

Evaluation of Percutaneous Nephrolithotomy Results and Their Potential Factors Among Local Population and Refugees

Yerli Popülasyon ve Mülteciler Arası Perkütan Nefrolitotomi Sonuçlarının ve Etkileyen Olası Faktörlerin Değerlendirilmesi

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Abstract

Objective: Over five million refugees have migrated to Turkey due to the current developments in their countries. Language problems, high number of unregistered refugees, economic reasons, and unemployment in the refugee population make it difficult for them to receive qualified health care and may cause patients to apply to the hospital with more complicated diseases. This study aimed to evaluate surgical results and complications between the local population and refugee patients who underwent percutaneous nephrolithotomy.

Material and method: We retrospectively evaluated who underwent percutaneous nephrolithotomy in two different healthcare centers between January 1, 2018 and December 31, 2019. The patients were divided into two groups as “Local Population” and “Refugees” and were compared with each other.

Results: The stone burden was significantly higher in refugee population (466.8 mm² & 1107.4 mm², p<0.01). On evaluation of time in terms of fluoroscopy, operation, period until the removal of nephrostomy tube, and hospitalization, the patients of local population had significantly lower values.

Conclusion: The size of kidney stones and stone burden were observed to be larger and the success rate was significantly lower in the refugee patient group.

Öz

Amaç: Ülkelerindeki mevcut gelişmeler nedeniyle beş milyondan fazla mülteci Türkiye’ye göç etmiştir. Mülteci nüfusundaki dil sorunları, kayıt dışı mülteci sayısının fazlalığı, ekonomik nedenler ve işsizlik kaliteli sağlık hizmeti almalarını zorlaştırmakta ve hastaların daha komplike hastalıklarla hastaneye başvurmasına neden olabilmektedir. Bu çalışmada, perkütan nefrolitotomi uygulanan yerel popülasyon ile mülteci hastalar arasındaki cerrahi sonuçlar ve komplikasyonların değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: İki farklı sağlık merkezinde 1 Ocak 2018 ile 31 Aralık 2019 tarihleri arasında perkütan nefrolitotomi uygulanan hastalar retrospektif olarak değerlendirildi. Hastalar “Yerel Nüfus” ve “Mülteciler” olarak iki gruba ayrılarak birbirleriyle karşılaştırıldı.

Bulgular: Mülteci nüfusunda taş yükü yerel popülasyona göre önemli ölçüde daha yüksekti (466,8 mm² & 1107,4 mm², p<0,01). Floroskopi ve operasyon süresi, nefrostomi tüpünün çıkarılmasına kadar geçen süre ve hastaneye yatış süresi açısından değerlendirildiğinde, yerel popülasyondaki hastalar anlamlı olarak daha düşük değerlere sahipti.

Sonuç: Mülteci hasta grubunda böbrek taşlarının boyutu ve taş yükünün daha fazla olduğu ve başarı oranının anlamlı olarak daha düşük olduğu gözlemlendi.

Introduction

Urolithiasis is a common disease around the world, with incidence rates varying between 7–13% in North America, 5–9% in Europe, and 1–5% in Asia (1). Minimally invasive treatment methods are available in the treatment of kidney stone, including extracorporeal shock wave lithotripsy (ESWL), percutaneous nephrolithotomy (PNL), retrograde intrarenal surgery (RIRS), and laparoscopic stone surgery. Localization and type of the stone, stone burden, patient's anatomy, and patient's accompanying comorbidities are the factors that should be considered in selecting the most appropriate method in the treatment of nephrolithiasis. Current guidelines of the European Association of Urology define PNL as a surgical treatment option for kidney stones larger than 2 cm (2). For smaller kidney stones, the guidelines leave the choice between PNL, ESWL, and RIRS to the preference of the patient and the surgeon.

With the introduction of optical fibers and miniaturized endoscopes in the market in the last 10 years, despite the terminology that is not yet to be standardized, the procedures performed using large devices with a sheath diameter of 24–30 Fr are called standard PNL (sPNL) and those using devices with a sheath diameter of 14–22 Fr are called mini-PNL (mPNL) (3). The conflicting results with regards to the outcomes of stone-freeness and complications are obtained due to the different classification of the devices between the sPNL and mPNL treatment methods and studies conducted in different populations (4).

