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Original Article

Evaluation of the Factors Affecting Percutaneous Success and Complications of Nephrolithotomy

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ABSTRACT

Objective: Nowadays, surgical procedures become more reliable as urinary system stone disease begins to be treated with minimally invasive methods. Percutaneous nephrolithotomy (PNL) is the first treatment option for kidney stones >2 cm. An increase in postoperative stone-free (SF) rates due to improvements in technology and experience, operation, and hospital stay is reduced. Over time, complications of PNL have been reduced and more standardized with classifications similar to the developed Clavien grading system. The aim of the present study was to comparatively investigate the factors that are considered to affect success and complications in PNL operation.

Methods: The present study included 928 patients (1011 renal units) who underwent PNL operation between November 2004 and January 2013 in our clinic. These patients had preoperative (sex, age, body mass index (BMI), operation side, previous stone operations, hydronephrosis and grade, stone localization, stone area, and volume), operative (operation time, fluoroscopy time, number of access, and calyces of access), and postoperative (hemoglobin, hematocrit, complication, transfusion, stone removal, nephrostomy withdrawal time, length of hospital stay, and need for additional intervention). The complications that occurred during and after the operation were classified according to the modified Clavien system. Subsequently, patients were divided into two groups: patients with complications (Group 1) and those with no complications (Group 2). The groups were analyzed comparatively.

Results: Overall, 628 male and 383 female (M/F: 8/5) patients were included in the study. The mean age of the patients was 41.9 years. Of the evaluated operations, 185 had minor or major complications, and 826 had no complications. Complications in PNL operation are classified according to the modified Clavien grading: 23 (2.27%) complications in grade 1, 143 (14.14%) complications in grade 2, 11 (1.08%) complications in grade 3A, 6 (0.59%) complications in grade 3B, 4 (0.39%) complications in grade 4A, and 15 (4.48%) complications in grade 4B. No complication according to grade 5 was observed. Statistically, stone size, preoperative hydronephrosis grade, time of operation and fluoroscopy, length of stay in the hospital, and SF rates were found to be effective parameters on complication development in both groups ($p<0.05$). Age, gender, BMI, number of access to the kidney, and postoperative complications were not found to be effective parameters in terms of complication development ($p>0.05$).

Conclusion: PNL is an effective and reliable method for the treatment of urinary stone disease. Most of the complications are minor. Stone size, presence of preoperative hydronephrosis, long operation times, and excessive access to the kidney collecting system increase the complication rates. Another important result obtained in the present study is that the complication rates are higher in patients with high SF rates than in other patients.

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INTRODUCTION

Urinary system stone disease plays a significant role in daily urology practice. It has been affecting humans since the first ages. Until the 1980s, surgical procedures were applied to a considerable number of patients owing to urinary tract stones with ensuing renal loss. Endoscopic and minimally invasive methods are the gold standard of treatment of stone disease considering that urinary system stones recur on an average of 50% of the cases within 10 years.[1]

The prevalence of urinary system stone disease varies between 2% and 15% and may show regional and ethnic differences.[2,3] The prevalence rates are 2%–3% in the United States, 3%–11% in Europe, 7% in Japan, and 14.8% in Turkey and have risen to approximately 20% in Arab countries dominated by warm climate.[3–7] In 1989, in the questionnaire survey conducted with 1500 individuals from 14 regions in Turkey, it was found that 2.2% of the survey responders were contracting stone disease at least once in their lifetime.[3] The incidence of urinary system stone disease is high in North India, Pakistani, North Australia, Central Europe, China, Central America, and Scandinavian and Mediterranean countries. All of these findings emphasize that the urinary system stone disease is endemic in Turkey.

