Abstract

Background. The placement of a nephrostomy tube or internal ureteral stent after PCNL has been considered standard practice.

Objectives. To investigate the inclusion criteria for totally tubeless PCNL in pediatric cases.

Material and Methods. A total of 27 children who underwent PCNL included in the study: twelve of the 27 patients who underwent totally tubeless PCNL (group 1; tubeless and stentless), and the remaining 15 patients underwent Standard PCNL (group 2; tube with or without stent). Whether or not to perform totally tubeless technique was decided intraoperatively. The length of hospitalization, drop in hemoglobin level, the operation time, stone burden and the fluoroscopy time of group 1 and 2 were compared statistically. Also stone free and complication rates were evaluated in both groups.

Results. The mean age was 5 years and 9.5 years in group 1 and 2, respectively (p = 0.01). The mean operative time was 15.83 min in group 1, and 48.6 min in group 2 (p = 0.0001). The mean change in hemoglobin levels between preoperative and postoperative measurements was –1.83 mg/dl for group1, and –5.2 mg/dl for group 2 (p = 0.0001). No blood transfusion was needed during or after the operation in any cases for group 1. The mean length of hospital stay was 1.83 day in group 1 and 5.53 day in group 2 (p = 0.001). Stone free rate for group 1 was 100% (12/12) and 93.3% (14/15) for group 2. There were no major operative or postoperative complications in both groups.

Conclusions. Provided an optimal patient selection, the success and safety rates of PCNL’s performed via totally tubeless technique are similar to those (Adv Clin Exp Med 2013, 22, 4, 565–570).

Key words: tubeless PCNL, inclusion criteria, children.

Streszczenie

Wprowadzenie. Wprowadzenie drenu nefrostomijnego lub wewnętrznego stentu moczowodowego po zabiegu PCNL zostało uznanе za standardową praktykę.

Cel pracy. Ocena kryteriów włączenia do przezskórnej nefrolitotomii bez stosowania drenażu u dzieci.

Material i metody. Do badań włączono 27 dzieci, u których przeprowadzono zabieg PCNL: 12 z 27 pacjentów, u których przeprowadzono przezskórna nefrolitotomię bez stosowania drenażu (grupa 1 – bez drenu ani stentu) oraz 15 pozostałych, u których przeprowadzono standardowy zabieg PCNL (grupa 2 – dren z/bez stentu). Decyzję o przeprowadzeniu bądź nie przeszkołnej nefrolitotomii bez stosowania drenażu podejmowano śródpowodnie. Długość hospitalizacji, zmniejszenie stężenia hemoglobiny, czas operacji, ciężar kamienia i czas fluoroskopii w grupie 1 i 2 porównano statystycznie. Również doszczętność usunięcia kamienia i odsetek powikłań oceniano w obu grupach.

 Wyniki. Średnia wieku wynosiła 5 lat i 9.5 roku w grupie 1 i 2 (p = 0.01). Średni czas operacji wynosił 15.83 min w grupie 1, a 48.6 min w grupie 2 (p = 0.0001). Średnia zmiana stężenia hemoglobiny między pomiarem przedope-
The prevalence of renal stone disease in children, which generally depends on metabolic disturbances, anatomic abnormalities and urinary tract infections, is 5–15% [1]. Although westernized lifestyle and dietary changes include higher salt intake and decreased water consumption consider being at high risk for urinary system stone development and high recurrence rate [2]. Extracorporeal shock wave lithotripsy (ESWL) has been accepted as the first line treatment choice for pediatric stone disease [3]. But, patients with dilated obstructed kidneys, large stone burden, infection or staghorn calculi have not been suitable candidates for ESWL [4]. In such cases, percutaneous nephrolithotomy (PCNL) has been preferred as the first line treatment.

The placement of a nephrostomy tube and/or internal ureteral stent after PCNL has been considered standard practice [5]. The purposes of the tube placements are to allow the renal puncture to heal, and to provide proper drainage of urine, and to permit access to the collecting system, if a secondary procedure is required [6]. On the other hand, in some patients, the placement of a nephrostomy tube and ureteral stent can be omitted. Thus, these modifications in PCNL procedures allow earlier discharge from the hospital, and leads to more rapid recovery [5]. Moreover, the complications of internal stenting such as ureteral paralysis and ureteral obstruction may be avoided [7].