Although bleeding during or after PNL is the most common complication, peripheral organ damages, such as on pleura and colon, as well as sepsis, hypothermia, and death may also be observed (5). Many factors, such as operative time, entrance, multiple accesses, canal dilatation method, number of canals, size and location of the calculi, staghorn calculi, preexisting comorbidity of diabetes mellitus, and the experience of the surgeon may affect complications during or after PNL (6).

Over five million refugees have been migrated from neighboring countries to Turkey due to the current developments there, and this number is projected to increase in the future as well (7). Language problems, high number of unregistered refugees, economic reasons, and unemployment in the refugee population makes it difficult for them to receive quality health care and may cause patients to apply to the hospital with more complicated diseases (8, 9).

This study aims to evaluate retrospectively the local population and the refugee patients who underwent PNL, to compare the surgical results and complications, and to evaluate the factors related to the variance, if any.

Material and Methods

Selection and Description of Participants

In this study, we retrospectively evaluated adult patients aged ≥ 18 who underwent PNL for nephrolithiasis in two different healthcare centers consisting of secondary and tertiary hospitals between January 1, 2018 and December 31, 2019. This study was approved by the Ondokuz Mayıs University Clinical Research Ethics Committee (Approval number: 2021/770). The data of the patients including age, gender, racial demographic data, body mass index (BMI), preoperative American Society of Anesthesiology (ASA) score, side of

kidney that underwent PNL, location, size and opacity of the stone, applied PNL method, location of kidney access and number of accesses, dilatation type, duration of fluoroscopy and operation, peroperative and postoperative complications, blood transfusion - if applied, the time of removal of the nephrostomy tube - if placed, status of the residual calculi in the postoperative 1st month according to kidney, ureter, and bladder (KUB) X-ray and late postoperative complications was recorded. Stone burden was calculated by cumulative diameter (cm) of the calculi on the KUB X-ray and the total volume of the calculi (cm³) was calculated from the axial images with coronal reconstructions of computerized tomography (CT) scan using the length x height x width x π x 1/6 formulas. Complications were classified according to the Modified Clavien System (10). The patients were divided into two groups as "Local Population (Group 1)" and "Refugees (Group 2)" and were compared in terms of the characteristics recorded. Patients aged below 18, pregnant women, patients with bleeding disorders and urinary system anomalies were not included in the study.

All patients were evaluated preoperatively and in the postoperative 1st month, if symptomatic, with non-contrast abdominal CT. Asymptomatic patients were evaluated with KUB X-ray in the postoperative first month. The procedures of all patients were performed in prone position, under general anesthesia with appropriate antibiotic prophylaxis, after a sterile urine culture was detected before surgery. Operations were performed by five different surgeons with similar backgrounds of experience in percutaneous nephrolithotomy. Success was defined as the absence of stones or the presence of asymptomatic residual stones of 4 mm or less on the operated side (11).

Statistical Analysis

SPSS version 21 (SPSS Inc., Chicago, IL, USA) package program was used for statistical analysis. For these analyzes, Fisher's Exact test, Chi-square test, Independent Sample T test, One Way ANNOVA tests were used. Ratio was used in vital variables as descriptive statistics. For quantitative variables, the median (minimum–maximum) for the nonparametric test results and mean \pm standard deviation for the parametric test results were given. Statistical significance was accepted as $p < 0.05$.

Results

We retrospectively analyzed the data of 150 patients who underwent PNL for renal calculi. Between January 2018 and December 2019, we had 98 cases in Group 1 and 52 cases in Group 2. The mean age of all the patients was 42.3 ± 6.1 years (19–82), whereas the male/female ratio was 98/52. While the mean age was 39.1 ± 4.3 years (18–67) in Group 1 and 48.6 ± 5.9 years (19–72) in Group 2, no statistical difference was observed between them ($p=0.32$). Similar results were observed between two groups when the BMI was compared ($p=0.5$) (Table 1). While the preoperative ASA scores were higher in Group 1, there was no statistically significant difference ($p=0.41$). Preoperative hemoglobin and creatinine levels of the patients were similar between the groups.

