

## EFFICACY OF PERCUTANEOUS NEPHROLITHOTOMY IN THE ELDERLY

## YAŞLILARDA PERKÜTAN NEFROLİTOTOMİNİN ETKİNLİĞİ

Okan ALKIŞ<sup>1</sup>, İbrahim Güven KARTAL<sup>1</sup>, Bekir ARAS<sup>1</sup>, Mehmet SEVİM<sup>1</sup>, Oğuzhan Yusuf SÖNMEZ<sup>1</sup>

## ABSTRACT

**AIM:** This study aims to investigate the safety and efficacy of percutaneous nephrolithotomy (PNL) in the elderly.**Material and Method:** The data of 238 patients who underwent PNL between January 2015 and January 2020 were retrospectively analyzed. A total 238 patients were divided into two groups made up of 86 elderly (above 65 years old) and 152 non-elderly persons (under 65 years old). Demographic data, stone characteristics, operation data, and complications were compared between the elderly and non-elderly patients.**RESULTS:** Eighty-six (36.1%) elderly patients were included in the study. There was no significant difference between the groups in terms of demographic characteristics, success, and complication rates ( $p>0.05$ ). The overall stone-free rate was 86.0% in the elderly and 86.8% in non-elderly ( $p>0.05$ ). In multivariable analysis; stone size ( $p=0.032$ , OR=0.202 and 95% CI=0.047-0.873) and number of stones ( $p=0.002$ , OR=0.067 and 95% CI=0.012-0.377) were found to be associated with complications in elderly.**CONCLUSION:** Percutaneous Nephrolithotomy can be performed safely with high success in elderly patients. It should be kept in mind that the risk of complications for PNL is increased in geriatric patients with a high number of stones and burden.**Keywords:** Nephrolithotomy, Percutaneous, Elderly, Safety

## ÖZET

**AMAÇ:** Bu çalışmanın amacı yaşlılarda perkütan nefrolitotominin (PNL) güvenliliğini ve etkinliğini araştırmaktır.**GEREÇ VE YÖNTEM:** Ocak 2015- Ocak 2020 arasında perkütan nefrolitotomi uygulanan 238 hastanın verileri geriye dönük olarak incelendi. Toplam 238 hasta 86'sı yaşlı (65 yaş üstü) ve 152'si genç (65 yaş altı) olmak üzere iki gruba ayrıldı. Demografik veriler, taş özellikleri, operasyon verileri ve komplikasyonlar gruplar arasında karşılaştırıldı.**BULGULAR:** Çalışmaya 86 (%36,1) yaşlı hasta dahil edildi. Demografik özellikler, başarı ve komplikasyon oranları açısından gruplar arasında anlamlı fark yoktu ( $p>0,05$ ). Genelde taşsızlık oranı yaşlılarda %86,0, genç hastalarda %86,8 idi ( $p>0,05$ ). Çok değişkenli analizde; taş boyutu ( $p=0,032$ , OR=0,202 ve %95 CI=0,047-0,873) ve taş sayısı ( $p=0,002$ , OR=0,067 ve %95 CI=0,012-0,377) yaşlı hastalarda komplikasyonlarla ilişkili bulundu.**SONUÇ:** Perkütan nefrolitotomi yaşlı hastalarda güvenle ve yüksek başarı ile uygulanabilir. Taş sayısı ve yükü fazla olan geriatric hastalarda PNL için komplikasyon riskinin arttığı unutulmamalıdır.**Anahtar Kelimeler:** Nefrolitotomi, Perkütan, Yaşlı, Güvenlik<sup>1</sup> Kütahya SBÜ Faculty of Medicine, Department of Urology, Kutahya, Turkey