Since the late 1990s, there is a challenge for many authors to minimize PCNL – related morbidity [8–10]. Then, it has been stated that totally tubeless PCNL could be a safe approach especially in selected adult patients, which many studies indicate shorter hospitalization time for patients undergoing totally tubeless PCNL [11, 12]. To date it has not been extensively reported in pediatric patients whether totally tubeless PCNL was performed [13].

In this study, the authors aimed to investigate the inclusion criteria for totally tubeless PCNL in pediatric cases.

**Material and Methods**

Between 2009 and 2011 years, 27 patients who underwent PCNL for renal stones aged 15 years or younger were included in the study and divided into two groups as totally tubeless PCNL (no nephrostomy tube and no ureteral stent) (group 1, n = 12 patients) and standard PCNL (nephrostomy tube with or without ureteral stent) (group 2, n = 15 patients). The demographic data of patients and stones are summarized in Table 1. The stone composition of 23 patients was calcium oxalate and 4 of them were uric acid. The institutional review board approved the study and informed consent was provided from all patients.

The criteria to perform totally tubeless PCNL were determined according to the present experience in adult patients and previous reports [5, 8, 9, 11]. Inclusion criteria for PCNL surgery were stone size greater than 1 centimeter (cm) for lower pole, 1.5 cm for upper pole or renal pelvis, stones that do not respond to ESWL or pelvicaliceal anatomy was not favorable for clearance after ESWL, or parents prefer PCNL as first line treatment. The inclusion criteria for the totally tubeless PCNL during the operation were a lack of perforation in the collecting system, no serious bleeding, no more than one access, no serious extravasations at the end of the PCNL, a stone free state or clinically insignificant residual fragments (CIRF) (less than 4 millimeters, -mm-), no bleeding for 5 minutes after operation were considered as inclusion criteria (Fig. 1). Preoperatively, patients were evaluated with urine analysis and culture, serum creatinine and biochemistry, complete blood count, coagulation tests, intravenous urography (IVU) and USG. Non-contrast computerized tomography (CT) was performed in patients with nonopaque stones. The stone size (mm²) was calculated by a millimeter graph paper tracing of the anteroposterior stone projection on a plain skiagram or CT.

PCNL technique was performed in the following manner. Under general anesthesia a 5 French ureteral catheter was placed to the operation side, then a prone position was given to the patient. Glands were protected with a lead apron. After selecting the most appropriate calyx in order to reach the stone, access was created by an 18 gauge needle with the help of retrograde pyelography. The nephrostomy tract was formed with plastic amplatz dilators under fluoroscopic image. In all patients 20 French working sheaths were used to perform the operation by an 18 French nephroscope. Stone fragmentation...
was carried out with a pneumatic lithotripter. At the end of the procedure, a C-arm multidirectional fluoroscopy was used to decide between stone-free patients and patients with CIRF. Anterograde pyelography was performed to evaluate the collecting system and assess the amount of extravasations. No internal or external catheter was used in group 1. In group 2, 14 French re-entry catheter was inserted as nephrostomy tube.

Perioperative and postoperative parameters were related to morbidity, which included the length of hospitalization, drop in hemoglobin level, the operation time which was defined as the time to obtain access to the desired calyx, stone fragmentation and removal of stone, the presence of hydronephrosis, stone burden, the fluoroscopy time of group 1 and 2 were compared. Stone clearance was defined as the absence of any residual fragments greater than 4 millimeters on urinary system plain radiography, postoperatively. The follow-up examinations in all patients were done using a plain skiagram on the first postoperative day and month. USG was also performed in patients in group 2 on the first postoperative day and month for perirenal hematoma, urinoma or residual stones.