($p=0.2$, $p=0.1$, respectively). Patients' past PNL or open kidney surgery histories and previous ESWL sessions were recorded and compared, and there was no difference between the groups ($p=0.3$, $p=0.4$, respectively).

On evaluation of the characteristics of renal calculi, it was observed that the stone burden was significantly higher in Group 2 (466.8 mm² & 1107.4 mm², $p<0.01$). The location and number of calculi were similar in both groups, whereas the presence of staghorn calculi was significantly higher in Group 2 patients when compared with Group 1 (3 (3%) & 8 (15%), $p<0.02$) (Table 1).

Table 1. Comparison of demographic data between groups

		Group 1 (n=98) Local population	Group 2 (n=52) Refugee population	p value
Gender	Male	59 (60%)	39 (75%)	0.5
	Female	39 (40%)	13 (25%)	
Age (years)		39.1 ± 4.3	48.6 ± 5.9	0.32
BMI (kg/m ²)		28 ± 3.6	26.8 ± 3.8	0.5
ASA (mean)		2.1	1.42	0.41
Stone burden (mm ²)		466.8 (200–1100)	1107.4 (200–3200)	0.01*
Stone location (Right/Left)		50/48	25/27	0.8
Number of calculi (single/multiple)		54/44	25/27	0.1
Presence of Staghorn calculi		3 (3%)	8 (15%)	0.02*
Mean preoperative Hb (g/l)		13.82 ± 1.99	13.61 ± 1.16	0.2
Mean preoperative serum Creatinine (mg/dl)		0.86 ± 0.32	0.99 ± 0.31	0.1
Previous kidney surgery		15 (%15.2)	16 (%31.7)	0.3
The past ESWL story		11 (%11.3)	6 (%11.6)	0.4

BMI: Body Mass Index, ASA: American Society of Anesthesiology, Hb: Hemoglobin

On evaluation of the operation data, the mean number of accesses in Group 1 patients was 1.01 (1–2), whereas it was 1.55 (1–3) in Group 2 patients and the difference between them was found to be significant ($p<0.03$) (Table 2). PNL was applied in the prone position in all patients and mPNL (17.5F) was preferred in 31 patients (20.6%). While mPNL was applied to 28 (28.5%) of cases in Group 1; mPNL was performed in only 3 patients (5%) in Group 2 ($p<0.01$). On evaluation of time in terms of fluoroscopy, operation, period until the removal of nephrostomy tube, and hospitalization, it was observed that the patients in Group 1 had significantly lower values in all these four categories of time data (68.2 sec. (22–180), 95.7 min (75–150), 2.41 days (1–6), 2.68 days (1–12) versus 83.1 sec.

(25–360), 113.2 min (70–180), 2.89 days (1–5), 3.71 days (1–11), $p<0.002$, $p<0.001$, $p<0.02$, $p<0.02$, respectively) (Table 2).

Results of PNL surgery were observed to be significantly more successful in Group 1 patients than in Group 2 (83% & 59%, $p<0.02$). While 29.2% of the patients in Group 1 had the operation terminated without a tube, this rate remained at 5.8% in Group 2 ($p<0.001$) (Table 2).

On the evaluation of complications made by grading according to Modified Clavien classification system, complications were observed in 7% of Group 1 patients and 19% of the patients in Group 2. In Group 1, additional antibiotic treatment was administered for fever and suspected urinary tract infection (Grade 1) in 3 cases, there was bleeding requiring blood transfusion in 2 cases (Grade 2) and bleeding thought to have caused by arteriovenous fistula in 2 cases, that angioembolization procedure under local anesthesia was performed by interventional radiologists (Grade 3a). In Group 2, antibiotic treatment for fever (Grade 1) was required in 2 cases, blood transfusion was required in 6 cases due to bleeding (Grade 2), whereas in 2 cases, placement of double J stent under local anesthesia was required due to prolonged urine leakage from the nephrostomy tract during the postoperative period (Grade 3a). Statistically, there was no difference in complication rates between the groups according to the Modified Clavien Classification (Table 2).