Today, the treatment approaches to kidney stones depend on the stone size and consist of extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PNL), retrograde intrarenal surgery (RIRS), laparoscopic surgery, open surgery, and combination treatment according to the condition of the patient. Owing to technological developments, RIRS and percutaneous surgery reduced the incidence of open surgery to 0.7%–4%, and PNL has become the first alternative in the treatment of large renal stones.[8]

MATERIAL AND METHODS

Between November 2004 and January 2013, we included 1011 renal units that were subjected to PNL in our clinic. For each unit, preoperative (gender, age, body mass index (BMI), operation side, previous stone operations, renal ectasia and grade, stone localization, stone area, and volume), operative (operative time, fluoroscopy time, number of renal accesses, and calyx to be accessed), and postoperative (hemoglobin, hematocrit, complications, transfusion procedures, stone-free (SF) rates, nephrostomy withdrawal time, and need for additional interventions) parameters were evaluated retrospectively. Cases were categorized as those who developed and did not develop complications. Complications were graded according to the modified Clavien system. Life-threatening complications were taken into consideration.

Patients with bleeding diathesis, solitary kidneys, urinary tract infections, retrorenal colon, and renal tumor were excluded from the study. Informed consent was obtained from all patients before the operation. Preoperative, operative, and postoperative data of the cases were compared. On computed tomography (CT), the stone area was calculated by multiplying the longest diameter with the longest diameter intersecting it perpendicularly and expressed in mm2. On the other hand, the stone volume was estimated using coronal and axial sections. If there were more than one stone, stone load was calculated for each stone separately, and their sum was the total stone burden. Postoperatively, opaque stones were evaluated using direct urinary system X-rays (kidney, ureter, and bladder (KUB)), and non-opaque stones using urinary tract ultrasonography (USG) or CT. During preoperative preparation, laboratory analyses including urine cultures and radiological imaging studies of all patients were performed. According to the results of the antibiograms, patients with urine cultures were treated with appropriate antibiotics to ensure that their urine was sterile.

After induction of general anesthesia, a 6F open-ended ureter catheter was inserted ipsilaterally and fixed to the Foley catheter, which would provide delivery of contrast material for opacification and dilatation of the cavities of the collecting system with the patient in the lithotomy position. Patients were then turned into a prone position on a table compatible with the C-arm, and under fluoroscopic control, a percutaneous access needle (18G Percutaneous Access Needle; Boston Scientific Corporation, Natick, MA, USA) was inserted into the appropriate calyx visualized at various planes with the aid of the C-arm. A guidewire (Sensor Guide Wire; Boston Scientific Corporation) was placed in the collecting system, and the access path was dilated up to 14F over the guidewire. A second guidewire was advanced for safety purposes over dual-lumen catheter (Dual Lumen Ureteral Access Catheter; Cook Medical, IN, USA), and then dilations up to 30F were performed using a balloon dilator (NephroMax Microvasive High Pressure Balloon Catheter; Boston Scientific Corporation) or Amplatz dilators (Amplatz Renal Dilator Set, Cook Medical). A 26F nephroscope (Karl Storz GmbH, Tuttlingen, Germany) was advanced into the collecting system through a 30F Amplatz sheath. Then, the stones were fragmented with the aid of pneumatic, ultrasonic lithotriptors or both (Swiss LithoClast; EMS, Nyon, Switzerland), and the fragments were extracted using endoscopic graspers. After the operation, a 14F nephrostomy tube (Malecot Nephrostomy Catheter; Cook Medical) was placed and fixed to the skin, and the procedure was terminated.

On postoperative day 1, patients with opaque stones were evaluated using KUB, and those with non-opaque stones using urinary USG or CT. Asymptomatic stone fragments <4 mm that did not cause obstruction and/or infection were accepted as clinically insignificant residual fragments (CIRFs), and particles >4 mm were accepted as residual

fragments. Nephrostomy tubes of patients with complete SF, CIRF, or without complication; fever; and hemorrhage were clamped. Nephrostomy tubes of patients without pain were removed. A double J ureter catheter was inserted in case of urine leakage lasting >48 h. Where necessary, ureterorenoscopy and ESWL were evaluated as additional treatment options. In cases where SF or CIRF was achieved, the PNL surgery was considered "successful."

