

Can We Predict Complications in Percutaneous Nephrolithotomy?

Perkütan Nefrolitotomide Komplikasyonları Öngörebilir miyiz?

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ÖZET

AMAÇ: Perkütan nefrolitotomi (PNL) operasyonunun başarı oranının yüksek olması yanında işlem sırasında veya sonrasında bazen ciddi boyutlarda komplikasyonlar görülebilmektedir. Çalışmamızda PNL operasyonlarında başarıyı ve gelişebilecek komplikasyonları öngörebilmeyi sağlayacak faktörleri bulmayı amaçladık

GEREÇ & YÖNTEM: Kliniğimizde 481 renal üniteye uygulanan PNL operasyonları, toplam renal ünite temel alınmış olgular komplikasyon görülen ve komplikasyon görülmeyen olarak iki gruba ayrıldı. Kan transfüzyonu gerektiren klinik durum, ateş, üreter taşı, kolon, plevra yaralanması ve arteriyovenöz fistül gibi komplikasyonlar karşılaştırıldı.

BULGULAR: Araştırmada post operatif komplikasyon görülen grubun yaş ortalaması, komplikasyon görülmeyen grubunkine göre anlamlı düzeyde daha yüksekti. Bununla birlikte pelvise yerleşen taşlarda komplikasyon görülme sıklığı kaliks ve kaliks+pelvise yerleşenlerine göre anlamlı düzeyde daha düşükken, kaliks+pelvise yerleşen taşlarda komplikasyon görülme sıklığı diğer gruplarına göre anlamlı düzeyde daha yüksek saptanmıştır.

SONUÇ: Çalışmamızda PNL operasyonlarında yaşın ve taşın yerleşim yerinin komplikasyonları ön görebileceği gösterilmiştir. Yaşlı hastalarda ve kompleks taşlarda komplikasyonlar açısından daha dikkatli olunmalıdır.

Anahtar Kelimeler: perkütan nefrolitotomi, komplikasyon, böbrek taşı, üriner sistem

ABSTRACT

OBJECTIVE: Percutaneous nephrolithotomy (PNL) has a high success rate, but on the other hand, serious perioperative and postoperative complications can be seen occasionally. In our study, we intended to identify the factors that might help us to predict the success of PNL and the complications that may develop.

MATERIALS & METHODS: PNL operations performed in 481 renal units in our clinic were divided into two groups as the cases with and without complications. Complications such as clinical conditions requiring blood transfusion, fever, ureteral stones, colonic injury, pleural injury and arteriovenous fistulas were compared.

RESULTS: Mean age was significantly higher in the group with postoperative complications in comparison to the group without complication. However, the incidence of complications was significantly lower in cases with pelvic stones in comparison to those with calyx and calyx+pelvic stones, while the cases with calyx+pelvic stones had a significantly higher rate of complications with respect to the other groups.

CONCLUSION: It is demonstrated in our study that patient's age and stone localization can predict complications in PNL. More attention needs to be paid to avoid complications in elderly patients and in complex stones.

Key Words: percutaneous nephrolithotomy, complication, renal stone, urinary system

INTRODUCTION

Urinary stone disease (USD) is an important and common healthcare problem with a high recurrence rate. Its prevalence varies by age, gender, race, and geographical location, and the rate of occurrence of USD throughout one's lifetime is estimated to be 1-15% (1).

As of today, PNL is the primary treatment choice for large or multiple renal stones unaccompanied by severe renal

anomaly as well as selected lower calyx stones (2). With the increased use of PNL and other non-invasive techniques in the treatment of USD, currently open surgery is practiced in less than 1% of the patients (2). Patient's age, body mass index, concomitant comorbidity, history of ipsilateral stone surgery or ESWL treatment, kidney's anatomical malformations or solitary conditions, stones' size, location and chemical composition, operative time, surgical

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technique and experience are among the factors affecting success (3-5). Percutaneous nephrolithotomy (PNL) has a high success rate, but occasionally, serious perioperative and postoperative complications can be seen. In our study, we intended to identify the factors that might help us to predict the success of PCNL and the complications that may develop.

MATERIALS & METHODS

PNL operations performed in 481 renal units in our clinic between January 2015 and October 2018 were divided into two groups as the cases with complications (Group I) and the cases without complications (Group II). In the study, complications such as presence of a clinical condition requiring blood transfusion, fever, ureteral stones, colonic injury, pleural injury and arteriovenous fistulas were compared.

