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EFFICACY AND SAFETY OF PERCUTANEOUS NEPHROLITHOTOMY IN ELDERLY PATIENTS: EXPERIENCE OF 128 CASES

YAŞLI HASTALARDA PERKÜTAN NEFROLİTOTOMİNİN ETKİNLİĞİ VE GÜVENİLİRLİĞİ: 128 VAKA DENEYİMİ

Kadir Karkin[1], Ediz Vuruşkan[1]

1 *Adana City Training and Research Hospital, Department of Urology, Adana, Türkiye*

Sorumlu Yazar/Corresponding Author: Kadir Karkin E-mail: kadir_karkin@msn.com

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Abstract

Aim: This study aimed to evaluate the efficacy and safety of percutaneous nephrolithotomy in elderly patients (≥65 years) with kidney stones > 2 cm in size.

Methods: Patients aged ≥65 years who underwent percutaneous nephrolithotomy for kidney stones between January 2015 and January 2022 were included in this study. Patient profiles, preoperative stone data, operative information, and postoperative complications were reviewed. We applied the Guys Stone score to predict the net results of percutaneous nephrolithotomy.

Results: Percutaneous nephrolithotomy was performed on 128 geriatric patients. Of these patients, 68 (53.1%) were male and 60 (46.9%) were female. The mean age was 69.87 ± 7.06 (65–80) years. The mean stone size was 28.7 ± 6.5 mm (22–46 mm). The mean operative time was 90.33 ± 40.56 min and fluoroscopy time was 5.16 ± 2.81 min. The reentry catheter was removed after an average of 3.21 ± 1.82 days. The mean duration of hospital stay was 3.17 ± 2.19 days. The stone-free survival rate was 90.6%. Transfusion was performed in four (3.1%) patients due to hemorrhage, and urine extravasation from the re-entry tract occurred in eight (6.2%) patients, and this required Double j-stent placement. When the four Guys stone score groups were compared, there was a statistically significant difference in stone-free rates (p = 0.001).

Conclusions: According to our results, percutaneous nephrolithotomy is a safe and effective treatment option for nephrolithiasis in the elderly, with high stone-free and acceptable complication rates.

Keywords: Elderly patients, percutaneous nephrolithotomy, nephrolithiasis, Guys stone score

Öz

Amaç: Bu çalışmada böbrek taşı> 2 cm olan yaşlı hastalarda (≥65 yaş) perkütan nefrolitotominin etkinlik ve güvenilirliğinin değerlendirilmesi amaçlanmıştır.

Yöntemler: Ocak 2015 ile Ocak 2022 tarihleri arasında böbrek taşı nedeniyle perkütan nefrolitotomi uygulanan 65 yaş ve üzeri hastalar bu çalışmaya dahil edildi. Hasta profilleri, ameliyat öncesi taş verileri, ameliyat bilgileri ve ameliyat sonrası komplikasyonlar gözden geçirildi. Perkütan nefrolitotominin net sonuçlarını tahmin etmek için Guys Stone skorunu uyguladık.

Bulgular: 128 geriatrik hastaya perkütan nefrolitotomi uygulandı. Bu hastaların 68'i (%53,1) erkek, 60'ı (%46,9) kadındı. Ortalama yaş 69.87 ± 7.06 (65-80) yıldı. Ortalama taş boyutu 28.7 ± 6.5 mm (22-46 mm) idi. Ortalama ameliyat süresi 90.33 ± 40.56 dk ve floroskopi süresi 5.16 ± 2.81 dk idi. Yeniden giriş kateteri ortalama 3.21 ± 1,82 gün sonra çıkarıldı. Ortalama hastanede kalış süresi 3.17 ± 2.19 gündü. Taşsız sağkalım oranı %90,6 idi. Dört hastada (%3,1) kanama nedeniyle transfüzyon yapıldı ve sekiz hastada (%6,2) yeniden giriş yolundan idrar ekstravazasyonu meydana geldi ve bu, Double j-stent yerleştirilmesini gerektirdi. Dört Guys taş skor grubu karşılaştırıldığında, taşsızlık oranlarında istatistiksel olarak anlamlı bir fark vardı (p = 0.001).

Sonuç: Sonuçlarımıza göre, perkütan nefrolitotomi, yaşlılarda nefrolitiazis için yüksek taşsızlık ve kabul edilebilir komplikasyon oranları ile güvenli ve etkili bir tedavi seçeneğidir.

