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Postoperative sequelae of percutaneous nephrolithotomy

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Abstract. ***Background.*** *Risk factors of postoperative complications during percutaneous nephrolithotomy (PCNL) include stone burden, the preoperative microbiological status of urine, comorbidity, age, operative time, intraoperative level of sterility, and antibiotic prophylaxis. The study aimed to assess the sequelae of these complications.* ***Materials and methods.*** *This retrospective study was conducted on patients treated by PCNL under fluoroscopic guidance for a one-year duration. The demographic data, body mass index, stone burden, stone density, number, duration of surgery, and postoperative complications were recorded.* ***Results.*** *Out of 50 patients, 32 (64 %) developed a fever. White blood cell count was significantly high among those patients. The age of the patients, gender, body mass index, and hospital stay were insignificant variables. Stone burden, prolonged surgery duration, prone position during surgery, and the use of pneumatic lithotripsy were significant variables.* **Conclusions.** *Increased stone burden, prolonged duration of surgery, prone position, and pneumatic lithotripsy during PCNL are significant risk factors for developing postoperative complications, mainly fever.*

Keywords: *renal stone; percutaneous nephrolithotomy; fever; pneumatic lithotripsy*

Introduction

Percutaneous nephrolithotomy (PCNL) is the recommended management for renal stones > 2 cm. PCNL has significantly reduced morbidity and mortality, but infection and bleeding are still the most common complications [1]. Other postoperative complications include a reduction in outflow leading to increase intra-renal pelvic pressure (IRP). Persistent high IRP leads to systemic fluid absorption, pyelo-tubular backflow, and forniceal rupture leading to stone and debris formation. In addition, debris and bacteria released from stone lead to bacteremia, postoperative fever, and septicemia [2]. The incidence of post-PCNL sepsis is low (1 %), but the death rate is as high as 66 to 80 % [3]. Clinically, maintaining an IRP of < 30 mmHg is acquired during percutaneous intra-renal techniques [4].

Materials and methods

In a clinical study conducted at the Department of Urology, among subjects have nephrolithiasis undergoing PCNL. Preoperatively patients were assessed and demographic parameters of the patients, history, and physical examination were documented. CT KUB or CT IVU was obtained for all. The stone burden was calculated (area). Investigations were done including urine culture sensitivity. Individuals who have grown in the culture of urine were prescribed seven days of oral antibiotics. All the surgeries were performed by experienced urologists. All the procedures were done under spinal anesthesia. A prophylactic antibiotic (ceftriaxone 1 g) was given. A Foley catheter was inserted and the ureteral catheter was secured. The transpapillary puncture was done under fluoroscopic guidance. The stone was fragmented and removed by irrigation flow. The strategies include totally tubeless, or gold standard. Postoperatively, individuals were treated with IV fluids, antibiotics, and analgesics with a proton pump inhibitor. Patients were discharged after 72 hours or when they were clinically stable. Postoperative complications are categorized according to the modified Clavien-Dindo classification [5–10]. Data analysis was done using the SPSS20 (IBM Corp., NY, USA). For baseline characteristics, we used the chi-square test or Fisher's exact test in categories and the t-test or Mann-Whitney U test for continuous data. A p-value < 0.05 was considered significant.

Results

A total of 50 patients were treated with PCNL. Male to female ratio was 2 : 1. IRP elevated more than 35 mmHg was seen in 40 (80 %) and 10 (20 %) had less than 35 mmHg. Mean age and mean BMI was found insignificant in the development of stone (Table 1).

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The majority of the patients underwent mini-PCNL (n = 45) and hence there was no significant difference. A total of 44 patients underwent PCNL by using pneumatic lithotripsy and the remaining 6 underwent PCNL using shock pulse. A significantly high number of patients (n = 37) patients in the prone position had raised IRP > 35 mmHg. Thirty-two patients developed postoperative fever (Fig. 1). As depicted in Table 2, GI complications, according to Clavien-Dindo classification, were found in 68 %, GII in 24 %, and 8 % had GIII. However, no grade IV was recorded.

Discussion

With the dramatic raising in stone disease occurrences, the use of PCNL to manage a large stone has continued to rise [11]. The success of stone surgery is measured by the duration of surgery, stone-free rate, hospital stay, complications, and cost-effective. Infectious after PCNL are most common and bacteremia is the most of the cases determined. Although these lead to sepsis are rare, which potentially end with life-threatening outcomes [12].

During PCNL, continuous pressurized irrigation is used to washout blood clots and debris for active removal of the stone fragments after lithotripsy [13, 14].

There are different studies documented post-PCNL high-grade fever, the incidence ranged between 10 to 32 %. In this work, a postoperative fever was recorded in 32 cases. The high rate of fever was reported by Gutierrez et al. [3] and Troxel and Low [15].