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**Sorumlu Yazar / Corresponding Author:**Okan ALKIŞ  
Kütahya SBÜ Faculty of Medicine, Department of Urology, Kutahya, Turkey  
Gsm: +90 532 648 72 97 E-mail: okanalks@hotmail.com**Yazar Bilgileri / Author Information:**Okan ALKIŞ (ORCID :0000-0001-6116-9588),  
İbrahim Güven KARTAL (ORCID :0000-0002-2313-3522) E-mail: igk84@hotmail.com,  
Bekir ARAS (ORCID :0000-0002-7020-8830) E-mail: bekiraras1@gmail.com,  
Mehmet SEVİM (ORCID :0000-0002-7571-7669) E-mail: drmehmetsevim@gmail.com,  
Oğuzhan Yusuf SÖNMEZ (ORCID :0000-0003-1538-867X)  
E-mail: oguzhanyusufsonmez@gmail.com*Ethical Approval of this study was obtained from Kütahya Health Sciences University Ethical Committee at 19.08.2020 with decision number 2020/13-14.*

## INTRODUCTION

Many methods have been developed in the treatment of nephrolithiasis, which is an important health problem. Minimally invasive methods that reduce morbidity in treatment have become increasingly popular in recent years. However, among these methods, in percutaneous nephrolithotomy there are more complications that can be serious (1).

People above the age of 65 are considered to be elderly according to the definition of the World Health Organization (WHO) (2). Comorbidities, therefore, the risk of complications generally increase in the elderly. With the increase in life expectancy, the management of stone disease in the elderly has become more important. This situation increases the importance of the minimally invasive PNL procedure in older patients who would have large kidney stones (3).

The average life expectancy in Turkey is rising in parallel to the world average (4). Also, the stone disease is quite common in our country (5). PNL is frequently performed in geriatric patients in our city, which is one of the cities where the elderly population is most concentrated in our country (3, 6). Aim of this study is to reveal the effectiveness and reliability of PNL in elderly patients who are in the high-risk group due to its morbidity.

## MATERIAL AND METHOD

Patients over 18 years of age who underwent PNL in our clinic between January 2015 and January 2020 were evaluated retrospectively. A total of 238 patients were divided into two groups, 86 elderly (above 65 years old) and 152 non-elderly (under 65 years old). The general health status of the patients was evaluated with the American Society of Anesthesiologists (ASA) score. Demographic data and stone-related characteristics, intraoperative and postoperative data, success, and complication rates were compared between groups.

Preoperatively, urine analysis and urine culture were evaluated. Patients with positive urine cultures were operated on when the culture was sterile after antibiotic treatment. All patients were evaluated with non-contrast abdominal computed tomography (CT) before the operation. Stone size was calculated as the longest dimension in CT. Generally, PNL was performed for renal and upper ureteral stones where shock wave lithotripsy (SWL) was unsuccessful and/or on stones that were larger than 2 cm.

Inclusion criteria in our study was determined as having undergone PNL, being over 18 years old, having complete demographic data, preoperative and postoperative abdominal CTs and follow-up data. Patients with missing data and patients with bilateral PNL or urinary anomalies were not included in the study.

Percutaneous Nephrolithotomy was performed under general anesthesia by 4 surgeons with similar experiences.

In the supine position, a ureteric catheter was placed through the ureter orifice with cystoscopy. Then the patient was placed in a prone position. Percutaneous access was applied to the appropriate calyx and/or directly to the stone after contrast administration with an 18-gauge needle under fluoroscopy. After the guidewire was sent to the collector system, it was dilated up to 30F with Amplatz dilators (Cook Medical®) over the guidewire. A nephrostomy catheter was inserted in all patients. Urethral catheters were removed on the 1st postoperative day, nephrostomies on the 2nd day.

Being stone-free was considered as having no residual stone on CT in the postoperative 3rd month. The operation time, length of hospital stay, hemoglobin decrease, number of access, puncture level, stone-free rates, re-treatment rates, auxiliary procedures, and complication rates were compared between groups. Complications in the first 30 days post operation were classified according to the modified Clavien grading system (7). The overall success rate was defined as in the postoperative period after additional procedures. Multivariate analysis was performed to determine the factors affecting the complications in the elderly.

The data were analyzed using the SPSS for Windows 24.0 package program (IBM Corp., Chicago, IL). Shapiro-Wilk test was used to show whether the distribution of numerical data was normal. Student t-test was applied to numerical data with normal distribution, and the Mann Whitney U test was applied to numerical data with non-normal distribution. Whether there was a difference between the groups in terms of nominal data was analyzed by Chi-Square and Fisher's Exact tests. Binary logistic regression analysis was used for multivariate analysis of factors that may affect morbidity in geriatric patients. For statistical significance,  $p < 0.05$  was accepted.