Anahtar Kelimeler: Yaşlı hastalar, perkütan nefrolitotomi, nefrolitiazis, Guys taş skoru

Introduction

The elderly constitutes 10–12% of all patients with stones; the burden of stone disease in elderly patients is expected to increase significantly because of the significant increase in the population of the elderly and metabolic changes due to aging in recent years[1]. Some recent population-based studies have shown that the number of elderly patients who receive treatment for kidney stones and the proportion in the general population are increasing daily[2,3]. Aging is the most important risk factor for perioperative complications and all possible adverse outcomes. Additionally, comorbid diseases are more common in the elderly, which may affect treatment decisions[4]. Therefore, it is important to manage stones more effectively and safely in elderly populations and to pay attention to this issue. Owing to recent developments in endoscopic instruments and surgical techniques, the success rates of percutaneous nephrolithotomy (PCNL) have increased and complication rates have decreased. However, data on kidney stones in the elderly population are lacking and have been reported by very few centers worldwide[5-7]. This study aimed to evaluate the efficacy and safety of this procedure in elderly patients (aged ≥65 years) who underwent PCNL for kidney stones > 2 cm.

Materials and Methods

This study was approved by the local ethics committee of our tertiary education and research hospital. The operative data of 128 elderly patients who underwent PCNL for kidney stones > 2 cm between January 2015 and January 2022 were retrospectively analyzed. Our study complied with the principles of the Declaration of Helsinki, and informed consent was obtained from each patient. Patients who were > 65 years of age, had normal renal function, had kidney stones > 2 cm, and underwent PCNL were included in the study. Preoperative history was obtained from all patients, and a physical examination was performed. Preoperative urinalysis, urine culture, serum urea and creatinine levels, complete blood cell count, and coagulation tests were performed for all patients. Ultrasound (USG), kidney-ureter-bladder radiography (KUB), and noncontrast abdominopelvic computed tomography (NCCT) were used as imaging modalities. Patients with positive urine cultures were treated with appropriate antibiotics before surgery and underwent surgery after the culture was negative. Stone size was calculated by measuring the longest axis of the stone on preoperative imaging; in those with multiple stones, stone size was determined as the longest axis of the largest stone. The operation time, bleeding requiring transfusion, number of percutaneous accesses, and complication rates were evaluated intraoperatively, and the mean hospital stay and nephrostomy time, urinary tract infection rate, leakage rate from the nephrostomy tract, fever rate, and complication development rate were evaluated postoperatively. KUB radiography was taken on the 1st postoperative day. Clavien degree of complication was used to assess complications. The stone-free rate (SFR) was evaluated using KUB radiography for opaque stones and CT for non-opaque stones. Kidney ultrasonography was performed 1 month after the operation. CT scans were not considered, except for patients with non-opaque stones who were in between owing to excessive radiation concerns. To estimate the net results of PCNL, we applied the Guys stone score (GSS), a 4 categorical rating according to the complexity of the stones, as described by Thomas et al[8].

- *Surgical Technique*

Standard PCNL was applied to all patients using a one-stage procedure in the prone position under general anesthesia. In the lithotomy position, a 6 Fr multi-hole ureteral catheter was inserted into the pelvicalyceal system using a cystoscope and fixed to the urethral Foley catheter. The patient was then placed in the prone position, and the

pelvicalyceal system was visualized with fluoroscopic guidance through an opaque 6 Fr ureteral catheter. Renal access was achieved by entering the appropriate calyx with an 18-gauge needle, and a guidewire was placed and fixed. After a 0.5-cm skin incision was made, a Renax tube was inserted through the guide wire by serial dilation up to 24–28 Fr with an Amplatz dilator. After detecting the stone using nephroscopy (Wolf), lithotripsy was performed using a pneumatic lithoclast, and the stone particles were removed with forceps. A nephrotomy tube was routinely placed in all patients at the end of the surgery. A double-J stent was inserted antegrade only in patients with suspected stenosis or injury at the ureteropelvic junction or in patients with severe edema. Usually, the nephrostomy tube is removed on the third postoperative day. The stents were removed with sedation or short-term general anesthesia in the 1st postoperative month in patients who had a double-J stent implanted.

- *Statistical Analysis*

Continuous variables are expressed as means and standard deviations. Categorical variables are presented as numbers and percentages. All statistical analyses were performed using Statistical Package for the Social Sciences (SSPS) software version 13.0 (IBM, SPSS Inc., Chicago, USA). One-way ANOVA was used to compare continuous variables. The chi-square test was used to compare categorical values in the different Guy stone score subgroups. P-values < 0.05 indicated statistical significance.

