shorter hospital stay. Despite advantages of tubeless PCNL, some surgeons still excluded bleeding or residual stone patients, no chance of second look which increase chance of missing residual stone fragments, requiring often an additional procedures like cystoscopy, stent dysuria and risk of no drainage for kidney.*

This study aimed to compare the effectiveness and safety of tubeless PCNL to tubed PCNL.

Methods: A prospective comparative study conducted in Urology department of Safeer Al-Imam Al-Hussein in Karbala, from January 2013, 1st to December, 31th 2017. One thousand four hundreds thirty four patients with renal stones surgically operated with PCNL were categorized into two groups; 882 patients with renal stones were treated with tubed PCNL and 552 patients were treated with tubeless PCNL.

Results: The young age female were predominantly related to tubeless PCNL. Left sided stones with lucent and upper approach were significantly associated with tubeless PCNL. The tubed PCNL was significantly related to right side stone, while tubeless PCNL was significantly related to left side stone ($p = 0.006$). Tubeless PCNL was significantly associated with lucent opacity more than tubed PCNL ($p = 0.001$). Postoperatively, tubeless PCNL was significantly associated with lower rates of residual stone ($p = 0.005$), bleeding ($p = 0.04$) and sepsis ($p = 0.01$) compared to tubed PCNL.

Conclusion: The tubeless option is effective and safe modality for PCNL. The low rate of residual stones and postoperative bleeding and sepsis can safely have associated with Tubeless PCNL.

Keywords: *renal stone, percutaneous nephrolithotomy, tubed, tubeless, outcome.*

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Ріяд аль-Тома

Порівняльне дослідження результатів лікування пацієнтів з сечокам'яною хворобою: нефростомний дренаж проти бездренажної перкутанної нефролітотомії

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Резюме. *Перкутанна нефролітотомія (ПНЛТ) є основним методом лікування пацієнтів з сечокам'яною хворобою. Сьогодні стандартне виконання ПНЛТ передбачає завершення операції шляхом встановлення черезшкірного нефростомного дренажу. Бездренажна ПНЛТ асоційована зі зменшенням післяопераційного болю та часу госпіталізації. Незважаючи на переваги, бездренажна ПНЛТ збільшує ризик залишення фрагментів конкременту, що вимагає застосування додаткових процедур та подовження часу госпіталізації.*

Метою дослідження було порівняти ефективність і безпечність бездренажної та стандартної ПНЛТ із застосуванням нефростомного дренажу.

Методи. Проспективне порівняльне дослідження, проведене у відділенні урології Safeer Al-Imam Al-Hussein у Карбалі з січня 2013 року по 31 грудня 2017 року. 1434 пацієнтів з нирковими конкрементами, яким виконано ПНЛТ були розподілені залежно від застосованого хірургічного лікування: 1-й групі пацієнтів (n = 882) виконано ПНЛТ із застосуванням дренажу, у 2-й групі (n = 552) застосовувалась бездренажна ПНЛТ.

Результати. Бездренажна ПНЛТ частіше застосовувалась у жінок молодого віку та у хворих з конкрементами лівої нирки з простим доступом, тоді як дренаж частіше використовувався за наявності конкременту правої нирки (p = 0,006). Післяопераційно, бездренажна ПНЛТ була статистично значущо асоційована з низькою частотою залишкових фрагментів конкременту (p = 0,005), кровотеч (p = 0,04) і сепсису (p = 0,01) порівняно із стандартною процедурою.

Висновки. Бездренажний варіант ПНЛТ асоціюється з низькою частотою залишкових фрагментів каменів, післяопераційних кровотеч та сепсису, що обґрунтовує ефективність і безпечність його застосування.

Ключові слова: *конкременти нирок, черезшкірна нефролітотомія, дренаж, бездренажна черезшкірна нефролітотомія, результат лікування.*

Introduction. The percutaneous nephrolithotomy (PCNL) is the best current choice in treating large renal calculi. It is an appropriate between uretero-renoscopy and shock wave lithotripsy [1]. The PCNL is followed by placement of nephrostomy tube and stent that help in tamponade of percutaneous tract, postoperative kidney drainage and allowance of secondary intervention [2] but ended sometimes in postoperative pain and long hospital stay [3]. The advantage of tubeless PCNL was to ensure safety, effectiveness and short hospital stay [4].

Despite advantages of tubeless PCNL, some surgeons still excluded bleeding or residual stone patients, no chance of second opinion which increases chance of missing residual stone fragments, requiring often additional procedures like cystoscopy, stent dysuria and risk of no drainage for kidney [5].

