Improved Split Renal Function after Percutaneous Nephrostomy in Young Adults with Severe Hydronephrosis Due to Ureteropelvic Junction Obstruction

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Purpose: We evaluated percutaneous nephrostomy for adult kidneys with severe hydronephrosis due to ureteropelvic junction obstruction and less than 10% split renal function.

Materials and Methods: In this retrospective analysis we included patients who underwent percutaneous nephrostomy for unilateral ureteropelvic junction obstruction of the kidneys with hydronephrosis and less than 10% split renal function at our hospital between May 2009 and January 2012. Adults (age 18 years or greater) were divided into those 35 years or younger (young adults) and older than 35 years (older adults). The percutaneous nephrostomy remained in situ a mean ± SD of 6.62 ± 2.55 weeks and patients underwent repeat renography before pyeloplasty. When there was no significant improvement in split renal function (10% or greater) and drainage (greater than 400 ml per day), nephrectomy was performed. Otherwise pyeloplasty was performed. Patients were followed by renography, ultrasound and contrast computerized tomography at 3 and 6 months, at 1 year and annually thereafter.

Results: Of 53 patients 30 (56.6%) showed improvement after percutaneous nephrostomy drainage and urine output greater than 400 ml per day with percutaneous nephrostomy. Pyeloplasty was then performed. Of 29 young adults 24 (82.8%) showed improved split renal function vs 6 of 24 older adults (25%). Nephrectomy of the other 23 kidneys was performed. At a mean followup of 19.27 ± 7.82 months (range 12 to 36), no patient showed hypertension or urinary tract infection.

Conclusions: Split renal function detected by renography may not accurately predict recovered, poorly functioning kidneys, especially in young adults. First observing the recoverability of hydronephrotic kidneys by percutaneous nephrostomy drainage and then preserving select kidneys may be an effective method to manage poorly functioning kidneys due to ureteropelvic junction obstruction.

Key Words: kidney; hydronephrosis; nephrostomy, percutaneous; ureteral obstruction; young adult

Abbreviations and Acronyms

BUN = blood urea nitrogen
CT = computerized tomography
DTPA = diethylenetriamine pentaacetic acid
GFR = glomerular filtration rate
PCN = percutaneous nephrostomy
SRF = split renal function
UPJ = ureteropelvic junction
UPJO = ureteropelvic junction obstruction

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Ureteropelvic junction obstruction is a common cause of hydronephrosis (water in the kidneys), which impairs all renal function and eventually leads to renal parenchymal atrophy.[1] SRF measured by diuretic renography is commonly used for assessment, prognosis and followup.[2,3] Treatment of poorly functional kidneys (greater than 10% SRF) due to

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UPJO remains controversial, mainly because of inaccurate prediction of the recoverability of renal function after obstruction is relieved.[3]

In 1955 PCN catheter insertion was first described by Goodwin et al as an emergency procedure to relieve urinary obstruction.[4,5] PCN catheter placement has been expanded to other indications. In recent years some reports described PCN as an easy, safe procedure to determine recoverability of renal function in obstructed kidneys in children.[6–8] The conclusion was that most poorly functional UPJO kidneys showed improved function and not all such kidneys should be removed without attempting PCN.

We report PCN drainage performed in adults with unilateral UPJO and less than 10% SRF.

SUBJECTS AND METHODS

Patients and Study Design

From May 2009 to January 2012 we included in study patients with unilateral renal UPJO and less than 10% SRF who underwent PCN drainage. Patients were divided into young adults (age 35 years or less) and older adults (age greater than 35 years). All patients routinely underwent abdominal ultrasound, contrast CT and diuretic renography before PCN. ^{99m}Tc-DTPA was used for diuretic renography to assess SRF and GFR according to the standard protocol. All patients had a normal contralateral kidney and routine examination in all revealed that UPJO was congenital. Urinary tract calculi, infection and vesicoureteral reflux were ruled out before PCN. Each patient provided written informed consent and the study was approved by the Nanjing Drum Tower Hospital review board.

After PCN catheter placement urine cultures and routine urinalysis were performed weekly. Diuretic renography was repeated after 4 to 12 weeks of PCN drainage. Patients underwent pyeloplasty if repeat diuretic renography showed improved function (10% or less SRF) and greater than 400 ml per day urine output from the PCN. Nephrectomy was performed when there were no improvement in function and less than 400 ml per day urine output despite PCN drainage.

PCN Procedure

All PCN procedures were performed under ultrasound or x-ray guidance by a physician in our department with the patient under general anesthesia. We used a nephrostomy set with a 10.2Fr Dawson-Mueller drainage tube (Cook Medical, Bloomington, Indiana). Drainage function was immediately confirmed by ultrasound or x-ray by the physician. Urine output from the nephrostomy tube was recorded daily. Urine output on the day of PCN was recorded but excluded as a renal functional index because it was assumed to be residual urine from the obstructed collecting system rather than true daily urine output from the drained kidney. All kidneys underwent PCN drainage for 4 to 12 weeks.

Pyeloplasty

The patient was placed in the lateral position and received general anesthesia. Using a retroperitoneal approach for laparoscopy or open operation the UPJ was initially left unstented to confirm the natural position of the obstructed ureter. It was then dissected upward to reach the pelvis. The proximal ureter and renal pelvis, including the UPJ, were fully mobilized and UPJO was confirmed. The redundant renal pelvis and extreme atrophied renal parenchyma far from the renal hilum were reduced. The stenotic segment of the UPJ was excised with the renal vessels protected. A Double-J® stent was inserted directly in antegrade fashion using a guide wire. A running anastomosis was created with 4-zero polyglactin sutures. A drain was placed in the perinephric space adjacent to the anastomosis.

Followup

After definitive pyeloplasty patients were followed by diuretic renography, contrast CT and abdominal ultrasound at 3 and 6 months, at 1 year and annually thereafter. BUN, blood creatinine and blood pressure were monitored during followup.

Statistical Analysis

Data are shown as the mean ± SD. Statistical analysis was done with SPSS®, version 17.0. Groups were compared by the t-test and chi-square test with $p < 0.05$ considered statistically significant.

RESULTS

We included in study 53 patients with a mean age of 38.66 ± 14.01 years (range 18 to 69) who had UPJO. The male-to-female ratio was 35:18 (table 1). PCN catheter placement was satisfactory in all patients and none had urinary tract infection or bleeding after PCN. Catheters remained in situ until definitive surgery was performed. Mean urine output on the day of PCN was 1,816.98 ± 870.27 ml (range 600 to 3,600).

At a mean of 6.62 ± 2.55 weeks (range 4 to 12) after PCN 30 of 53 patients (56.6%), including 24 young adults, demonstrated improved kidney function on repeat diuretic renography with greater than 400 ml per day urine output from the PCN. Pyeloplasty was then performed. According to intraoperative findings 6 improved and 4 unimproved patients had crossing vessels.

Of the 29 young adults with a mean age of 28.28 ± 4.88 years 24 (82.8%) showed improved SRF compared to 6 of the 24 older adults (25%) with a mean age of 51.21 ± 10.69 years. In patients with improved kidneys mean GFR before and after PCN was 3.57 ± 2.79 and 14.05 ± 5.42 ml/minute/1.73 m^2, and mean SRF was 4.53% ± 3.21% and 16.07% ± 5.49%, respectively (each $p < 0.001$, table 2). A urine specific gravity test revealed significant improvement after PCN drainage ($p < 0.001$, table 2). The remaining 23 patients