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An analysis of long-term occurrence of renal complications following pediatric pyeloplasty

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Abstract *Objective:* Few reports discuss post-pubertal renal complications after pyeloplasty. We analyzed long-term complications, such as decreased renal function (RF) measured by serum creatinine (SCr), hypertension (HTN), or proteinuria (protU) following pediatric pyeloplasty.

Subjects and methods: We retrospectively investigated 257 patients who underwent dismembered pyeloplasty due to ureteropelvic junction obstruction from January 1986 to December 2001. Medical history, preoperative and postoperative blood pressure, urinalysis, and SCr results were reviewed.

Results: Fifty-five patients (47 male, 8 female) who were followed up for at least 10 years with post-pubertal follow-up data available were analyzed. Seven (12.7%) patients were diagnosed with HTN, and 10 (18.2%) with protU. The grade of hydronephrosis decreased, and the differential RF measured by MAG-3 renal scan significantly increased at final analysis ($p < 0.001$). Presence of preoperative symptoms ($p = 0.034$), and SCr elevation ($p = 0.018$) showed correlation with HTN. HTN took 15.7 (± 5.8) (7–25) years, and protU detection took 16.2 (± 5.9) (6–23) years, with the highest incidence of both HTN and protU between 15 and 20 years post-operatively.

Conclusion: According to our investigation, a prudent evaluation of signs of RF decrease at 10 years after surgery, and then every 5 years, until 20 years should be recommended, although further studies are necessary.

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Introduction

Ureteropelvic junction obstruction (UPJO) and pyeloplasty for its treatment is a common clinical situation for pediatric urologists. The goal of postoperative follow-up in patients who undergo pyeloplasty for UPJO is to identify patients at risk of losing renal function (RF) and who may require intervention [1]. Many studies report improvement of differential renal function (DRF) and hydronephrosis (HN) in children after pyeloplasty [2,3]. Although most radionuclide studies evaluating DRF non-invasively evaluate obstruction, DRF may not accurately evaluate the true physiological RF of the kidney [4], and the exact correlation between DRF and RF is not yet fully understood [5].

Although recovery of DRF may be maintained during childhood, puberty is a whole different developmental stage. Children experience a growth spurt, during which an increase in metabolic demand and body weight occurs. Puberty has been reported to cause RF decrease in patients with Chronic Kidney Disease (CKD) [6]. Several animal studies have shown developmental deleterious effects of UPJO [7,8]; however, human clinical studies investigating post-pubertal RF changes after UPJO treatment are rare. In a study reporting of post-pubertal maintenance of improved DRF, parameters evaluating RF deterioration were not evaluated [9]. Therefore long-term follow-up of factors suggestive of RF decrease, such as serum creatinine (SCr) elevation, hypertension (HTN), and proteinuria (protU) is necessary.

Korea has a special situation of obligatory military service for all young men who pass a health check-up after reaching 18 years of age. Therefore, in our clinic, almost all patients who underwent pyeloplasties at a young age revisited our clinic for a medical certificate stating their previous surgical history prior to enlistment for military service after they turned 18 years old. During such check-ups we noticed that quite a few patients presented with HTN and protU. Based upon our clinical experience, we decided to evaluate patients whose long-term, post-pubertal information was available, and to analyze factors that could affect RF. In this study, we aimed to identify what parameters could be used for diagnosis and prediction of decrease in RF in order to provide information on long-term follow-up for pediatric patients who undergo pyeloplasty.

Materials and methods

We retrospectively investigated the clinical data from 257 patients who underwent dismembered pyeloplasty (DMP) by a single surgeon (HC) at Seoul National University Children's Hospital from January 1986 to December 2001. The DMP was performed as previously described [10]. Patients with vesicoureteral reflux, ureterovesical junction obstruction, ureterocele, neurogenic bladder, or multicystic dysplastic kidney were excluded from analysis. A final analysis on 55 patients who were followed up for at least 10 years, and whose post-pubertal follow-up data were available, was performed. We considered the minimum age of completion of puberty as 18 years old, and excluded children whose final follow-up age was younger than 18, although some of them were followed up for more than 10 years.

Baseline evaluation and postoperative follow-up were performed as previously reported. Preoperatively, baseline evaluation of HN with kidney ultrasound and DRF with a MAG-3 renal scan, SCr evaluation, and measurement of blood pressure (BP) were performed. The age of operation and the waiting period from the diagnosis of UPJO to the operation date were analyzed. The presence or absence of preoperative symptoms such as pain, urinary tract infection (UTI), and hematuria was analyzed.

Postoperatively, the patients were advised to have their HN, DRF, protU, BP, and SCr regularly checked until the completion of puberty. Ultrasounds were performed every 3 months until 1 year postoperatively, and in the following 2 years patients were followed up every 6 months. In patients whose HN did not worsen within 3 years after DMP, annual or biannual ultrasound was recommended until the patients completed puberty. More frequent ultrasound examination was required when immediate postoperative complications, such as fever, persistent urine leakage via drain or aggravated HN at the 3-month follow-up ultrasound were observed, and all patients we analyzed completed at least 5 years of ultrasound follow-up. Radionuclide scans for analysis of DRF were performed at 12 months postoperatively, and then at similar intervals as the ultrasound examinations at follow-up.

Because of the Korean situation of obligatory military service, all male patients who reached the age of at least 18 years old revisited us for renal evaluation prior to enrollment in military service. As a result, patients who had been lost to follow-up before completion of puberty were checked by the above-mentioned studies to ensure their renal status, completing post-pubertal follow-up.

The definition of HTN was based upon the normative distribution of BP in normal children, and we followed the National High Blood Pressure Education Program Working Group (NHBPEP) 2004 guidelines [11]. At final analysis, we classified patients with persistent HTN diagnosed any time postoperatively who showed persistent HTN requiring medical treatment into the HTN group. The serum renin and aldosterone levels of the HTN group were evaluated at both baseline and follow-up. The normal value of renin was 1~2.5 ng/mL/hour, and aldosterone was 50–194 pg/mL, and values were measured as previously reported [12].

As for diagnosis of protU, a urinalysis including dipstick measures of albumin concentration was performed, and a measurement of 1+ or higher was considered as protU. Dipstick analysis was performed at least three times during follow-up for each patient, and only those whose protU persisted were classified in the protU group. Among the protU group, patients the urine protein/creatinine (P/Cr) ratio was calculated in those whose protein (mg/dL) and creatinine (mg/dL) data were available. Statistical analysis was performed using SPSS version 18 (SPSS Inc, Chicago, IL, USA).

Results

Fifty-five patients who were followed up for at least 10 years, and whose post-pubertal follow-up data was available, were analyzed; the demographics of these patients are shown in Table 1. The subgroups of seven (12.7%)

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