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) for Windows 15.0 program. Findings were classified into two groups: those with and without complications. Statistical methods (mean and standard deviation) as well as descriptive statistical methods (Student's t-test) and Mann–Whitney U test were used for comparison of two parameters with normal distribution. Paired sample t-test was used for intragroup, preoperative, and postoperative comparisons of the parameters. Chi-square test was used for comparison of qualitative data. A p value <0.05 was accepted as statistically significant.

RESULTS

The study included 1011 PNL operations performed on 980 renal units of 928 patients. A total of 1011 PNL interventions were performed, including 952 unilateral single session and 28 bilateral single session PNL operations. PNL operations in 31 patients were performed at a second session. All operations were divided into two groups: those associated with (Group 1) and without (Group 2) complications (Table 1). Any statistically significant difference was not detected between the groups in terms of age, gender, BMI, operation side, and patients who had previous intervention. The mean stone area of complicated cases was found to be statistically significantly higher than that of cases without complications (p=0.014; p<0.05). The mean stone area and volume of the complicated cases were found to be statistically higher than those of cases without complication. Complications demonstrated a negative correlation with operative success rates, and success rate decreased as the stone load increased (p=0.01; p<0.05). Therefore, PNLs associated with the development of complications were terminated prematurely, especially due to perioperative bleeding.

In both groups, mostly access into the lower calyx was attempted, and manipulations were made through a single working channel (Table 2). A significant difference was not found between both groups as for the number of working channels, whereas operative and fluoroscopy times were

Table 1. Demographic characteristics of the cases

	Patients who developed complications (n=185)	Patients who did not develop complications (n=826)	p
	Mean±SD (Median)	Mean±SD (Median)	
Age (years)[+]	41.87±15.68	41.97±15.25	0.936
Body mass index (kg/m^2)[+]	26.86±6.21	26.52±7.45	0.567
Stone area (mm^2)[++]	950.75±712.62 (707)	888.71±874.98 (589)	0.014*
Stone volume (mm^3)[++]	3899.03±3351.91 (2703)	3751.14±3176.67 (1977)	0.001**
Grade of preoperative hydronephrosis[++]	1.59±1.25 (2)	1.20±1.15 (1)	0.001**
	n (%)	n (%)	
Gender[+++]			
Male	110 (59.5)	518 (62.7)	0.410
Female	75 (40.5)	308 (37.3)	
Percutaneous nephrolithotomy[+++]			
Right	102 (55.1)	396 (47.9)	0.077
Left	83 (44.9)	430 (52.1)	
Preoperative presence of hydronephrosis[+++]	136 (73.5)	534 (64.6)	0.021*
Previous treatment interventions[+++]			
Open surgery	27 (14.6)	145 (17.6)	0.333
Extracorporal shock wave lithotripsy	40 (21.6)	182 (22.0)	0.903
Percutaneous nephrolithotomy	24 (13.0)	75 (9.1)	0.107

[+]Student's t-test. [++]Mann–Whitney U test. [+++]Chi-square test. *p<0.05. **p<0.01.

Table 2. Evaluation of calyceal locations accessed and the number of access sites according to groups*

	Group-I	Group-2	p
	n (%)	n (%)	
Calyces accessed			
Upper	14 (7.6)	68 (8.2%)	0.982
Middle	32 (17.3)	166 (20.1)	
Lower	85 (45.9)	357 (43.2)	
Upper-Middle	11 (5.9)	51 (6.2)	
Upper-Lower	9 (4.9)	40 (4.8)	
Middle-Lower	22 (11.9)	98 (11.9)	
Upper-Middle-Lower	11 (5.9)	44 (5.3)	
Upper-Lower-Lower	1 (0.5)	2 (0.2)	
Number of entries			
1	149 (80.5)	650 (78.7)	0.830
2	25 (13.5)	127 (15.4)	
3	11 (5.9)	47 (5.7)	
4	0 (0.0)	2 (0.2)	