In one randomized single-blind trial by Omar et al. [16] randomized cases that high-pressure irrigation elevated the risk of complications.

Table 1. Patients' basic characteristics

Parameters	IRP > 35 mmHg (n = 34)	IRP < 35 mmHg (n = 16)	P-value
Male/female, %	80	20	0.1
Mean age, years	42.15 ± 12.89	38.67 ± 14.39	0.9
Mean BMI, kg/m^2	25.32 ± 4.20	25.45 ± 3.30	0.9

Table 2. Postoperative complication according to modified Clavien-Dindo classification

Complications	Elevated IRP	Normal IRP	P-value
GI	26	8	0.001
GII	10	2	
GIII	2	2	
GIV	0	0	

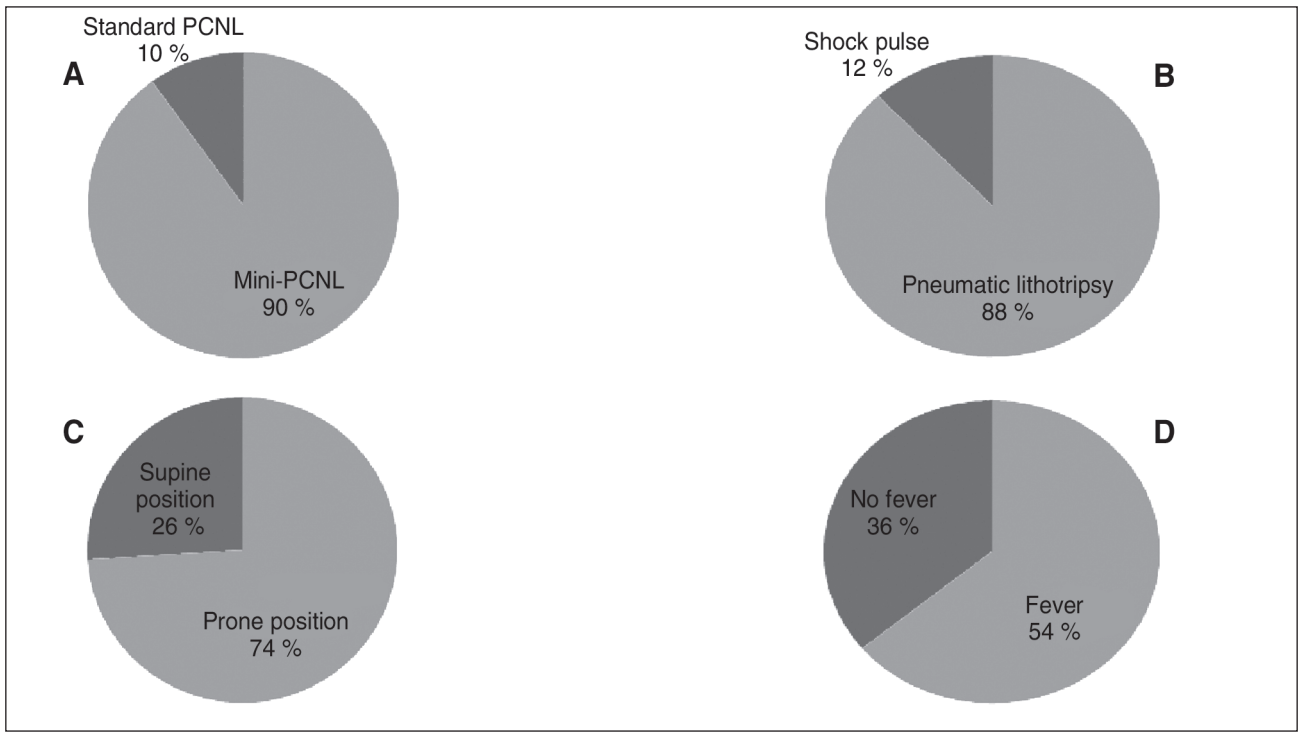

Figure 1. A — types of PCNL, B — types of lithotripsy, C — patients' position, D — accompanied fever

Troxel with Low [15] measured IRP using a ureteral occlusion balloon catheter and a urodynamic system. In contrast, they did not record any association of IRP 30 mmHg or greater with postoperative fevers [15, 16]. Cheng Wu et al. [17] found a significant association between higher IRP and increased incidence of postoperative fever where 43.83 % (100/228) patients had IRP > 30 mmHg and 28 patients developed a fever. They analyzed that the longer accumulated period of IRP > 30 mmHg for > 60 sec predicted the fever.

The female sex is recognized to be a risk for post-PCNL fever development [18]. In this study, male to female ratio was 2 : 1 among raised IRP group and was not a risk for developing a fever.