Complete blood count, serum creatinine, sodium, potassium, liver function tests, complete urinalysis, urine culture and antibiogram, coagulation tests were performed before the operation. Complete blood count was repeated in patients with hemorrhage and serum creatinine in patients with low urine output, postoperatively.

Antiaggregant or anticoagulant treatments were stopped at least seven days before the operation. All patients were evaluated by computed tomography (CT) preoperatively. In addition, those patients considered to have anomalies such as horseshoe kidneys, calyceal diverticula or renal ectopia were evaluated with CT urography.

The patients were inserted a 6F open-ended ureteric catheter using a 22F cystoscope in the lithotomy position, and correct placement of the catheter was checked by fluoroscopy. The ureteric catheter was fixed to the 16F Foley urethral catheter with silk. The collecting system was visualized retrograde, by applying the contrast medium diluted 1:1 with saline solution.

Percutaneous puncture was achieved with an 18G needle, then a guidewire was placed to collecting system, preferentially to ureter and renal parenchymal dilatation was performed up to 30F. Triangulation technique was used for needle entry. Amplatz dilators are preferred in our clinic. Based on postoperative blood count control, blood transfusion was given to appropriate patients. During the operation, the ureter catheter was removed as soon as

possible and instead a guidewire was sent through the catheter. When the operation was completed, a re-entry malecot catheter was inserted to place at renal pelvis. In general, urinary catheter and nephrostomy were removed at postoperative day one in all patients.

SPSS 21.0 (SPSS, Chicago) package program was used to analyse the data//for data analysis. Central tendency and dispersion measures such as number, percentage, mean, standard deviation were used for establishing descriptive statistics, while Pearson's chi-square test was used for determining the differences between categorical variables. Compatibility of numerical variables to normal distribution was tested with Shapiro-Wilk normality test and the difference between normal compatible independent variables was determined with Student's t test. P value of less than 0.05 was considered statistically significant.

RESULTS

Comparison of the occurrence of postoperative complications in regard to some demographic and clinical characteristics is shown in Table 1. Accordingly, a statistically significant difference was determined between patient age and stone location and occurrence of complications ($p < 0.05$). The mean age of the group with postoperative complications was significantly higher in comparison to the group without complications ($p = 0.02$). However, the incidence of complications was significantly lower in cases with pelvic stones in comparison to those with calyx and calyx+pelvic stones, while the cases with calyx+pelvic stones had a significantly higher rate of complications with respect to the other groups ($p < 0.05$). There was no statistically significant difference between the presence of complications and the parameters such as gender, BMI, stone site, stone size, access number, SSD and operation time ($p > 0.05$).

Table 1. Comparison of postoperative complications with respect to some demographic and clinical characteristics in patients

VARIABLES	COMPLICATION		
	Gw/oc**	GwC**	p*
	Mean±SD	Mean±SD	
Age (years)	46±14	52±15	0.02
Gender			
Male n (%)	264 (84.1)	50 (15.9)	0.42 ^P
Female n (%)	145 (86.8)	22 (13.2)	
BMI	27.8±4.9	27.7±5.7	0.86

Stone Site			
Right n (%)	201 (84.8)	36 (15.2)	0.84 ^P
Left n (%)	206 (85.5)	35 (14.5)	
Stone Location			
Calyx n (%)	61 (85.9)	10 (14.1)	0.01 ^P
Pelvis n (%)	109 (93.2)	8 (6.8)	
Pelvis+Calyx n (%)	236 (81.4)	54 (18.6)	
Stone Size (mm²)	836±397	770±305	0.11
Access Number			
Single n (%)	321 (85.6)	54 (14.4)	0.51 ^P
Multiple n (%)	88 (83)	18 (17)	
SSD	95±23	90±24	0.12
Operative Time (min)	89±180	107±56	0.44

* Student's t test, p Pearson's Chi-square test | BMI: Body Mass Index, SSD: Skin-to-stone distance, %: Percentage

**Gw/oC: group without complications; GwC: group with complications

Table 2. Complications of Percutaneous Nephrolithotomy

Number of Complications (n=72)	
Prolonged tract leakage	9
Fever	12
Urinary tract infection	15
Pleural effusion	2
Regional cellulitis	4
Sepsis	2
Required blood transfusion	12
Pain	16

As shown in Table 2, no patient included in the study was lost due to complications throughout the study. The majority of the complications were pain, bleeding, urinary leakage after removal of the nephrostomy tube, and postoperative fever. Pleural effusion as a major complication was seen in two patients; they were treated conservatively. Postoperative major infections, such as pyelonephritis or sepsis, developed in two patients. A regional cellulitis developed on the needle access area in four patients and second-generation cephalosporin was administered. Septic shock, damage of neighboring organs, and bowel perforation were not seen in any of our patients.