The aim: the increase of renal calculi incidence with great advancement of medical technologies and application of PCNL in addition to high shift to safe surgical procedures like tubeless PCNL, urged us to compare the effectiveness and safety of tubeless PCNL to tubed PCNL.

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Material and methods. This was a prospective comparative study conducted in Urology department from 1st of January, 2013 to 31th of December, 2017. One thousand four hundreds thirty four patients were included and categorized into two groups; 882 patients were treated by tubed PCNL and 552 patients were treated with tubeless PCNL. A written informed consent was signed with each patient before enrolling in the study implementing the PCNL and the ethical agreement was provided by the administration of the hospital.

Inclusion criteria: renal stone more than 1.5 cm in size and negative culture of urine. Exclusion criteria: coagulopathy diseases, collecting system perforation, severe intraoperative bleeding, elevated creatinine level, and ectopic kidney.

The preoperative, operative and postoperative patients` characteristics were assessed by the researcher. The PCNL was done in Surgical Theater of Surgical Specialties hospital. Pre-operative native CT scan and early morning x-ray on the day of surgery were performed in all cases and/or intravenous urography. Ultrasound and/or chest x-ray were done postoperatively.

After general anesthesia administration, a lithotomy position was applied for a patient with 6 or 5 F open end ureteric catheter inserted trans-urethral via cystoscopy using fluoroscopy and placed with a Foley's catheter. The main techniques of PCNL done by urologist included percutaneous puncture of pelvicalyceal system, arrangement of tract and fragmentation or removal of stones.

At the end of the procedure the stone clearance was confirmed by endoscopy and fluoroscopy and the ureteric catheter was removed. In tubed PCNL patients a nephrostomy tube was positioned through the Amplatz sheath and fixed to the skin and the nephrostomy was clamped for twenty-four hours. In tubeless PCNL: after removal of the Amplatz sheath the wound was compressed for two to five minutes and then sutured with one stitch non absorbable suture followed by dressing without putting nephrostomy tube.

Statistical analysis was performed with SPSS software version 22. The Fischer's exact test, independent sample t-test and one way ANOVA analysis were used for statistical analysis as appropriate. P value less than 0.05 was considered statistically significant.

Results. This study included 882 patients with renal stones wich were treated surgically with tubed PCNL and 552 patients with renal stones wich were treated surgically with tubeless PCNL. Mean age of patients with tubed PCNL was 32.9 years and mean age of patients with tubeless PCNL was 37.7 years with a significant difference in age between both study groups (p = 0.03). Male patients in two study groups was predominant, however, there was a significant association between female patients and tubeless PCNL surgical option (p = 0.01). The tubed PCNL was significantly related to right side stone, while tubeless PCNL was significantly related to left side stone (p = 0.006). Tubeless PCNL was significantly associated with lucent opacity more than tubed PCNL (p = 0.001). No significant differences were observed between two PCNL techniques regarding operative time (p = 0.26) (Table 1).

Table 1

Preoperative and operative characteristic distribution according to tubed and tubeless PCNL groups (n = 1434)

Variables		Tubed (n = 882)	Tubeless (n = 552)	Total	P value
Gender	Male	511 (57.9 %)	283 (51.3 %)	794	0.013*S
	Female	371 (42.1 %)	269 (48.7 %)	640	
Side	Right	451 (51.1%)	241(43.7 %)	692	0.006*S
	Left	431 (48.9 %)	311 (56.3 %)	742	
Opacity	Opaque	667 (75.6 %)	370 (67.0 %)	1037	0.001*S
	Lucent	215 (24.4 %)	182 (33.0 %)	397	
Age (M ± SD)		39.6 ± 15.02	37.7 ± 17.1	-	0.03**S
Operative time (M ± SD)		32.9 ± 14.8	32.0 ±1 5.2	-	0.26**NS

*Chi-square test, **Independent sample t-test, S=Significant, NS=Not significant.

No significant differences were observed between two PCNL techniques regarding number of accesses (p = 0.29) and history of previous renal surgery (p = 0.68). A significant association was observed between upper surgical approach and tubeless PCNL (p = 0.001) (Figures 1-3).