A comparative study of mini-PCNL and standard PCNL by Zhong Wen et al. [20] and Cheng Wu et al. [17] showed that mini-PCNL was correlated with higher IRP and significantly associated with postoperative fever. In this study the majority of cases were mini-PCNL and we could not find statistical significance among them.

Liangren Liu et al. [18] in their systematic review and meta-analysis including 389 patients found that PCNL in the supine position spends a shorter time than the prone, but both situations have insignificant influence. Falahatkar et al. [21] mentioned in their prospective analytical cross-sectional study, fever was associated with 7.5 % (25/330) which was not found significant. The patients with supine, access sheath remains angled horizontally when compared with prone, which falls pressure in the collecting system that facilitates the stone fragments to get out through the sheath.

This study was done in only one center within a short period and with a relatively small patient number. This study failed to compare mini PCNL and standard PCNL and different energy sources on postoperative fever due to disparity in the number of cases.

An elevated stone development and burden correlated with long surgery time, the position of the patient during the operation, and lithotripsy types. Postoperative complications including fever and bleeding most common after percutaneous nephrolithotomy, however, it has significantly dropped morbidity and mortality.

Limitations of the study. This study was done in only one center within a short period and with a relatively small patient number. This study failed to compare mini PCNL and standard PCNL and different energy sources on postoperative fever due to disparity in the number of cases.

Conclusions

An increased stone burden, prolonged duration of surgery, prone position, and pneumatic lithotripsy during PCNL represent a significant risk for postoperative infective complications development especially fever.

References

1. Sano T, Ichiba N, Masui K, et al. Computed tomography detected pyelovenous backflow associated with complete ureteral obstruction. IJU Case Rep. 2019 Sep 1;2(6):321-323. doi:10.1002/iju5.12117.

2. Lojanapiwat B, Kitirattrakarn P. Role of preoperative and intraoperative factors in mediating infection complication following percutaneous nephrolithotomy. Urol Int. 2011;86(4):448-452. doi:10.1159/000324106.

3. Gutierrez J, Smith A, Geavlete P, et al. Urinary tract infections and post-operative fever in percutaneous nephrolithotomy. World J Urol. 2013 Oct;31(5):1135-1140. doi:10.1007/s00345-012-0836-y.

4. Dogan HS, Guliyev F, Cetinkaya YS, Sofikerim M, Ozden E, Sahin A. Importance of microbiological evaluation in management of infectious complications following percutaneous nephrolithotomy. Int Urol Nephrol. 2007;39(3):737-742. doi:10.1007/s11255-006-9147-9.

5. Shin TS, Cho HJ, Hong SH, Lee JY, Kim SW, Hwang TK. Complications of Percutaneous Nephrolithotomy Classified by the Modified Clavien Grading System: A Single Center's Experience over 16 Years. Korean J Urol. 2011 Nov;52(11):769-775. doi:10.4111/kju.2011.52.11.769.

6. Kadlec AO, Greco KA, Fridirici ZC, Hart ST, Vellos TG, Turk TM. Comparison of complication rates for unilateral and bilateral percutaneous nephrolithotomy (PCNL) using a modified Clavien grading system. BJU Int. 2013 Apr;111(4 Pt B):E243-248. doi:10.1111/j.1464-410X.2012.11589.x.

7. De la Rosette J, Assimos D, Desai M, et al. The Clinical Research Office of the Endourological Society Percutaneous Nephrolithotomy Global Study: indications, complications, and outcomes in 5803 patients. J Endourol. 2011 Jan;25(1):11-17. doi:10.1089/end.2010.0424.

8. Torrecilla C, Vic ns-Morton AJ, Meza IA, et al. Complications of percutaneous nephrolithotomy in the prone position according with modified Clavien-Dindo grading system. Actas Urol Esp. 2015 Apr;39(3):169-174. doi:10.1016/j.acuro.2014.07.006.

9. Aljuhayman A, Abunohaiah I, Addar A, Alkhashan M, Ghazwani Y. Assessment of lower calyceal single-access percutaneous nephrolithotomy for staghorn stones: A single-surgeon and a single-center experience at KAMC, Riyadh. Urol Ann. 2019 Jan-Mar;11(1):62-65. doi:10.4103/UA.UA_77_18.

10. Kara C, De irmenci T, Kozacioglu Z, Gunlusoy B, Koras O, Minareci S. Supracostal Approach for PCNL: Is 10th and 11th Intercostal Space Safe According to Clavien Classification System? Int Surg. 2014 Nov-Dec;99(6):857-862. doi:10.9738/INTSURG-D-13-00167.1.