Table 3. Evaluation of operative and fluoroscopy times and mean number of entries

	Group-I	Group-2	p
	Mean±SD (Median)	Mean±SD (Median)	
Operative time (min)+	135.02±48.08	122.58±49.36	0.002**
Fluoroscopy time (min)++	6.30±4.80 (5)	5.72±5.32 (4)	0.003**
Number of entries++	1.25±0.55 (1)	1.27±0.57 (1)	0.599

*Chi-square test. **p<0.01. +Student's t-test. ++Mann–Whitney U test.

significantly higher in Group 1 (Table 3).

The groups were evaluated for bleeding complications, and a statistically significant difference was found between preoperative and postoperative hemoglobin and hematocrit values (Table 4). In addition, the rates of blood transfusions performed (73%) and complications (0.2%) were found to be statistically significantly higher in complicated cases (p=0.001; p<0.01). Patients who developed complications had statistically significantly longer hospital stays (p=0.043; p<0.05). The dwell time of nephrostomy tubes was found to be statistically significantly longer in patients who developed complications (p=0.001; p<0.01) (Table 4). The SF rate in Group 2 (71.2%) was significantly higher than that in Group 2 (48.1%) (p=0.001, p<0.01) (Table 5).

The average overall complication rate was 18.29% in all cases. The number of complications classified according to the modified Clavien grading system was as follows: grade 1 (n=23, 2.27%), grade 2 (n=143, 14.14%), grade 3A (n=11, 1.08%), grade 3B (n=6, 0.59%), grade 4A (n=4, 0.39%), and grade 4B (n=15, 1.48%), whereas any grade 5 complication was not seen. In Group 1, 196 complications developed in 185 patients due mostly to bleeding. Disseminated intravascular coagulation developed in 2 (0.19%) and acute renal failure in 1 (0.09%) patients, and nephrectomy was performed in 1 (0.09%) patient. Renal angiography was performed in 3 (0.29%) patients due to serious decrease in hemoglobin and hematocrit values caused by bleeding despite the fact that the nephrostomy catheter was clamped for 24 h. During renal angiography, lacerated renal vessel was detected in 2, and pseudoaneurysm in one patient, and selective angioembolization was performed using metallic coils.

Two (0.19%) patients who underwent PNL developed colon perforation, and one patient jejunum perforation. Hemothorax developed in 1 (0.09%) patient during supracostal access into the upper calyx. Postoperative urinary tract infection was seen in 24 (2.37%) patients after PNL. Antibiotherapy was started in accordance with the results

Table 4. Comparison of postoperative data of the groups

	Group-I	Group-2	p
	Mean±SD (Median)	Mean±SD (Median)	
Postoperative hemoglobin decrease (g/dL)+	-3.07±1.52	-1.92±1.00	0.001**
Postoperative hematocrit decrease (%)+	-8.69±4.27	-5.12±2.75	0.001**
Postoperative hematocrit decrease (%)+	-21.35±9.53	-12.17±6.07	0.001**
Length of hospital stay (days)++	5.88±4.34 (6)	5.17±2.46 (5)	0.043*
Dwell time of the nephrostomy tube (days)++	4.11±2.93 (4)	3.18±1.45 (3)	0.001**
Blood transfusion rate (n,%)+++	135 (73.0%)	2 (0.2%)	0.001**

+Student t test,++ Mann Whitney U test; +++ chi-square test.