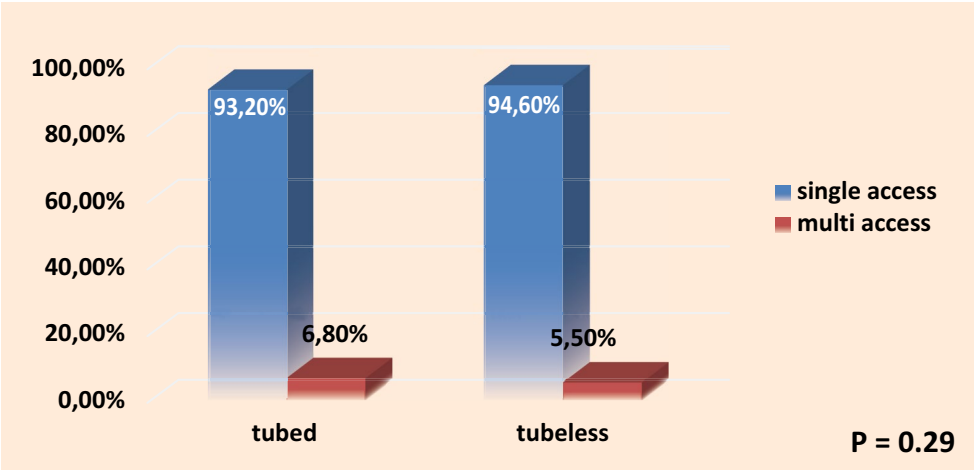

Fig. 1. Distribution of accesses number according to tubed and tubeless PCNL.

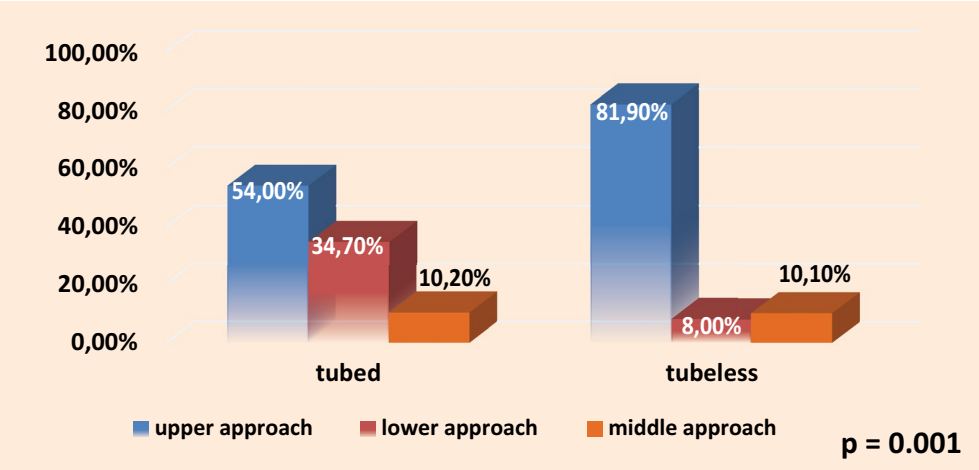

Fig. 2. Distribution of surgical approach according to tubed and tubeless PCNL.

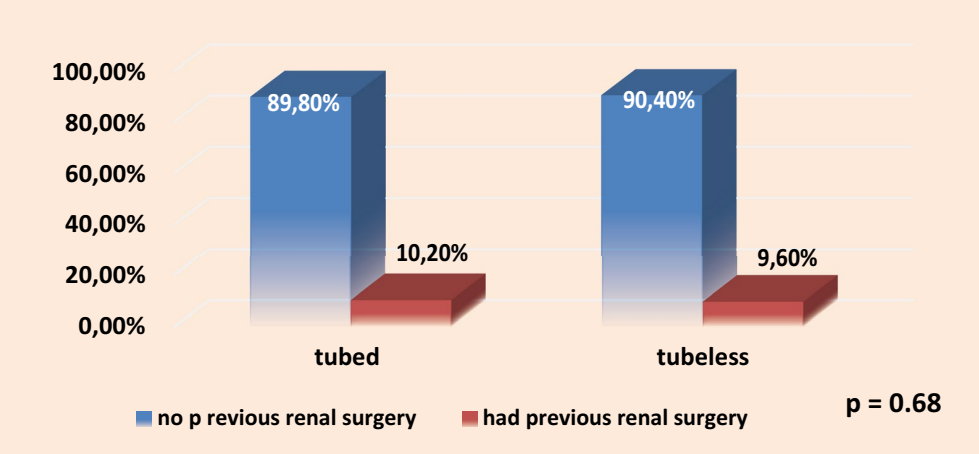

Fig. 3. Distribution of renal surgery history according to tubed and tubeless PCNL

Postoperatively, 8.2% of patients treated surgically with tubed PCNL had residual stones, while 4.3% of patients treated surgically with tubeless PCNL had residual stones with a significant difference between two study groups (p = 0.005). Postoperative bleeding PCNL complications represented as blood transfusion (1.7%) and postponed PCNL (0.2%) in patients of both study groups; however, blood transfusion and postponed PCNL were significantly associated with tubed PCNL (p = 0.04). No significant differences were observed between tubed and tubeless PCNL regarding postoperative renal function (p = 0.34) and organic injury (p = 0.43). The postoperative sepsis was significantly higher among patients treated surgically with tubed PCNL than patients treated surgically with tubeless PCNL (2.2% vs. 0.5%; p = 0.01) (Table 2).

