Effect of Simple Malrotation on Percutaneous Nephrolithotomy: A Matched Pair Multicenter Analysis

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Purpose: In this multicenter study we compared the outcome of percutaneous nephrolithotomy in patients with and without malrotated kidneys.

Materials and Methods: A total of 44 patients (group 1) at 6 institutions who underwent percutaneous nephrolithotomy for kidneys with simple malrotation were enrolled in our study. Attending physicians in our group also provided the same number of cases of percutaneous nephrolithotomy done for nonmalrotated (normal) kidneys (group 2). Group 2 patients were selected by match pairing. Operative and postoperative data on the 2 groups were compared using the chi-square, Student t and Fisher exact tests.

Results: As a result of match pairing, the 2 groups were similar in age, gender, body mass index, and stone size and site. Mean ± SD stone size was 5.9 ± 3.5 cm^2 in group 1. Multiple access attempts were required in 9 (20.5%) and 7 cases (15.9%) in groups 1 and 2, respectively ($p > 0.05$). Mean fluoroscopy time was 7.0 ± 3.9 minutes in the malrotated kidney group and 7.3 ± 4.5 minutes in the nonmalrotated kidney group ($p > 0.05$). The mean hemoglobin decrease after percutaneous nephrolithotomy was significantly higher in group 1 (−1.9 vs −1.3 gm/dl, $p = 0.008$) but the blood transfusion rate was similar in the 2 groups. The procedure success rate in groups 1 and 2 was 77.3% and 79.5%, respectively ($p > 0.05$).

Conclusions: Percutaneous nephrolithotomy is safe and effective even in patients with larger kidney stones and malrotated kidneys.

Key Words: kidney; nephrostomy, percutaneous; nephrolithiasis; abnormality; hemoglobins

Abbreviations and Acronyms

BMI = body mass index

CT = noncontrast helical computerized tomography

Hb = hemoglobin

PNL = percutaneous nephrolithotomy

SWL = shock wave lithotripsy

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CURRENTLY PNL is the first line recommended treatment for kidney stones larger than 2 cm.[1] Nonetheless, performing PNL in kidneys with a complex or anomalous anatomy is particularly challenging for urologists. A key requisite for successful stone clearance and a low complication rate during PNL is establishing optimal access to the renal collecting system. However, it is not always easy to achieve optimal access in malrotated kidneys due to altered caliceal position, especially when fluoroscopy is the technique of choice. Also, reaching the stone may not be easy due to the rotated anatomy of the kidney.

Kidney malrotation is usually found in conjunction with other renal anomalies, such as ectopia with or without

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fusion or a horseshoe. The combination of malrotation in a kidney with other renal anomalies makes it difficult to assess the effect of malrotation on the PNL outcome. The exact incidence of simple malrotation without a coexisting renal anomaly is not known but this anomaly is found in 1/939 autopsies and at a rate of 1 case per 390 hospital admissions. As with fusion anomalies, males are affected twice as often as females.[2,3] Current results of PNL in malrotated kidneys have been reported in a limited number of cases as a part of studies of PNL in anomalous kidneys.[4–6] The success rate of PNL in malrotated kidneys is greater than 90% according to these noncomparative series.

In this multicenter study we compared the outcome of PNL in patients with and without simple malrotated kidneys using matched pair analysis. To our knowledge we report the largest and only comparative study of PNL in malrotated kidneys of studies published in English.

MATERIALS AND METHODS

At 5 centers in Turkey and 1 in Greece a total of 5,315 patients underwent PNL from 2002 to January 2010. All centers were high volume endourology centers with more than 700 PNL cases. Patient and procedure related factors, including age, gender, BMI, stone size, configuration and site, access number and site, preoperative and postoperative blood levels, operative time, fluoroscopy time, and procedure success and complications were analyzed retrospectively. Groups at each center matched the parameters of patients who underwent PNL in kidneys with simple malrotation vs those in patients who underwent PNL in kidneys without malrotation. Matching parameters were patient age, gender, BMI, and stone size, site and configuration. A total of 44 patients (0.8%) who underwent PNL and had kidneys with simple malrotation (group 1) were compared with same number in whom PNL was done in nonmalrotated kidneys (group 2).