Table 5. Intergroup comparison of stone-free rates

	Group-1	Group-2	p
	n (%)	n (%)	
Stone clearance+			0.001**
No	96 (51.9)	238 (28.8)	
Yes	89 (48.1)	588 (71.2)	

*Student's t-test. **p<0.01. *p<0.05. +Chi-square test.

of blood/urine culture and antibiogram. Subsequently, 12 (1.18%) of these patients had sepsis, and disseminated intravascular coagulation developed in 1 (0.09%) patient. Postoperatively, 1 (0.1%) patient had coughing and fever, and antibiotherapy was started after the consolidation area was observed in the chest X-ray. Four (0.39%) patients developed perforation in the collecting system during PNL. No additional procedure was performed except a nephrostomy catheter was left in situ for 1 week. Urine leak from the catheter site 24 h after withdrawal of the nephrostomy catheter seen in 5 (0.49%) patients necessitated insertion of a double J stent. Newly developed ureteropelvic junction stenosis was detected in 3 (0.29%) patients 1 year after PNL operation.

DISCUSSION

In the treatment of kidney stones, complications of open kidney stone surgery decreased since the introduction of PNL in 1976. In addition, many technological developments realized up to now in PNL have made PNL a safe and effective procedure. However, operation-specific complications have not been completely prevented.

In the preoperative evaluation of patients, it was seen that in the elderly, patients with increased BMI, and previously treated patients in whom the urologists attributed higher risk of complication development, PNL did not increase the risk compared with other patients.

In elderly patients, PNL may be considered as an invasive treatment modality owing to reduced body reserve due to the prone position of the patient during PNL and the presence of a greater number of comorbidities in elderly patients.[9] In patients aged ≥65 years who had undergone, higher (85%) SF rates were found, and well-controlled comorbidities had not increased the risk of operation.[10] In our study, the effect of age on the risk of development of complications was not seen.

The prevalence of obesity is increasing worldwide, and obesity in urinary system stones is considered as an important risk factor. Recurrent open surgeries patients experienced and bulky stone size of these patients cause frequent use of PNL operation, whereas obesity complicates the operation. In a study where 1121 patients were divided into two groups according to their BMIs, differences in complication rate, additional treatment requirement, and hospital stay were not observed in the study group.[11] The main problem is longer distance between the skin and the collecting system of obese patients, and with the instruments used, it is hard to reach the targeted stone. While alternative instruments can be provided, the operation can be continued by incising the muscle layer and fixing the Amplatz sheath with sutures. When our patients were assessed for BMI, any effect of BMI on the success of the operation and the occurrence of complications was not observed.

In patients who underwent open kidney surgery, deterioration in the anatomy of the pelvical and retroperitoneal structures is expected.[12] If kidney stones are considered to have a 50% risk of recurrence within 5–7 years, a recurring need for surgery will arise.[13] PNL reoperation is again considered as the first treatment alternative for stone disease even though fear from excessive bleeding, peripheral organ damage, and failure still exists. In comparative studies in the literature, there was no increase in complication rates in patients with PNL.[14,15] In the present study, according to the literature, there was no increase in complications due to PNL operation in patients who had previously undergone renal surgery.

Predominantly, the presence of hydronephrosis, increased stone area, and volume are effective factors in the development of complications. An increase in complication rates in parallel with the grade of hydronephrosis may be attributed to the high stone load in these patients. Development of complications decreases hemoglobin and hematocrit values, thereby increasing blood transfusion rates. As the complication develops, fluoroscopy and operative times, hospital stay, and dwell time of the nephrostomy tube also increase. The SF rates decrease as the complication rates increase.

Staghorn renal stones are assessed based on their surface area and volume, whereas excess stone load will increase the number of complications, the need for secondary surgical treatment, and the number of accesses.[16] In Group 1, it was detected that surface area and volume of the stone affect the development of complication (p<0.005). Negative correlations were observed between the mean stone area and volume and the success rate of surgery (p=0.001). In addition, surgery was terminated prematurely due to complications, especially peroperative bleeding. Instead, of using surface area and volume of the stone in relevant studies, more frequently, the groups of partial staghorn, complex staghorn, and non-staghorn are considered. Desai et al.[17] studied 5335 patients with PNL from 96 centers worldwide and categorized them into two groups: staghorn (27.5%) and non-staghorn (72.5%) groups. Preoperative