Table 1. The characteristics of patients and stones

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (Grupa 1)</th>
<th>Group 2 (Grupa 2)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients</td>
<td>12</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Male/Female</td>
<td>4/8</td>
<td>11/4</td>
<td>9.06</td>
</tr>
<tr>
<td>Age – years, mean (range)</td>
<td>5.25 (1–9)</td>
<td>9.4 (5–15)</td>
<td>0.01</td>
</tr>
<tr>
<td>Body mass index – kg/m², mean (range)</td>
<td>25.99 (17.7–33.3)</td>
<td>19.96 (16.96–27.07)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Stone location</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pelvis</td>
<td>8</td>
<td>6</td>
<td>0.44</td>
</tr>
<tr>
<td>calices</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>pelvis + calices</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Stone side, left/right – %</td>
<td>3/9 (25/75)</td>
<td>6/9 (40/60)</td>
<td>0.68</td>
</tr>
<tr>
<td>Stone burden – mm², mean (range)</td>
<td>199 (100–320)</td>
<td>402.67 (95–1550)</td>
<td>0.07</td>
</tr>
<tr>
<td>Hydronephrosis – %</td>
<td>11 (91.7)</td>
<td>7 (46.7)</td>
<td>0.01</td>
</tr>
<tr>
<td>Stone opacity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>radiopaque (%)</td>
<td>11 (91.7)</td>
<td>12 (80)</td>
<td>0.61</td>
</tr>
<tr>
<td>radiolucent (%)</td>
<td>1 (8.3)</td>
<td>3 (20)</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1. After PCNL procedure was completed, the authors waited for 5 minutes and when no hemorrhage was observed, the procedure of the 5-year old patient ended totally tubeless

Ryc. 1. Po zakończeniu zabiegu PCNL u 5-letniego pacjenta czekano 5 min; jeśli nie stwierdzono krwotoku, nie stosowano drenażu
In this study, the authors aimed to investigate the inclusion criteria for totally tubeless PCNL in pediatric cases. Data analysis was performed using SPSS for Windows, version 15. The data was shown as mean ± standard deviation for continuous variables. Categorical variables were presented in percentages. Means were compared using Mann Whitney U test. For categorical comparisons, Chi-square or Fisher’s Exact test were used, where appropriate. P < 0.05 was considered statistically significant.

**Results**

The mean age was 5 years (range, 1–9 years) and 9.5 years (range, 5–15 years) in group 1 and 2, respectively (p = 0.01). Of the 27 children, the female male ratio was 4:5 (12 female, 15 male).

The operative data is summarized in Table 2. The mean operative time was 15.83 min. (range, 3–25 min.) in group 1, and 48.6 min. (Range, 10–80 min.) in group 2 (p = 0.0001). The mean fluoroscopy time was 2.24 min. (range, 1–3 min.) in group 1, and 4.99 min. (range, 2–13 min.) in group 2 (p = 0.0001). The mean change in hemoglobin levels between preoperative and postoperative measurements was –1.83 mg/dl (range, 0–5) for group 1, and –5.2 mg/dl (range, 2–10) for group 2 (p = 0.0001). No blood transfusion was needed during or after operation in any cases for group 1. Only one patient in group 2 required blood transfusion. The mean length of hospital stay was 1.83 (range, 1–4 days) in group 1 and 5.53 (range, 1–12 days) in group 2 (p = 0.001) (Table 3).

All PCNL procedures were done via one access and subcostal approach. In Group 2, one patient had a residual stone of 6 mm, two patients had suspected perforations in the collecting system, and five patients had considerable extravasations at the end of the procedure. Seven patients had considerable bleeding and had to be managed by a nephrostomy tube. Stone free rate for group 1 was 100% (12/12) and 93.3% (14/15) for group 2 was stone free. There were no major operative or postoperative complications in both groups. However, postoperative fever was detected in 2 patients in group 2 and managed medically using antibiotic prophylaxis, and no urosepsis was developed. No patients had urinoma and/or perirenal hematoma.

**Discussion**

The results of this study have shown that totally tubeless PCNL may be performed safely and effectively in selected pediatric patients with renal stones. The choice of patients to perform totally tubeless PCNL was essential for the successful outcome and minimal morbidity.

The first series of standard PCNL in children was successfully performed by Woodside et al. in 1985. In more recent years, due to the emergence of new instruments such as new generation dilators, lithotripters and flexible nephroscope and due to the development of more effective energy sources such as holmium lasers, new techniques such as tubeless mini PCNL (no nephrostomy, with ureteral stent) have been developed to treat selected children with renal stones. As reported
Totally Tubeless Percutaneous Nephrolithotomy in Children

References


Address for correspondence:
Ufuk Ozturk
Ministry of Health
Ankara Dışkapı Yıldırım Beyazıt Education and Research Hospital
Department of Urology
Ankara
Turkey
Tel.: +903125962243
E-mail: ufukozturk71@gmail.com

Conflict of interest: None declared

Received: 25.06.2012
Revised: 27.08.2012
Accepted: 12.08.2013