Anticoagulant drugs were discontinued at least 1 week before the operation. Radiological evaluation, excretory urography, urinary tract ultrasound and CT were done in select cases. Stone size was measured as surface area and calculated according to European Association of Urology guidelines.[1] Operative time was defined as the period from access needle insertion into the patient skin to nephrostomy tube placement at the end of the operation.

All cases were performed by the same surgeon at each institution. With the patient in the prone lithotomy position a 5Fr to 6Fr open end ureteral catheter was placed in the ipsilateral pelvicaliceal system. Percutaneous access was achieved by the attending urologist under C arm fluoroscopic guidance. Ultrasound was preferred by the Greek group in only 2 cases. After achieving proper caliceal puncture the tract was dilated with a high pressure NephroMax™ balloon dilator, an Amplatz dilator or a metal dilator and a 30Fr Amplatz sheath was placed. In each groups the same number of dilation techniques was applied. Balloon dilators were used in 19 of 44 patients (43.1%), Amplatz dilators were preferred in 23 of 44 (52.2%) and metal dilators were used in 2 (4.5%). Nephroscopy was performed with a rigid 26Fr nephroscope. When indicated, additional tracts were created at the same session. Stones were fragmented using a pneumatic or an ultrasonic lithotriptor. A 14Fr to 16Fr nephrostomy tube was placed in the renal pelvis or the involved calix as the final treatment step in most cases. Depending on surgeon preference tubeless PNL was done when indicated.

Antibiotic prophylaxis was provided by quinolones or second generation cephalosporins. The first dose was administered intravenously when anesthesia was initiated, and the second dose was given 12 hours later.

A complete blood count done 24 hours before the procedure and at hospital discharge, and the number of blood units transfused were used to determine total perioperative blood loss. We considered that a 1 U blood transfusion increased Hb by 1 gm/dl. Therefore, hemoglobin decreases were calculated using the equation, [(preoperative Hb − postoperative Hb) − (number of units transfused × 1 gm/dl Hb/U transfused)].[7] Procedure complications were assessed by the modified Clavien classification.[8]

On postoperative day 1 plain x-ray of the kidneys, ureters and bladder was done. In cases with a nephrostomy tube the tube was removed on postoperative day 2 after antegrade nephrostography revealed ureteral drainage down to the bladder.

All patients were evaluated by excretory urography or helical CT 2 to 3 months postoperatively. PNL was considered successful if the patient was free of stones at that time. Clinically insignificant residual fragments were defined as those less than 4 mm that were nonobstructive, noninfectious and asymptomatic.

Data were analyzed with SPSS®, version 16 with the chi-square, Student t and Fisher exact tests. Statistical determinations were within the 95% CI and $p < 0.05$ was considered statistically significant.

RESULTS

According to match pairing the demographics in the 2 groups were similar for age, gender, BMI, and stone size and site (table 1). In the malrotated kidney group the male-to-female ratio was 1.75:1 and mean ± SD age was 41.6 ± 13.3 years (range 15 to 68). The incidence of stones in the pelvis, partial staghorn and lower calix was 36.4%, 25% and 20.5%, respectively. Mean stone size was 5.9 ± 3.5 cm^2 (range 1.8 to 18). Percutaneous access was achieved through the lower calix in 22 patients (50%) and multiple access attempts were required in 9 (20.5%). Tubeless PNL was performed in 5 patients (11.3%) with malrotated kidneys.

Table 1 shows operative and postoperative results in each group. Mean access number was not significantly different between the groups ($p > 0.05$). Intercostal access was required in 8 patients (18.2%) in the malrotated kidney group and in 4 (9.1%) in the nonmalrotated kidney group ($p = 0.35$). Mean operative time was comparable in groups 1 and 2