urine culture positivity, multiple working channels, postoperative fever, bleeding, amount of blood transfusion, operative time, and length of hospital stay were significantly higher in patients who had undergone PNL for staghorn kidney stones, whereas the average SF rates were 82.5% in non-staghorn kidney stones and 56.9% in staghorn kidney stones. In addition, Soucy et al.[18] reported a 91% SF rate after PNL in the treatment of staghorn renal calculi. In patients with excess stone burden, multiple working channels may reduce the development of complications due to the difficulty of reaching all calyces through a single working channel. However, higher PNL complication rates are also seen while increasing the SF rate is targeted. When most of the evaluation criteria were compared, it was reported that complications were related to the number of working channels rather than the stone size.[19] When the results of PNLs performed through single and multiple working channels were compared, increases in fluoroscopy, operative times, amount of bleeding, and SF rates but unchanged creatinine levels were observed.[20] In cases where two or more than two working channels were used, bleeding was seen in 18.5%, and when a single working channel was used, it was seen in 7.6% of the cases.[21] Complications developed in 149 (149/185: 80.5%), 25 (13.5%), and 11 (5.9%) patients when single, two, or three working channels were used, respectively. Compared with the non-complicated group, although intergroup difference in the number of working channels was not found to be statistically significant, the need for transfusion was found to be increased in these patients (p=0.830).

PNL has the highest SF rate among all kidney stone treatment options. Greater number of working channels or combination therapies has been developed to increase this SF rates.

In the literature, SF rates ranging between 51% and 100% have been cited in patients with PNL.[22] The first large series was reported to have achieved a 98% success rate in a series of 1000 patients who had undergone PNL in 1985.[23] Stone clearance was reported to be 68% in the UK as a result of the assessment of 1028 PNLs performed throughout the UK, whereas the SF rate of 75.7% was reported in the Clinical Research Office of the Endourological Society study, where 5803 participants were studied.[24,25] After 1011 PNLs were performed in our study, 67% (677 renal units) of all patients were completely cleared of their stones; whereas the SF rates were 48.6% (90 renal units) and 71.1% (588 renal units) among patients in the group with and without complications, respectively. Our results showed similarities with those of the objective studies cited in the literature.

CONCLUSION

Nowadays, PNL is accepted as an effective and reliable first-line treatment method for kidney stones >2 cm. In the present study, the factors that might affect the success and complications in patients with renal stone during PNL were investigated. None of the demographic characteristics of the patients had an impact on surgical outcomes. As was seen in the group who developed complications, stone surface area and volume were higher, and bleeding and amount of blood transfusion increased with lower SF rates. Most complications that occur were minor complications. Stone size, presence of preoperative hydronephrosis, long operation times, and greater number of accesses into the renal collecting system increase the complication rates. Complication rates are expected to gradually decrease owing to experience in PNL and new developments.

Ethics Committee Approval

Approved by from the Şişli Etfal Training and Research Hospital.

Informed Consent

Retrospective study.

Peer-review

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Authorship Contributions

Concept: O.M.İ., K.H.; Design: O.M.İ., K.H.; Supervision: K.H., O.M.İ.; Data collection &/or processing: O.M.İ.; Analysis and/or interpretation: O.M.İ.; Literature search: O.M.İ.; Writing: O.M.İ., O.M.İ.; Critical review: O.M.İ.

Conflict of Interest

None declared.

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Perkütan Nefrolitotomi Başarı ve Komplikasyonlarını Etkileyen Faktörlerin Değerlendirilmesi

Amaç: Günümüzde üriner sistem taş hastalığının minimal invaziv yöntemlerle tedavi edilmeye başlamasıyla cerrahi prosedürler güvenilir hale gelmeye başlamıştır. Perkütan nefrolitotomi (PNL) operasyonu, 2 cm'den büyük böbrek taşlarında ilk tedavi seçeneği haline gelmiştir. Teknolojideki gelişmeler ve tecrübenin artmasıyla operasyon sonrası taşsızlık oranlarında artış; operasyon ve hastanede yatış sürelerinde azalma olmuştur. Zaman içinde PNL komplikasyonları azalmış ve geliştirilen Clavien derecelendirme sistem benzeri sınıflandırılmalarla daha standart hale getirilmiştir. Bu çalışmada, PNL operasyonunda başarıyı ve komplikasyonları etkilediği düşünülen faktörlerin karşılaştırmalı olarak araştırılması amaçlandı.