Results

The mean age of the patients was 69.87 ± 7.06 (65–80) years. Overall, 68 (53.1%) patients were male and 60 (46.9%) were female. The mean stone size was 28.7 ± 6.5 mm (22–46 mm). Many stones (57.8%) were located in the pelvis and were opaque (84.3%).

Table 1. Demographic characteristics of 128 elderly patients who underwent percutaneous nephrolithotomy (PNL).

Gender	Male	68 (%53.1)
	Female	60 (%46.9)
Age (years)[Y]		69,87 ± 7,06 (65-80)
Comorbidities	DM	48 (37.5%)
	HT	62 (48.4%)
	IHD	10 (7.8%)
	UTI	17 (15.17%)
Stone size (mm)[Y]		28.7 ± 6.5, 22–46
Stone location[X]	Renal pelvis	74 (57.8%)
	Renal pelvis /Lower pole	22 (17.1%)
	Staghorn	16 (12.5%)
	Multiple	16 (12.5)
Stone laterality[X]	Right	58 (45.3%)
	Left	70 (54.7%)
Radiopacity of stone[X]	Opaque	108 (84.3%)
	Lucent	20 (15.6%)
Hydronephrosis[X]	Mild	77 (60.1%)
	Moderate	36 (28.1%)
	Severe	15 (11.7%)
Preoperative HB (g/dl)[Y]		13.4 ± 2.6, 11–15.6
Preoperative BUN (mg/dl)[Y]		15 ± 3.2, 12–23
Preoperative creatinine (mg/dl)[Y]		1.4± 0.56, 0.8–2.5

[x]Data were presented as n (%). [y]Data were presented as mean ± SD, range.ESWL, extracorporeal shock wave lithotripsy; HB, hemoglobin; mm, millimeter; UTI, urinary tract infection; BUN, blood urea nitrogen; DM (Diabetes Mellitus); HT (Hypertension); IHD (ischemic heart disease)

Table 2. Outcome and complications of PNL surgery of 128 elderly patients.

Stone clearance status[x]		Early stone free	112 (87.5%)
		Final stone free	116 (90.6%)
Puncture site [X]		Upper calyx	26 (20.3%)
		Middle calyx	36 (28.1%)
		Lower calyx	55 (42.9%)
		Multiple calyx	11 (8.5%)
Operation time (min)[Y]			90.33 ± 40.56
Fluoroscopy screening time (min)[Y]			5.16 ± 2,81
Nephrostomy duration (day)[X]			3,21 ± 1,82
Postoperative hospitalization (day)[Y]			3,17± 2,19
Complications	Grade 1[X]	Fever	5 (3.9%)
		Blood transfusion	4 (3.1%)
	Grade 2[X]	Urine leakage	8 (6.2%)
		Infection (UTI)	5 (3.9%)
	Grade 3[Y]	DJ placement for urine leakage	8 (6.2%)
		Residual	8 (6.2%)
	Grade 4[X]	Urosepsis	2 (1.5%)
		Visceral injury	0 (0.00%)
	Grade 5[X]	Death	0 (0.00%)

[x]Data were presented as n (%). [y]Data were presented as mean ± SD, range.
DJ, double J; UTI, urinary tract infection.

The most frequent preoperative complication was grade 1 hydronephrosis (84.3%). In 55 (42.9%) patients, the lower calyx was affected, the middle calyx was affected in 36 (28.1%) patients, the upper calyx in 26 (20.3%) patients, and 11 (8.5%) patients had stones in multiple calyces. The mean operative time was 90.33 ± 40.56 min, and fluoroscopy time was 5.16 ± 2.81 min (Table I). The reentry catheter was removed after an average of 3.21 ± 1.82 days. The mean hospital stay was 3.17±2.19 days. The early stone-free rate was 87.5%, and the final stone-free rate was 90.6%. While transfusion was performed in four (3.1%) patients due to bleeding, urine extravasation occurred in eight (6.2%) patients from the re-entry tract, which required DJ stent placement. Angioembolization was performed in two (1.5%) patients after severe hematuria using interventional radiology.

