



Does previous open nephrolithotomy affect the outcomes and complications of percutaneous nephrolithotomy in children?

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Abstract *Objective:* To analyze the success and complication rates of percutaneous nephrolithotomy (PCNL) performed in pediatric patients and to compare outcomes of the patients undergoing primary PCNL with those of patients who had undergone previous open nephrolithotomy.

Materials and methods: Between 2000 and 2011, PNL procedures were performed in 123 renal units (RU) of 111 children. We compared RU on which previous open surgery had been performed (group 1 RU = 26) on the same kidney with RU that had not been involved in previous surgery (group 2 RU = 97). Patient characteristics, pre- and postoperative hematocrit and creatinin levels, operative time, fluoroscopic screening time, stone free rate, complications and hospitalization time were documented and compared.

Results: There were no significant differences between the groups in sex, stone burden, pre- and postoperative hematocrit levels. Mean age and pre- and postoperative creatinin levels were significantly higher in group 1 ($p < 0.05$). Mean operative time, fluoroscopic screening time and hospitalization times were similar in each group ($p > 0.05$). The stone free rates after PCNL were 65.4% in group 1 and 81.4% in group 2 ($p > 0.05$). Multiple access rate was higher in group 1; however, this was not statistically significant (27% vs. 15%, $p > 0.05$).

Conclusion: PCNL can be performed in pediatric patients who have previously undergone open nephrolithotomy but the success rates may be lower and risk of bowel injury higher. NCCT should be considered preoperatively for patients who have previously undergone open renal surgeries to investigate the presence of retrorenal colons. Our study includes relatively few patients with a history of open surgery and we believe that additional clinical studies with larger numbers of patients are needed to confirm our initial findings.

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Introduction

Pediatric stone disease has a wide epidemiologic variation between developed and developing nations, with prevalences of 1–5% to 5–15% respectively [1]. Urolithiasis is a major health problem in Turkey with a rate of 0.8% reported among Turkish School children [2].

Besides minimally invasive approaches such as extracorporeal shock wave lithotripsy (SWL), percutaneous nephrolithotomy (PCNL), ureterorenoscopy (URS) and retrograde intrarenal surgery (RIRS), open nephrolithotomy was the treatment of choice for majority of renal stones. In 1985, Woodside and associates reported the first pediatric PCNL series [3]. Because of lifelong risks of stone recurrence; minimally invasive endoscopic techniques are now the preferred treatment modality in children who previously would have been treated with multiple open procedures.

Effects of previous open nephrolithotomy on the results and morbidity of subsequent PCNL in adults have been previously determined in a number of studies [4,5]. Two studies noted that there were higher failure rates for PCNL in patients with previous open interventions and those studies explained that this lower success rate might be caused by the renal and retrorenal scar tissues and deterioration of the collecting system after previous open nephrolithotomy [6,7]. However, all of these studies were done in adults and there is no study evaluating whether previous open surgery affects the outcomes and complications of the PCNL in the pediatric age group. The aim of this study was to determine the effects of previous open nephrolithotomy on the results and morbidity of subsequent PCNL in pediatric patients. The ethical committee approval protocol number is 22496-20/7/2009.

Materials and methods

We consecutively entered the records of 111 children with 123 renal units (RU) treated with percutaneous nephrolithotomy in our institution between 2000 and 2011. Records of these children were retrospectively reviewed. Of these 111 children, 69 were male and 42 were female. Three patients who had undergone bilateral simultaneous PCNL, two patients with planned staged PCNL for complex staghorn calculi and two patients with uncorrected coagulopathy disorders were not included in to the study.

We compared the RUs on which previous open surgery had been performed (group 1, $n = 23$, RU = 26) on the same kidney with RU that had not been involved in previous surgery (group 2, $n = 88$, RU = 97). Previous open surgeries included 20 pyelolithotomies and six anastrophic nephrolithotomy procedures. Stone size was assessed as the surface area and calculated according to European Association of Urology guidelines [8].

Urinalysis, urine culture, serum biochemistry, complete blood cell count, coagulation tests, plain radiography, excretory urography, urinary ultrasonography and/or non-contrast helical CT scan (NCCT) were the primary preoperative evaluation modalities in selected cases.

Patient characteristics, pre- and postoperative hematocrit and creatinin levels, operative time, fluoroscopic screening time (FST), stone free and complication rate, secondary intervention requirement, hospitalization time and stone analysis were documented and compared in each group.

Mean operative time was defined as the time from insertion of ureteral catheter until suturing of the skin. Stone analysis was made using the X-ray diffraction method.

Intraoperative complications were grouped according to the Satava classification system (grade I, incidents without consequences; grade II, incidents repaired intraoperatively; grade III, incidents requiring reoperation) and postoperative complications were grouped based on the modified Clavien system (see Table 4) [9,10].

Surgical technique

PCNL was performed as in adults. The amplatz renal dilator set was used in 47 RUs and balloon dilators in the remaining 76 RUs. Normal saline at 37 °C was used for irrigation. Surgery was performed through a single tract in 101 RUs, whereas a two combined tracts were used in 20 RUs and three tracts in two RUs. In 45 RUs, 11th intercostal percutaneous access was used. a 17 Fr (63 RUs) or 26 Fr (60 RUs) nephroscope was used.

Postoperative care and follow-up

Hematocrit and hemoglobin concentration estimation were performed postoperatively on the same day in all patients. All patients with supracostal access underwent chest radiography if any symptoms occurred. Patients received ibuprofen and/or paracetamol for postoperative pain. The foley catheter was removed in all patients 12–24 h after the procedure. The nephrostomy tube was removed after demonstrating the flow from the ureter to the bladder on the antegrad nephrostogram in the first 15 cases. The remaining patients' tubes were clamped and if there was no pain or fever, the nephrostomy tube was removed. Postoperative stone clearance was determined with a plain film of the kidneys, ureters and bladder in all the patients following the first day. At follow-up, excretory urography and/or ultrasonography and urine culture was performed after the first month and the status was evaluated by abdominal plain film and ultrasonography every 6 months thereafter. The results were designated as stone free or as having residual stones (any evidence of persistent stone fragments irrespective of size), and a final decision was made according to the evaluation at the postoperative first month.

Statistical analysis

Statistical analysis was done using SPSS, version 13.0. Comparisons were done using Mann–Whitney and chi-square testing where appropriate. Statistical significance was defined as $p < 0.05$.

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