DISCUSSION

PNL is a minimally invasive method in the treatment of USD and it has replaced the open stone surgery today. It provides advantages such as short hospital stays, low treatment cost and less labor loss. Nonetheless, various complications can occur in PNL, as it is the case in any other surgical procedure (6,7).

The need for additional treatment statistically significantly increases as the stone size and the access number increase. The need for additional treatment is also high in complex stones. The number of access and stone size are independent factors affecting the need for additional treatment (8,9). Kukreja et al. (10) showed that stone size did not significantly affect the amount of blood loss but increased transfusion rate. The complications observed in our study were not related to stone size and access number. Although similar results are found in the literature, stone size and access number generally affect the complication rates (10,11). However, stone size and access number did not affect the complication rate in our study, which may be attributed to rather small number of patients.

Relatively lower success rates and higher complication rates can be achieved with PNL in the treatment of coralliform and complex stones in comparison to simple stones. Complication rates increase as the distribution of stones in the kidney increase (7,10). More than one working channel is generally needed to clean these stones. Bleeding rates are shown to increase in case of multiple working channels (12,13). In their study published in 2013, Zeng et al. (14) compared the patients with simple stones and those with complex stones in terms of postoperative stone-free status and complications. They reported the rate of general complications as 17.9% in simple stone group and 19% in complex stone group. There are also studies reporting the contrary results (4). In our study, the complication rates increased as the distribution of stones in the kidney increased.

PNL is indicated as an effective and reliable treatment modality in all age groups (4,15,16). However, accompanying diseases, drugs used, weakening immune system and malnutrition as a result of increasing age were shown to increase postoperative complication rates (17-19). In this study too, complication rates were found to increase with aging.

Obesity can be technically troublesome in PNL. Anesthesia-related problems can be accompanying sometimes as well. Again, in obese patients, skin-to-stone distance (SSD) increase and perioperatively the distance to reach the stone becomes longer. There are several studies investigating the effect of obesity and SSD in PNL. In one of

these studies, Faerber and Goh claimed that complication rate is increased in obese patients (20). Paerle et al. (21) reported increased need for blood transfusion in obese patients. However, there are some other studies claiming the contrary. In a study performed in obese patients evaluating postoperative stone free status and complications in PNL, BMI was determined as an insignificant factor in terms of bleeding and general complications, and PNL was asserted as an effective and reliable method in obese patients (22). This conclusion was also supported by some other studies (23-25). In our study too, increased BMI and SSD did not increase complication rates.

Perioperative and postoperative complications in PNL can be basically classified as major and minor complications. One of the first series on this issue was published by Segura et al. in 1985, where a total of 1000 PNL cases were examined, and the rate of major complications was reported as 3.2% (26). Another study examined perioperative PNL complications in detail and reported major complication rate as 6.8% and minor complication rate as 50% (27). Although 2 (0.3%) cases resulted in death in this series, as for the major complications in the early postoperative period, critical bleeding requiring intervention was determined in 6 (1%) patients, severe infection in 2 (0.3%), pneumothorax in 17 (2.9%), urinoma formation in 2 (%), pelvic laceration in 5 (0.9%) patients and ureteral avulsion in 1 (0.2%) patient. Fever was the most frequently encountered minor complication (22%). In addition, bleeding requiring blood transfusion was reported in 11.2%, extravasation in 7.2%, premature removal of nephrostomy tube in 5.8%, transient urinary obstruction in 6%, paralytic ileus in 2.6%, urine drainage from nephrostomy tube for more than one week in 1.5% of the patients. In our study, sepsis as a major complication developed in 2 (0.4%) patients and minor complications developed in 70 (14.5%) patients.

Retrospective design of the study, limited number of patients, lack of evaluation concerning some factors such as previous operations and surgical experience can be considered as the limitations of this study. However, we consider this study to be informative and useful for showing the initial complication rates of PNL, which we started to perform recently.

CONCLUSION

It should be noted that some complications may occur in PNL, although it is the gold standard with high success rates in the treatment of kidney stones. In this study, it was shown that patient age and stone localization can predict complications in PNL operations. In this context, elderly patients and complex stones deserve much more attention during PNL.

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