Does Renal Function Remain Stable After Puberty in Children With Prenatal Hydronephrosis and Improved Renal Function After Pyeloplasty?

Boris Chertin,* Avner Pollack, Dmitry Koulikov, Ron Rabinowitz, Ori Shen, Daniel Hain, Irit Hadas-Halpren and Amicur Farkas

From the Departments of Urology (BC, AP, DK, AF) (Division of Pediatric Urology) (BC, AP, AF), Nuclear Medicine (DH) and Diagnostic Radiology (IHH), and Obstetric Ultrasound Unit (RR, OS), Shaare Zedek Medical Center, Jerusalem, Faculty of Medical Science, Hebrew University, Jerusalem, Israel

Purpose: We evaluated whether improved renal function after pyeloplasty for prenatal ureteropelvic junction obstruction persisted through puberty.

Materials and Methods: A total of 441 males and 137 females with a prenatal diagnosis of hydronephrosis that led to the postnatal diagnosis of ureteropelvic junction obstruction were followed at our department from 1989 to 2008. Of the patients we reviewed the records of 49 who underwent surgery between 1989 and 1992, and completed puberty. Hydronephrosis was on the right side in 18 children (36.7%) and on the left side in 31 (63.3%). According to Society for Fetal Urology classification at first presentation postnatal hydronephrosis was grades 2 to 4 in 18 (36.7%), 23 (46.9%) and 8 children (16.3%), respectively. Initially relative renal function was more than 40% in 18 children (36.7%), between 30% and 40% in 24 (49%), and less than 30% in 7 (14.3%). Preoperatively mean ± SEM relative renal function was 36.6% ± 7.8% in all reviewed patients.

Results: Improvement in hydronephrosis was confirmed in all patients. This remained stable during and after puberty in all except 2 patients, who required endopyelotomy 8 and 10 years following pyeloplasty, respectively, due to deterioration in hydronephrosis without a decrease in relative renal function. They showed improvement in the washout curve pattern after the procedure. Pyeloplasty led to increased relative renal function in the short term from 36.7% ± 1.2% before surgery to 41.2% ± 0.91% in all patients ($p < 0.001$). It remained stable at 43.2% ± 0.75% after puberty in all reviewed patients.

Conclusions: To our knowledge our data show for the first time that successful pyeloplasty after the prenatal diagnosis of ureteropelvic junction obstruction is associated with improved renal function throughout puberty.

Key Words: kidney, kidney function tests, ureter, prenatal diagnosis, puberty

Abbreviations and Acronyms

DTPA = diethylenetriaminepenta acetic acid

RRF = relative renal function

SFU = Society for Fetal Urology

UPJ = ureteropelvic junction

* Correspondence: Pediatric Urology Unit, Shaare Zedek Medical Center, P. O. Box 3235, Jerusalem, 91031, Israel (telephone: 972-2-6555560; FAX: 972-2-6555299; e-mail: bchertin@yahoo.com).

DISMEMBERED Anderson-Hynes pyeloplasty for UPJ obstruction is a successful treatment in terms of renal function recovery and obstruction resolution.[1–5] We noted that if UPJ obstruction is diagnosed earlier in life as a result of a prenatal diagnosis of hydronephrosis, pyeloplasty leads to improved renal function.[1] Moreover, we clearly observed that renal function recovery occurs not only in patients allocated to surgical correction after delivery due to poor renal function, but also in those on conservative treatment who required pyeloplasty due to deteriorating renal function

0022-5347/09/1824-1845/0
THE JOURNAL OF UROLOGY®

Vol. 182, 1845-1848, October 2009
Printed in U.S.A.
DOI:10.1016/j.juro.2009.03.008

during observation.[2] The outcome of pediatric pyeloplasty in terms of recovered renal function is the subject of many publications.[4,5–7] However, those studies mainly monitored renal drainage or recurrent clinical symptoms. Furthermore, most studies do not reflect a homogenous group with unified followup.[4–6] Pediatric UPJ must accommodate the numerous changes in the pediatric urinary tract that occur along with child development. The increase in urinary output and body weight may theoretically cause an occult loss of renal function during adolescence.

Since every recruit to the Israel Defense Forces with a history of congenital urogenital disease must undergo urological reevaluation, we used this unique opportunity to evaluate whether improved renal function after pyeloplasty for UPJ obstruction after prenatal hydronephrosis persisted after adolescence.