Table 2

Postoperative outcome distribution according to tubed and tubeless PCNL groups (n = 1434)

Variables		Tubed (n = 882)	Tubeless (n = 552)	Total	P value
Residual stone		72 (8.2 %)	24 (4.3 %)	96 (6.7 %)	0.005*S
Postoperative bleeding	Blood transfusion	16 (1.8 %)	3 (0.5 %)	19 (1.3 %)	0.04**S
	Postponed PCNL	3 (0.3 %)	0(0 %)	3 (0.2 %)	
Renal function	Improved	16 (1.8 %)	8 (1.4 %)	24 (1.7 %)	0.34 **NS
	Transient impairment	3 (0.3 %)	0 (0 %)	3 (0.2 %)	
Postoperative sepsis		19 (2.2 %)	3 (0.5 %)	22 (1.5 %)	0.01**S
Organic injury	Pleural injury	14 (1.6 %)	6 (1.1 %)	20 (1.4 %)	0.43**S
	Abdominal organs	0 (0 %)	0 (0 %)	0 (0 %)	

*Chi-square test, S=Significant, NS=Not significant.

Discussion. High proportion of Urologists performed percutaneous nephrolithotomy preferring the classic practice of nephrostomy tube and stent which commonly accompanied by pain and discomfort; for that, new surgical techniques are required to implement PCNL without application of tube or stent for drainage [6, 7].

Present study showed a significantly older age patients with tubed PCNL (p = 0.03). This finding is consistent with results of Nakamon et al [8] study in Thailand which preferred traditional tubed PCNL for elderly age patients and explained this preference to decrease co-morbidities. Irving et al [9] study in UK found that PCNL is safe surgery for older age patients. Inconsistent with our findings, Isac et al [2] study reported no significant differences in age between patients with tubed and tubeless PCNL. Female patients in current study were significantly related to tubeless PCNL (p = 0.01). Men were predominant in renal calculi and for PCNL, in spite of that, Zehri et al [10] documented that female gender is risk factor for blood transfusion in PCNL which might influenced surgeons to select tubeless PCNL. Left sided stone was significantly related with tubeless PCNL; a finding that is similar to results of Khan et al [11] study in India. Tubeless PCNL was significantly associated with lucent opacity more than tubed PCNL (p = 0.001). This finding is inconsistent with results of Giusti et al [12] study in Italy which revealed higher opaque opacity for tubeless than tubed PCNL. This inconsistency may be due to difference in sample size between studies. Upper approach was significantly related to tubeless PCNL in present study (p = 0.001). Similarly, Sourial et al [13] study in USA proved that upper tract tubeless PCNL lead to lowering the thoracic complications and shorter hospital stay.

The main interesting outcome of tubeless PCNL in our study was a significantly low residual stone as compared to tubed PCNL (p = 0.005). This finding is in agreement with results of many literatures like Balandi study in Iraq [14] and Karadag et al [15] study in Turkey which stated that residual stone rates were higher among standard PCNL using nephrostomy tubes.

Another significant advantage of tubeless PCNL in current study was the low incidence of postoperative bleeding in comparison to tubed PCNL (p = 0 .04). Lee et al [16] meta-analysis study in South Korea showed that tubeless PCNL was superior to other surgical procedures regarding hemoglobin changes. Additionally, Lai et al [17] study in Taiwan revealed that tubeless PCNL is safe surgical procedures with fewer complications. The postoperative sepsis incidence in this study was significantly lower among patients treated surgically with tubeless PCNL (p = 0.01). This finding coincides with results of Sharma et al [18] study in India which found that tube placement was a significant risk factor for PCNL postoperative infection. In our study, no significant differences were observed between two study groups regarding postoperative renal function and organ injury. These findings proved the effectiveness and safety of tubeless PCNL as reported in the literature [19]. The main limitation in present study was the exclusion of hospital stay and pain perception in patients as all previous studies confirmed shorter duration stay and less pain for patients treated surgically with tubeless PCNL.

Conclusion. In conclusion, the tubeless option is an effective and safe modality for percutaneous nephrolithotomy. The low rate of residual stones and postoperative bleeding and sepsis can safely have associated with Tubeless PCNL.

Conflicts of Interest. I declared there is no any conflict of interest.

Contribution. My contribution are include; Conceptualization, Data Curation, Formal Analysis, Funding Acquisition, Investigation, Methodology, Project Administration, Resources, Software, Supervision, Validation, Visualization, Writing – Original Draft Preparation, Writing – Review & Editing

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