11. Labadie K, Okhunov Z, Akhavein A, et al. Evaluation and comparison of urolithiasis scoring systems used in percutaneous kidney stone surgery. J Urol. 2015 Jan;193(1):154-159. doi:10.1016/j.juro.2014.07.104.

12. Draga RO, Kok ET, Sorel MR, Bosch RJ, Lock TM. Percutaneous nephrolithotomy: factors associated with fever after the first postoperative day and systemic inflammatory response syndrome. J Endourol. 2009 Jun;23(6):921-927. doi:10.1089/end.2009.0041.

13. Akbulut F, Ucpinar B, Savun M, et al. A Major Complication in Micropercutaneous Nephrolithotomy: Upper Calyceal Perforation with Extrarenal Migration of Stone Fragments due to Increased Intrarenal Pelvic Pressure. Case Rep Urol. 2015;2015:792780. doi:10.1155/2015/792780.

14. Nagele U, Nicklas A. Vacuum cleaner effect, purging effect, active and passive wash out: a new terminology in hydrodynamic stone retrival is arising - Does it affect our endourologic routine? World J Urol. 2016 Jan;34(1):143-144. doi:10.1007/s00345-015-1575-7.

15. Troxel SA, Low RK. Renal intrapelvic pressure during percutaneous nephrolithotomy and its correlation with the develop-

ment of postoperative fever. J Urol. 2002 Oct;168(4 Pt 1):1348-1351. doi:10.1016/S0022-5347(05)64446-1.

16. Omar M, Noble M, Sivalingam S, et al. Systemic Inflammatory Response Syndrome after Percutaneous Nephrolithotomy: A Randomized Single-Blind Clinical Trial Evaluating the Impact of Irrigation Pressure. J Urol. 2016 Jul;196(1):109-114. doi:10.1016/j.juro.2016.01.104.

17. Wu C, Hua LX, Zhang JZ, Zhou XR, Zhong W, Ni HD. Comparison of renal pelvic pressure and postoperative fever incidence between standard- and mini-tract percutaneous nephrolithotomy. Kaohsiung J Med Sci. 2017 Jan;33(1):36-43. doi:10.1016/j.kjms.2016.10.012.

18. Liu L, Zheng S, Xu Y, Wei Q. Systematic review and meta-analysis of percutaneous nephrolithotomy for patients in the supine versus prone position. J Endourol. 2010 Dec;24(12):1941-1946. doi:10.1089/end.2010.0292.

19. Shahrour K, Tomaszewski J, Ortiz T, et al. Predictors of immediate postoperative outcome of single-tract percutaneous nephrolithotomy. Urology. 2012 Jul;80(1):19-25. doi:10.1016/j.urology.2011.12.065.

20. Zhong W, Zeng G, Wu K, Li X, Chen W, Yang H. Does a smaller tract in percutaneous nephrolithotomy contribute to high renal pelvic pressure and postoperative fever? J Endourol. 2008 Sep;22(9):2147-2151. doi:10.1089/end.2008.0001.

21. Falahatkar S, Moghaddam KG, Kazemnezhad E, et al. Factors affecting complications according to the modified Clavien classification in complete supine percutaneous nephrolithotomy. Can Urol Assoc J. 2015 Jan-Feb;9(1-2):e83-92. doi:10.5489/cuaj.2248.

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Післяопераційні наслідки черезшкірної нефролітотомії

Резюме. Актуальність. Фактори ризику післяопераційних ускладнень під час черезшкірної нефролітотомії (ЧШНЛ) включають каменеутворення, передопераційний мікробіологічний статус сечі, супутню патологію, вік, тривалість втручання, інтраопераційний рівень стерильності та антибіотикопрофілактику. Дослідження спрямоване на оцінку наслідків цих ускладнень. **Матеріали та методи.** Це ретроспективне дослідження було проведено за участю пацієнтів, яким проведено ЧШНЛ під флюороскопічним контролем, протягом одного року. Реєстрували демографічні дані, індекс маси тіла, каменеутворення, щільність і кількість каменів, тривалість операції та післяопераційні ускладнення. **Результати.** Із 50 хворих у 32 (64 %) розвинулася лихоманка. Кількість лейкоцитів була вірогідно високою в цих пацієнтів. Вік хворих, стать, індекс маси тіла та перебування в лікарні були незначущими змінними. Каменеутворення, тривала операція, положення під час втручання та використання пневматичної літотрипсії вважалися вагомими змінними. **Висновки.** Посилення каменеутворення, тривала операція, положення лежачи та пневматична літотрипсія під час ЧШНЛ є суттєвими факторами ризику розвитку післяопераційних ускладнень, головним чином лихоманки.

Ключові слова: нирковий камінь; черезшкірна нефролітотомія; лихоманка; пневматична літотрипсія