## RESULTS

"Ethical Approval of this study was obtained from Kütahya Health Sciences University Ethical Committee at 19.08.2020 with decision number 2020/13-14. Study protocol was in accordance with Declaration of Helsinki." While 86 (36.1%) of the 238 patients who met the study inclusion criteria were in the elderly group, 152 (63.9%) were non-elderly. Age and ASA scores were significantly higher in the elderly than non-elderly ( $p = 0.001$ , respectively). There was no statistically significant difference between the two groups in terms of gender, size, and body mass index ( $p > 0.05$ ). There was no statistical difference between the two groups in terms of stone size, number of stones, stone location, hydronephrosis level, and prior renal stone surgery that could affect PNL surgery (Table 1).

In the evaluation of operative data, there was no significant difference between operation time, hemoglobin decrease, number of tracts, and puncture level ( $p > 0.05$ ). Stone-free was achieved in 71 (82.6%) patients after the first session of PNL in the elderly, while it was achieved in 123 (80.9%)

patients in non-elderly group ( $p > 0.05$ ). The re-treatment was performed in 2 patients, SWL in 2, and Retrograde intrarenal surgery (RIRS) in 2 due to residual stones in the elderly. Success was achieved in 3 more patients after additional treatment, and stone-free was achieved in 74 patients (86.1%). A re-treatment was performed on 4 patients, SWL in 5, and RIRS in 3 patients in non-elderly group. Stone-free was achieved in 9 patients after additional treatment. Thus, stone-free was achieved in a total of 132 patients. (86.8%). There were no significant differences

between the two groups in terms of re-treatment and auxiliary procedure ( $p > 0.05$ ) (Table 2).

There was no difference between the length of hospital stay and complication rates between elderly and non-elderly ( $p > 0.05$ ). Blood transfusion was performed in 7 (7.8%) patients in the elderly group. Complications such as pain, nausea-vomiting, and hematuria were observed in the other 4 geriatric patients, which were resolved with symptomatic treatments. Ureteral stents were placed in

**Table 1. Patients' demographics and stone characteristics**

	<i>Elderly (n=86)</i>	<i>Younger (n=152)</i>	<i>p value</i>
Age (years)	69.2±3.5	47.3±10.5	<b>0.001</b>
Gender (n) (%)			
Male	51 (50.3)	105 (69.1)	0.127
Female	35 (40.7)	47 (30.9)	
Side (n) (%)			
Right	44 (51.2)	74 (48.7)	0.982
Left	42 (48.8)	78 (51.3)	
ASA score (Mean±SD)	2.77±4.52	1.63±0.58	<b>0.001</b>
BMI (kg/m <sup>2</sup> ) (Mean±SD)	27.33±4.57	27.49±4.57	0.789
Previous renal surgery (n) (%)			
No	58 (67.4)	119 (78.3)	0.066
Yes	28 (32.6)	33 (21.7)	
Stone size (cm) (Mean±SD)	2.52±0.96	2.75±1.13	0.114
Number of stone (n) (%)			
Single	52 (60.4)	78 (51.3)	0.179
Multiple	34 (29.6)	74 (48.7)	
Hydronephrosis grade (n) (%)			
No	59 (68,6)	101 (66,5)	0,795
Mild	18 (20,9)	32 (21,1)	
Moderate	8 (9,3)	14 (9,2)	
Severe	1 (1,2)	5 (3,2)	

