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## Time course of hydronephrotic changes following unilateral pyeloplasty

Kwanjin Park <sup>a,\*</sup>, Minki Baek <sup>b</sup>, Sung Yong Cho <sup>a</sup>, Hwang Choi <sup>c</sup>

<sup>a</sup> Department of Urology, Seoul National University, Republic of Korea

<sup>b</sup> Department of Urology, Sungkyunkwan University, Republic of Korea

<sup>c</sup> Department of Urology, Armed Forces Capital Hospital, Republic of Korea

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**Abstract Objectives:** The temporal pattern of hydronephrotic change following pyeloplasty has not been well defined. To address this issue, 23 years of postpyeloplasty follow-up data from a single surgeon were analyzed.

**Patients and methods:** Records of dismembered pyeloplasty from 1986 to 2004 were retrospectively reviewed. Ultrasound follow-ups were conducted at 3–6-month intervals after surgery for up to 3 years, and were then extended to either annually or biannually until the completion of puberty. Overall outcome of hydronephrosis (HN), timing of initial improvement and normalization were determined. Factors associated with these changes were examined.

**Results:** Of 215 patients who completed follow-up of at least 5 years, about 80% experienced either normalization or improvement. Once they had shown improvement of HN during follow-up, no recurrence was observed. The median time for recognition of initial improvement and normalization of HN was 8 months and 41 months after surgery, respectively. Multivariate analysis revealed that the presence of immediate postoperative obstruction was a negative factor for initial improvement. Symptomatic presentation and no initial improvement until 6 months after pyeloplasty turned out to be negative factors for normalization.

**Conclusions:** The results confirm the excellent long-term outcome of pyeloplasty, and highlight the importance of frequent ultrasound until initial improvement of HN, when subsequent ultrasound follow-ups may be safely omitted to focus on follow-up of renal function, proteinuria and hypertension.

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\* Corresponding author. Department of Urology, Seoul National University, 101 Daehak-Ro, Jungno-Gu, Seoul, Republic of Korea. Tel.: +82 2 2072 0695; fax: +82 2 742 4665.

E-mail addresses: urodori9@snu.ac.kr (K. Park), minki.baek@samsung.com (M. Baek), kmometry@daum.net (S.Y. Cho), hchoimd@gmail.com (H. Choi).

## Introduction

With the advent of ultrasound, hydronephrosis (HN) has become a common prenatal finding and its persistence in the newborn presents significant challenges. Ureteropelvic junction obstruction (UPJO) accounts for 40–70% of cases of persistent HN [1,2]. Surgical treatment, such as dismembered pyeloplasty (DMP), can be offered in the case of significant obstruction [3].

Following DMP, both differential renal function and HN are usually monitored to evaluate the treatment efficacy. While the change in differential renal function has been sufficiently evaluated [4], only a few studies have investigated the outcome of HN following DMP [5–8]. Moreover, only one study has undertaken analysis of the temporal changes in HN [5]. During a mean follow-up of 3.8 years, these authors revealed an excellent HN improvement rate (91%), but only 38% of patients showed initial improvement (within 6 months of surgery) stressing the limitation of early sonographic follow-up for determining surgical efficacy. Moreover, about a fifth of patients showed complete resolution of pyelocaliectasis, i.e. normalization of HN in the long run.

Due to obligatory military service in South Korea, a substantial number of adult male patients who had been lost to pubertal follow-up revisited our clinic for their medical check-up and completed their follow-up on a long-term basis. These data enabled us to analyze the overall outcome of HN after pyeloplasty, the timing of improvement and normalization, and the factors independently associated with the improvement and normalization of HN.

## Patients and methods

We retrospectively reviewed the records of all patients who underwent DMP at the Children's Hospital of Seoul National University from 1986 to 2004, allowing for a follow-up of at least 5 years. The study protocol was approved by the Institutional Review Boards of Seoul National University Hospital.

In 1986–2004, 312 patients were treated with DMP by the same surgeon (H.C.). Cases with concurrent bilateral UPJO, solitary kidney, vesicoureteral reflux, ureterovesical junction obstruction, ureterocele, ureteral duplication, neurogenic bladder or multicystic dysplastic kidney were excluded. The data were also considered inadequate if the duration of follow-up after DMP was less than 5 years. Thus, the data of 215 patients were eligible for analysis.

For 105 patients who presented with prenatal HN, the surgical decision was made primarily on the basis of renal functional impairment (56 patients), worsening HN during follow-up (49 patients) and the presence of symptoms, such as abdominal mass, pain, gross hematuria or urinary tract infection (110 patients). The surgical technique has been described previously [9] and no attempt was made to reduce a dilated renal pelvis. In the case of a difficult anastomosis or giant hydronephrosis, a ureteral stent was inserted to help drainage during the immediate postoperative period.

Following pyeloplasty, the patients were advised to have their HN, proteinuria, blood pressure and diuretic renal

scan regularly checked until the completion of puberty. They were scheduled for ultrasound every 3 months until 1 year. During the ensuing 2 years, patients were followed up every 6 months. For patients without evidence of aggravation of HN up to 36 months after DMP, annual or biannual ultrasound was checked until 18 years old when pubertal growth came to an end, and they were discharged from further follow-up thereafter. More frequent ultrasound examination was needed when there were immediate postoperative complications, such as fever, persistent urine leakage via drain or increased amount of HN at the 3-month follow-up ultrasound. Hence, all patients had completed at least 5 years of follow-up ultrasound.

As mentioned earlier, all male patients who reached the age of 19 or 20 years old revisited us to get their certificate of renal status before enrollment in the army. Patients who had been lost to follow-up before the completion of puberty were checked by the above-mentioned studies to ensure their renal status, completing the post-pubertal follow-up.

The degree of pyelocaliectasis was graded as 0–4 according to the classification scheme of the Society for Fetal Urology (0, normal kidney with intact renal sinus; 1, slightly dilated renal pelvis without caliectasis; 2, moderately dilated renal pelvis with mild caliectasis; 3, large renal pelvis and dilated calices; 4, large renal pelvis with large dilated calices) [9].

After the last follow-up, overall outcome of HN treatment was defined as normalization, improvement, stabilization or aggravation. Normalization of HN was defined as downgrade of HN to grade 0 or 1. Improvement was any downgrade of HN short of normalization. If there was no change or upgrade of HN after the last follow-up, this was called stabilization or aggravation, respectively. To discriminate the case of transient downgrade of HN during follow-up from eventual downgrade of HN (improvement), this was called 'initial improvement'.

All categorical and time variables were expressed in proportions and months, respectively. Kaplan–Meier survival analysis was used to determine median time to initial improvement and normalization, and the corresponding curve was plotted using Prism version 5 (GraphPad Software, La Jolla, CA, USA). For determination of the factors independently associated with the initial improvement of HN and normalization, univariate analysis of differences in proportions was performed by chi square tests. Then, multiple logistic regressions were used to determine the factors associated with the initial improvement and normalization. This work was performed using SPSS version 13 (SPSS Inc, Chicago, IL, USA).

## Results

### Patient demographics, characteristics and follow-up

Table 1 describes demographics and clinical characteristics of patients. Of the 215 patients with primary UPJO, 179 (84%) were boys and 36 (16%) were girls. Regarding laterality, 162 (75%) had left-sided HN and 53 (25%) had right-sided HN. Of the 105 prenatally detected patients, 45

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