PATIENTS AND METHODS

A total of 441 males and 137 females with a prenatal diagnosis of hydronephrosis that led to the postnatal diagnosis of UPJ obstruction were followed at our department from 1989 to 2008. Of the patients we identified and reviewed the records of 49 who underwent surgery between 1989 and 1992, and completed puberty. Average age at surgery was 4.7 months (range 1 to 17). In all patients hydronephrosis was identified on prenatal ultrasound performed during the second trimester at 20 to 22 weeks of pregnancy as part of the routine screening program for fetal anomalies in Israel.[3,8] To evaluate a homogeneous group of patients children with single kidney, bilateral hydronephrosis or concomitant vesicoureteral reflux were excluded from study. Our regimen of conservative followup was described previously.[1–3,8]

Ultrasound was performed on day 3 of life in patients with a prenatal diagnosis of hydronephrosis with repeat ultrasound done to grade hydronephrosis. Radionuclide studies were performed at age 6 to 8 weeks. The frequency of further examinations was according to the findings of the initial studies. Although at the time of the study the SFU classification of hydronephrosis was not available, retrospective evaluation of ultrasound images was performed and the degree of hydronephrosis was assessed according to the SFU classification.[9] DTPA renal scans were done to determine renal perfusion during the first minute of perfusion in absolute units.[10] The isotope washout curve was recorded after a bolus of 1 mg/kg furosemide was injected 15 minutes after radionuclide administration. ^{99m}Technetium-dimercapto-succinic acid renal scans were done to assess RRF using background corrected regions of interest of each kidney in the posterior view and calculating the resulting percent uptake. Renal scintigraphy was done 2 hours after ^{99m}technetium-dimercapto-succinic acid injection. Fractional left and right renal activity was calculated for each kidney. A kidney uptake of 40% to 50% of total renal activity was considered normal, 30% to 40% RRF was considered moderate and renal function less than 30% of RRF was considered poor. Right and left hydronephrosis was present in 18 (36.7%) and 31 children (63.3%), respectively. According to the SFU classification at first presentation postnatal hydronephrosis was grade 2 to 4 in 18 (36.7%), 23 (46.9%) and 8 patients (16.3%), respectively (see table). Initially RRF was more than 40%, between 30% and 40%, and less than 30% in 18 (36.7%), 24 (49%) and 7 patients (14.3%), respectively (see table). Mean ± SEM RRF was 36.6 ± 7.8 in all reviewed children before surgery.

The combination of more than 5% hydronephrotic kidney functional deterioration and worsening hydronephrosis, considered SFU upgrading, served as the only indication for surgery in all reviewed study patients. Although half-time was recorded in each case as part of the well tempered DTPA protocol, like many others we did not rely on a half-time of more than 20 minutes as an unequivocal sign of obstruction.

Dismembered pyeloplasty was performed using the same technique in all patients. All children underwent repeat evaluation, including ultrasound, 3 months after surgery. If no worsening hydronephrosis was noted, all patients underwent DTPA renal scan 6 months postoperatively as routine followup after pyeloplasty in our department. Ultrasound was performed yearly thereafter until age 18 years with repeat radionuclide study when any worsening hydronephrosis was noted. In all cases radionuclide study was performed at the beginning of adolescence and repeated after patients completed adolescence, starting at age 16 years upon enlisting in the army. GraphPad Prism® for Windows®, version 4 was used with Fisher's exact test for statistical evaluation.

RESULTS

Improvement in hydronephrosis was confirmed in all patients. This remained stable during and after puberty in all except 2 patients, who had poor RRF (24% and 19%, respectively) before surgery. These 2 patients required endopyelotomy 8 and 10 years after pyeloplasty, respectively, due to deteriorating hydronephrosis without a decrease in RRF. They showed improvement in the washout curve pattern after the procedure. Overall surgery led to an improved SFU hydronephrosis grade from 2.8 ± 0.1 to 1.6 ± 0.13 after puberty (fig. 1). Pyeloplasty led to an increase in RRF in the short term from 36.7% ±

Patients by SFU grade and RRF throughout study period

	No. Initial (%)	No. Preop (%)	No. Postop (%)	No. Puberty (%)
SFU grade:				
2	18 (36.7)	—	14 (28.6)	38 (75.6)
3	23 (46.9)	11 (22.5)	28 (57.1)	8 (22.5)
4	8 (16.3)	38 (77.5)	7 (14.3)	3 (6.1)
RRF:				
Greater than 40	18 (36.7)	7 (14.2)	21 (42.9)	23 (46.9)
30–40	24 (46)	27 (55.1)	22 (44.9)	22 (44.9)
Less than 30	7 (14.3)	15 (30.7)	6 (12.2)	4 (8.2)