ASA= American Society of Anesthesiologists score, BMI= Body mass index

**Table 2. Operative characteristics, success and complication rates of groups**

	<i>Elderly (n=86)</i>	<i>Younger (n=152)</i>	<i>p value</i>
Operation time (minute)	80.35±42.74	78.55±34.95	0.726
Length of hospital stay (day)	4.17±1.91	3.85±3.1	0.378
Hemoglobin decrease (mg/dL)	1.07±0.83	1.27±0.86	0.087
Number of access (n) (%)			
Single	83 (96.5)	143 (94.1)	0.544
Multiple	3 (3.5)	9 (5.6)	
Puncture level (n) (%)			
Supracostal	7 (8.1)	8 (5.2)	0.380
Subcostal	79 (91.9)	144 (94.8)	
Stone-free rate (n) (%)	71 (82.6)	123 (80.9)	0.755
Re-treatment (n) (%)	2 (2.3)	4 (2.6)	0.999
Auxillary procedure (n) (%)	4 (4.6)	8 (5.2)	0.836
Overall stone-free rate (n) (%)	74 (86.0)	132 (86.8)	0.863
Complication (n) (%)	14 (16.2)	22 (14.4)	0.709
Grade of complication (n) (%)			
≥ Grade 3	3 (3.5)	4 (2.6)	0.905
< Grade 3	11 (12.7)	18 (11.8)	

2 of the patients due to prolonged urine leakage after the nephrostomy was removed. Three patients had grade 3 complications according to the modified Clavien grading in the elderly. One patient underwent angioembolization after an arteriovenous fistula (AFV) was detected in abdominal CT angiography performed on the 8th postoperative day due to gross hematuria in the elderly group. When urosepsis developed in a different patient, he was followed up with a medical treatment in the intensive care unit. Pleural effusion was seen in one patient regressed with follow-up. Mortality was not observed in any of the patients in both groups (Table 3).

In elderly group, it was concluded that the general characteristics of the patient, age, size, gender, and surgical-related features, the entrance, and access site did not affect the development of complications in PNL surgery in univariate and multivariate analyzes. Previous renal surgery, stone size, and number were found to be factors in the development of complications in univariate analyzes.

In multivariate analysis, it was found that the increase in the number (Odds Ratio (OR)=0.067, 95% Confidence Interval (CI)=0.0047-0.873, p=0.002) and size of stones (OR=0.202, 95% CI=0.047-0.873, p=0.032) was associated with the development of complications (Table 4).

## DISCUSSION

The stone disease should be carefully evaluated because of increased morbidity in the elderly. Also, many parameters should be considered in the selection of the appropriate treatment. While PNL has high complication rates, other minimally invasive procedures such as SWL and URS do not seem innocent due to factors such as increased comorbidity and drug use in the elderly (8, 9). Our study demonstrates that PNL surgery, which has the highest treatment success in large stones, can be used safely in the geriatric population with low morbidity, in parallel with the literature (10-12).

While evaluating the treatment alternatives with low

**Table 3. Complications according to the modified Clavien grading system**

	Grade 1	Grade 2	Grade 3a	Grade 3b	Grade 4a	Grade 4b	Grade 5
Elderly	3	8	3	-	-	-	-
Younger	5	13	4	-	-	-	-

**Table 4. Univariate and multivariate analysis of factors that may affect morbidity in geriatric patients**

	Univariate analysis			Multivariate analysis		
	p-value	OR	95%CI	p-value	OR	95%CI
Age						
≥70	0.228	2.130	0.669-6.788			
<70						
Side						
Right	0.083	3.125	0.896-10.889			
Left						
Gender						
Male	0.171	2.222	0.696-7.096			
Female						
ASA score						
1-2	0.282	0.514	0.151-1.753			
3-4						
Stone size (cm)						
<3	<b>0.004</b>	5.682	1.606-20.997	<b>0.032</b>	0.202	0.047-0.873
≤3						
Number of stone						
Single	<b>&lt;0.001</b>	13.636	2.812-66.118	<b>0.002</b>	0.067	0.012-0.377
Multiple						
Previous renal surgery						
No	<b>0.032</b>	3.467	1.068-11.253	0.101	3.273	0.041-0.806
Yes						
Number of access						
Single	0.417	2.692	0.227-31.905			
Multiple						

ASA= American Society of Anesthesiologists Score, OR= Odds Ratio, CI= Confidence Interval

morbidity, in geriatric patients, success should not be ignored. Effectiveness of PNL for large stones has already been demonstrated many times. It is recommended as the first option for stones larger than 2 cm in the European Association of Urology Guidelines (13). Also, meta-analyses have shown that PNL can be performed safely and with a high success rate in elderly patients (14).