Discussion

In this study, the operation findings and the preoperative demographic data were compared between the patients from the local and the refugee population who underwent PNL operation for renal calculi, and some important findings were obtained as a result of the comparisons. To the best of our knowledge, this is the first study to investigate the results of PNL operation and preoperative stone characteristics of patients from the local and the refugee population. Stone burden was higher in the refugee patient group when compared with the local patient group. Secondly, the duration of operation, hospitalization and fluoroscopy, period until the removal of nephrostomy tube, and the number of accesses to kidney were found to be significantly higher in the refugee patient group. Furthermore, the success rate was significantly lower in the refugee patient group when compared with the local population group. With the development of technology over time, percutaneous surgery has become a successful surgical treatment option applied in many clinics in the 2000s. However, the definition of successful surgery has varied over time. Today, the presence of stones less than 4 mm, which is called clinically insignificant residual stone, is considered to be a successful surgery; however, there are some other studies that this cut off value varies (12, 13). The criterias that affect the success depend on size and location of the stone, grade of hydronephrosis, kidney anatomy, chemical composition of the stone, and the surgeon's level of experience; however, it also varies according to the patient characteristics, such as patients' age, gender, anatomical features, and BMI (14).

Table II. Comparison of operation data between groups

	Group 1 (n=98) Local population	Group 2 (n=52) Refugee population	p value
Number of accesses to kidney	1.01 (1-2)	1.55 (1-3)	0.03*
Method			0.01*
17.5 Fr Mini-PNL	28 (28.5%)	3 (5%)	
28/30 Fr Standard PNL	70 (71.5%)	49 (95%)	
Fluoroscopy time (sec)	68.2 (22-180)	83.1 (25-360)	0.002*
Duration of operation (min)	95.7 (75-150)	113.2 (70-180)	0.001*
Nephrostomy removal time (days)	2.41 (1-6)	2.89 (1-5)	0.02*
Hospitalization time (days)	2.68 (1-12)	3.71 (1-11)	0.02*
Success rate	83 (83%)	30 (59%)	0.02*
Tubeless surgery	29 (29.2%)	3 (5.8%)	0.01*
Modified Clavien complication	7 (7%)	10 (19%)	0.2
Grade 1	3	2	
Grade 2	2	6	
Grade 3a	2	2	

The most important parameter determining the presence of residual stone, which is the most important indicator of surgical success, is considered to be the stone size. Margel et al. compared PNL results in two patient groups with similar stone size and found similar results in terms of stone-free rate and complications in the two groups (15). And also, in a similar study conducted on 125 cases in Turkey, it was shown that there was a significant relationship between stone size and stone-freeness (16). In our study, it was shown that the stone burden in the refugee patient group was significantly larger than the local population, and consequently, the surgical success was higher in the local population. With the increase in stone size, the duration of the operation, the duration of the fluoroscopy used during the operation, and the risk of complications also increases. In our cases, these periods were observed to be longer in the refugee group; however, the rate of complications was similar in both groups. Due to the prolonged operative time in the refugee group, bleeding was observed in more cases during the procedure and the nephrostomy removal time was thus prolonged. This resulted a significantly longer hospital stay in Group 2.

In a study conducted by Muslumanoğlu et al., in which the cases that resulted in failure were examined, all cases that resulted failure were found to have pelvic stones accompanying staghorn or multiple calyceal stones (17). In this study, it was shown that the staghorn stone burden was higher in the refugee group, and when the subgroup analysis is performed, the presence of residual stones and complications was more common in patients with staghorn calculi. In the same study, it was also stated that 75.4% of the cases with a large calculus size had multiple accesses to the kidney and the success rate was 89.2% in those cases, while those with a single access to the kidney had a success rate of 96.7% (17). Although increased number of accesses may not contribute to stone-freeness, it is estimated that multiple accesses may increase the duration of operation and complication rates. Martin et al. also suggests single access instead of multiple accesses in many peripheral stones (18).