Table 3. Results according to Guys stone score (GSS) categorization

Variables	GSS-1	GSS-2	GSS-3	GSS-4	*p*-value
Stone free	81/86 (94.1%)	22/26 (84.6%)	7/10 (70%)	4/6 (66.6%)	0.001*
Hospital stays	3±1.3	3±1.1	3±0.8	3.2±1.4	0.7
Complications	9 (16.6%)	3 (27.2%)	2 (33.3%)	2 (25%)	0.9

Data were presented as n (%) and mean ± SD, range. $p \leq 0.05$

Five (3.9%) patients were treated with 7 days of IV antibiotic therapy because of postoperative fever and urinary tract infection (UTI). Urosepsis was seen as a clavian grade 4 complication in only two patients (Table II). When the four Guys stone score (GSS) groups were compared, there were statistically significant differences in stone-free rates (Table III). However, no significant difference was observed in the length of hospital stay and complications among the four GSS category patients (Table III).

Discussion

Surgery in elderly patients is associated with many challenges. In this population, various complications and undesirable results may occur as a result of age-related changes in the cardiovascular, pulmonary, nervous, metabolic, and locomotive systems[9,10]. However, owing to advances in endoscopic technologies and expertise, percutaneous nephrolithotomy (PCNL) has become easier to perform, even in advanced age, and appears to be as effective and safe as in the standard adult population[5].

The main indicator of success in PCNL can be defined as the patient getting rid of the stone with minimal damage. Anagnostou et al[11] In their study, in which they evaluated 779 patients in two groups comprising individuals who were over 70 years old and those less than 70 years old. However, they found no difference between the two groups in terms of complications, complete stone-free rates, and clinical success rates. Similar to this study, a study by Nakamon et al[12] showed that there was no significant difference between the two groups in terms of operation time, complete stone-free rate, hospital stay, and complications. Stoller et al[5] reported that the complete stone-free rate was 82% at the third-month follow-up in 33 elderly patients who underwent PCNL. Although there was no young control group in our study, stone-free (90.6%) and complication rates were similar to those reported in the literature.

Although some studies[13] have shown that critical complications after PCNL are rare and death is not observed in elderly patients, studies have reported the need for a relatively higher blood transfusion rate in this age group. While blood transfusion was administered to only four patients (3.1%) in our study, high blood transfusion rates of up to 12% have been reported in some studies[14]. Sepsis is an important complication of PCNL. Nakamon et al[12] reported that the incidence of sepsis in the elderly group was 6% versus 13%; however, high urine culture positivity in elderly patients in the preoperatively led to an increase in the incidence of sepsis, but the difference was not statistically significant. In our study, no difference was observed in sepsis rates between the different GSS category groups (Table III). After the PCNL procedure, only two patients (1.5%) had sepsis. We believe that this success is due to the specific patient selection and extra care given to the patients preoperatively (for example, no patient was treated without culture-negative, nephrostomy catheter, or double-J stent placement in patients with infected kidneys before PCNL).

One of the common complications of PCNL is fever. Seitz et al[15] İn a systemic review that evaluated PCNL complications, reported that fever is a common complication after PCNL, and the overall incidence is as high as 10.8%. However, as can be seen in Table II, the complications in our study were minor, and the rates of fever and sepsis were low (3.9–1.5%).

Studies on the safety of PCNL in the elderly have recently been published. Okeke et al[16] compared PCNL in elderly and young patients and reported that the hospital stay was longer in elderly patients than in younger patients (approximately 5 days vs. 3 days). Ozturk et al[17] in their study which had a small sample size, reported that the tubeless PCNL procedure can be safely applied in the elderly population. However, in these studies, complications or stone complexity in elderly patients undergoing PCNL was not studied. The most important strength of

our study is that we divided elderly patients into Guys stone score groups to rank complications, and to examine the differences in the results based on these categories.
The present study has some limitations. First, the study has a retrospective study design that reflects single-center results. Although the incidence of stones in this age group was lower than that in the younger group, we believe that the number of patients was sufficient, thus increasing the reliability of the statistical analysis. Second, biochemical analyses of the stones could not be performed.

Conclusion

The results of our study showed that PCNL is a safe and effective treatment option for elderly patients with nephrolithiasis due to its high stone-free and acceptable complication rates. Elderly patients with a low Guys stone score were found to have a higher stone-free rates than those with a high score.

Author contributions

All authors contributed to the study conception and design. All authors read and approved the final manuscript.

Conflict of interest

The authors declare that they have no conflict of interest.

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Ethical approval

In accordance with the 1964 Helsinki Declaration, our study was approved by the clinical research ethics committee of the Health Sciences University, Adana City Training and Research Hospital (Date: 21.04.2022, number: 1907). Informed written consent was obtained from all individual participants included in the study.

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