Anagnostou et al. showed that they achieved stone-free 73.3% in the geriatric group with a stone burden of 56.7 mm<sup>3</sup>, indistinguishable from the youth (15). Over the years, stone-free rates in the elderly have also increased and reached 90% in the literature (16). In this case, the experience of the surgeon is also an important factor (17). Also, we performed the PNL procedure in the elderly with high stone-free rates and low complication rates parallel to the literature in our clinic. This situation is considered to be related to the experience of the surgeon, good preoperative evaluation of the patients and careful postoperative follow-up. However, considering the limited number of patients in this study, different results may be obtained in studies with larger patient groups.

Failure management is as important as the success of the operation. In a recent study, Haberal et al. reported that they performed additional procedures at a rate of 3.3% in geriatric patients after PNL (18). Okeke et al. reported in their multicentric prospective study that they performed the additional procedure (URS, SWL, and PNL) after PNL in 15% of elderly patients (19). In our study, PNL was performed on 2 geriatric patients again. Shock wave lithotripsy and RIRS on 4 patients, and stone-free was achieved in 3 more patients parallel to the literature.

Although it is a minimally invasive method, major complications such as colon perforation, AV fistula (AVF), pseudoaneurysm, and sepsis can be seen in PNL (20). In such cases, a multidisciplinary approach with other clinics such as general surgery, anesthesia, and radiology is important (21, 22). In this study, AVF occurred in only 1 geriatric patient. It is a known fact that AVF is usually seen in the late period (23). The patient, who had AVF on the postoperative 8th day, was followed up with a blood transfusion. Angioembolization was performed as the hematuria did not regress during the follow-up.

Predicting which patient may develop complications is also a matter of concern. Although there is different information among the risk factors in terms of complications in PNL, stone size, and the number of stones stands out (24, 25). However, studies designed to determine risk factors for complications in PNL have generally been conducted with all age groups. Studies evaluating risk factors specific to geriatric patients are limited. In this study, stone number and stone size were found to be independent risk factors for the development of complications in geriatric patients. As the number and size of the stones increase, the duration of the operation, the number of access, and the manipulations in the kidney may increase. This situation increases

the risk of postoperative complications, especially bleeding. Considering that the elderly patients are frail and more susceptible to complications, it is argued that it is necessary to approach more carefully when the stone burden is high. Also, in patients with severe comorbidities, alternative treatment methods should be considered by calculating the profit-loss ratio well.

Some of the limitations of this study are the retrospective and single center design. Although the number of patients is limited compared to other studies, it is considered that this study may be a guide for performing PNL in geriatric patients and contribute to the literature. While stone analysis and disregarding the surgeon's experience are also important limiting factors, it is argued that these limitations can be overcome with well-planned prospective studies.

## CONCLUSION

Percutaneous Nephrolithotomy can be achieved with high success and low complication rate in stone disease, which is an important problem in the elderly. The risk of complications for PNL increased in geriatric patients with high number of stones and stone volume. The factors mentioned should be taken into account in the management of stone disease treatment in the elderly.

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## REFERENCES

- 1.)Wollin DA, Preminger GM. Percutaneous nephrolithotomy: complications and how to deal with them. *Urolithiasis*. 2018; 46: 87-97.
- 2.)World Health Organization. Psychogeriatrics Report of a WHO scientific group. *World Health Organ Tech Rep Ser* 1972; 507: 1-48.
- 3.)Akman T, Binbay M, Ugurlu M, et al. Outcomes of retrograde intrarenal surgery compared with percutaneous nephrolithotomy in elderly patients with moderate-size kidney stones: a matched-pair analysis. *J Endourol*. 2012; 26: 625-29.
- 4.)Beard JR, Officer A, de Carvalho IA, et al. The World report on aging and health: a policy framework for healthy aging. *Lancet*. 2016; 387: 2145-54.
- 5.)Muslumanoglu AY, Binbay M, Yuruk E, et al. Updated epidemiologic study of urolithiasis in Turkey. I: Changing characteristics of urolithiasis. *Urol Res*. 2011; 39: 309-14.
- 6.)řahin S, Ertođral O, Yarıcı MA. Türkiye'de 3 Yař Grubu Nüfusun İllere Göre Deđişiminin Cođrafı Bilgi Sistemleri İle Analizi. *Journal of International Scientific Researches*. 2019; 4: 292-304.
- 7.)Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*. 2004; 240: 205-13.