However, in the study conducted by Aron, it is reported that PNL treatment with multiple accesses is safer in large staghorn calculi and should be the first choice of treatment even in cases of large staghorn calculi (19). In this study, the high stone burden, the high presence of staghorn calculi, and consequently the higher number of accesses and complications in the refugee population were as expected. However, in the subgroup evaluation, the statistical significance of the failure and complications could not be found with multiple accesses.

In a study conducted by Skolarikos in 2005, blood transfusion rates were reported between 0-14% and it has been shown that the need for blood transfusion increases especially in staghorn and multiple calyceal calculi (20). When we examined 10 cases in need of blood transfusion, we showed the presence of staghorn calculi in 6 of them and multiple kidney stones in 3 of them. However, no significant relationship was found between the number of stones and the rate of failure.

Another factor that affects surgical success is the size of the instruments. With the advancement of technology, minimally invasive surgeries have become widespread and nephroscopes with smaller diameters are widely being used. Due to the large size of the instruments used in the sPNL that may cause bleeding, thinning of dilatations and small diameter instruments were required over time. Although mPNL is thought to be more advantageous in terms of complications, there is no difference between them in terms of success. The biggest disadvantage of mPNL is the long operation time (4). In this study, mPNL (17.5 Fr) was preferred more in Group 1 patients. Examination of the cases with mPNL revealed that the operative time was longer and the rate of complications was lower in this study, similar to the literature. However, it was thought that these cases were more successful in stone-freeness than the sPNL cases because of the application of this surgery in selected patients.

There are many studies investigating the effect of previous surgeries on the success of percutaneous nephrolithotomy,

and it is reported that there is no relationship between them as a common result (21, 22). When we evaluated 31 cases with a history of previous surgery, we were not able to show that failure was related to the history of previous surgeries; however, it was observed that these patients had higher rates of complications, although not statistically significant.

Many studies have been conducted, comparing the refugee patient group with the patients in the local population (8, 23-25). In a study evaluating bladder tumor surgery and success rates between the two groups, it was found that both groups had similar characteristics of the disease, the detrusor muscle could be sampled more in the refugee patient group and the surgical success rate was higher in this group. It has been stated that the reason for this success rate was that the surgeon's success increased in the refugee patient group because of the lack of surgical stress, and the complications were similar in both groups (23). In a study evaluating peptic ulcer disease in refugee population, it was stated that the rates of peptic ulcers in these groups were observed to be higher than in the local population due to stress, malnutrition, poor hygiene, and difficulty in accessing physicians; moreover, the peptic ulcers in this group had a bleeding course (24). Post traumatic stress disorder, depression, and anxiety, which are common features of refugee communities in different parts of the world, have been shown to increase these diseases (25). Similarly, it has been shown that smoking and imbalanced nutrition increases the risk of coronary artery disease in the refugee patient group, and wound infection and complications are observed more frequently due to poor hygiene and lack of care after the bypass surgery in this group (8). Our study is the first study in the literature to examine the differences in renal calculi disease and treatment in refugee and local populations. Similar to other studies, renal calculi disease was found at advanced stages in refugee patients due to reasons, such as nutritional disorders, insufficient fluid intake, low socioeconomic conditions, and difficulty in accessing healthcare, and consequently, the success of surgery was lower.

There are some limitations of this study such as its retrospective nature and insufficient number of patients. Other limitations include that the operations were performed by 5 different surgeons although they have similar backgrounds of experience in percutaneous nephrolithotomy, and the patients who underwent mPNL were only selected cases.

Conclusion

The size of kidney stones was observed to be larger in the refugee group due to reasons, such as malnutrition, insufficient fluid intake, difficulties in accessing the health care, and low socioeconomic level. The local population was found to be younger and overweight, but less stone burdened. It has been shown that surgical success is high in terms of low stone burden and easy accessibility to health care and mPNL is more successful in selected cases. In these cases, it was observed that the low stone burden also led to a shortened duration of operation, reduction in complications, completion of surgery without a tube, and thus early discharge. Stone burden, duration of operation, nephrostomy insertion rates, and discharge times were observed to be higher in refugee population group.

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