Gereç ve Yöntem: Çalışmamızda Kasım 2004 ile Ocak 2013 arasında kliniğimizde PNL operasyonu uygulanmış 928 hasta (1011 renal ünite) dahil edildi. Bu hastaların ameliyat öncesi [cinsiyet, yaş, vücut kitle indeksi (VKİ), operasyon tarafı, daha önce taş nedeniyle yapılan işlemler, hidronefroz ve derecesi, taş lokalizasyonu, taş alanı ve hacmi], operatif (operasyon süresi, skopi süresi, giriş yeri sayısı, giriş yapılan kaliks) ve ameliyat sonrası (hemoglobin, hemotokrit, komplikasyon, transfüzyon yapılması, taşsızlık, nefrostomi çekilme süresi, hastanede kalış süresi, ek girişim ihtiyacı) verileri geriye dönük olarak dosya kayıtlarından incelendi. Operasyon esnasında ve operasyon sonrasında meydana gelen komplikasyonlar modifiye Clavien sistemine göre sınıflandırıldı. Daha sonra olgular, komplikasyon gelişen hastalar (Grup 1) ve gelişmeyenler (Grup 2) olarak ikiye ayrıldı. Gruplar karşılaştırmalı olarak analiz edildi.

Bulgular: Çalışmaya alınan hastaların 628 erkek, 383 kadın (E/K: 8/5), yaş ortalaması ise 41.9 idi. Değerlendirilen operasyonların 185'inde minör veya majör bir adet komplikasyon gelişirken, 826'sında komplikasyon gelişmediği görüldü. PNL operasyonunda görülen komplikasyonlar modifiye Clavien derecelendirilmesine göre sınıflandırıldığında derece 1'de 23 (%2.27) komplikasyon, derece 2'de 143 (%14.14) komplikasyon, derece 3A'da 11 (%1.08) komplikasyon, derece 3B'de 6 (%0.59) komplikasyon, derece 4A'da 4 (%0.39) komplikasyon, derece 4B'de 15 (%1.48) komplikasyon görülürken, derece 5'e uygun komplikasyon görülmedi. Her iki grup arasında yapılan karşılaştırmada taşın büyüklüğü, preoperatif hidronefroz derecesi, operasyon ve floroskopi süreleri, hastanede kalış süreleri ve taşsızlık oranlarının komplikasyon gelişimi üzerine etkili parametreler olduğu istatistiksel olarak gösterildi ($p<0.05$). Hastanın yaşı, cinsiyeti, VKİ, böbreğe giriş sayısı, operasyon sonrası ek girişimlerin ise komplikasyon gelişimi açısından etkili parametreler olmadığı saptandı ($p>0.05$).

Sonuç: Perkütan nefrolitotomi, üriner sistem taş hastalığı tedavisinde etkin ve güvenilir bir yöntemdir. Meydana gelen komplikasyonların çoğu minör komplikasyonlardır. Taş büyüklüğü, ameliyat öncesi hidronefroz varlığı, uzun operasyon süreleri, böbrek toplayıcı sistemine fazla giriş yapılması komplikasyon oranlarını artırmaktadır. Bu çalışmada elde ettiğimiz başka önemli bir sonuç ise taşsızlık oranlarının yüksek olduğu hastalarda komplikasyon oranlarının da diğer hastalara göre yüksek olmasıdır.

Anahtar Sözcükler: Clavien derecelendirme; komplikasyon; perkütan nefrolitotomi; taş.