- 8.)Sighinolfi MC, Micali S, Grande M, et al. Extracorporeal shock wave lithotripsy in an elderly population: how to prevent complications and make the treatment safe and effective. *J Endourol.* 2008; 22: 2223-6.
- 9.)Gokcen K, Dundar G, Bagcioglu M, et al. Safety and Efficacy of RIRS in Geriatric Patients: A Comparative Evaluation on an Age Based Manner. *Urol J.* 2020; 17: 129-33.
- 10.)Abedali ZA, Large T, Heiman JM, et al. Percutaneous Nephrolithotomy in the 80 Years of Age and Older Population. *Urology.* 2019; 134: 62-5.
- 11.)Sahin A, Atsu N, Erdem E, et al. Percutaneous nephrolithotomy in patients aged 60 years or older. *J Endourol.* 2001; 15: 489-91.
- 12.)Karami H, Mazloomfard MM, Golshan A, et al. Does age affect outcomes of percutaneous nephrolithotomy? *Urol J.* 2010; 7: 17-21.
- 13.)Turk C, Petrik A, Sarica K, et al. EAU Guidelines on Interventional Treatment for Urolithiasis. *Eur Urol.* 2016; 69: 475-82.
- 14.)Haider R, Regnier P, Roustan FR, et al. (Percutaneous nephrolithotomy for kidney stones in elderly patients: Meta-analysis of results and complications). *Prog Urol.* 2017; 27: 58-67.
- 15.)Anagnostou T, Thompson T, Ng CF, et al. Safety and outcome of percutaneous nephrolithotomy in the elderly: retrospective comparison to a younger patient group. *J Endourol.* 2008; 22: 2139-45.
- 16.)Buldu I, Tepeler A, Karatag T, et al. Does aging affect the outcome of percutaneous nephrolithotomy? *Urolithiasis.* 2015; 43: 183-7.
- 17.)Huang WY, Wu SC, Chen YF, et al. Surgeon volume for percutaneous nephrolithotomy is associated with medical costs and length of hospital stay: a nationwide population-based study in Taiwan. *J Endourol.* 2014; 28: 915-21.
- 18.)Haberal HB, Gudeloglu A, Deger M, et al. Percutaneous Nephrolithotomy in Young-Old, Old-Old, and Oldest-Old Patients: a Multicenter Study. *J Laparoendosc Adv Surg Tech A.* 2021; 31: 796-802.
- 19.)Okeke Z, Smith AD, Labate G, et al. Prospective comparison of outcomes of percutaneous nephrolithotomy in elderly patients versus younger patients. *J Endourol.* 2012; 26: 996-1001.
- 20.)Knoll T, Daels F, Desai J, et al. Percutaneous nephrolithotomy: technique. *World J Urol.* 2017; 35: 1361-8.
- 21.)Tefekli A, Ali Karadag M, Tepeler K, et al. Classification of percutaneous nephrolithotomy complications using the modified clavien grading system: looking for a standard. *Eur Urol.* 2008; 53: 184-90.
- 22.)Dikicier E, Kamburoğlu M, Gönüllü E, et al. Surgical outcomes in elderly patients with obstructed colorectal cancer: Single center experience. *Ankara Eğitim ve Araştırma Hastanesi Tıp Dergisi.* 2020; 53: 196-201.
- 23.)Un S, Cakir V, Kara C, et al. Risk factors for hemorrhage requiring embolization after percutaneous nephrolithotomy. *Can Urol Assoc J.* 2015; 9: 594-8.
- 24.)Meng X, Bao J, Mi Q, et al. The Analysis of Risk Factors for Hemorrhage Associated with Minimally Invasive Percutaneous Nephrolithotomy. *Biomed Res Int.* 2019; 30:8619460.
- 25.)Rashid AO, Fakhulddin SS. Risk factors for fever and sepsis after percutaneous nephrolithotomy. *Asian J Urol.* 2016; 3: 82-7.

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