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Intravesical ureteric reimplantation for primary obstructed megaureter in infants under 1 year of age

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Summary

Purpose
This study aimed to assess the outcome of intravesical ureteric reimplantation for primary obstructed megaureter (POM) performed in infants under 1 year of age.

Materials and methods
A retrospective cohort study was carried out of all infants undergoing intravesical ureteric reimplantation surgery for POM at two pediatric centers in the 12 years between 2003 and 2014. Outcomes were compared with those of children aged over 1 year undergoing intravesical reimplantation for POM during this period. Follow-up was until November 2015.

Results
Thirty-seven megaureters in 34 infants were reimplanted, at median age 5.2 months (Table). Operative success was 97%, with one out of 34 patients (3%) requiring reoperation for recurrent ureteric obstruction. Renal preservation was high. One patient of 34 (3%), who had bilateral congenital renal dysplasia, showed evidence of decline in renal function. Five patients of 34 (15%) had postoperative urinary tract infections (UTIs). Four (13%) of those toilet trained had some symptoms of lower urinary tract dysfunction (LUTD). Three patients (9%) who had congenitally dysplastic kidneys developed hypertension. Comparatively, 14 children with POM underwent reimplantation over 1 year of age. Operative success was 86%, with two children requiring reoperation for recurrent stenosis. Both had evidence of bladder dysfunction before surgery, and thickened bladder walls noted during surgery. One of 14 (7%) had a decline in ipsilateral renal function after recurrent stenosis. Two (14%) had postoperative UTI. Three (25%) had evidence of LUTD.

Discussion
There are few data about feasibility and long-term outcomes specifically of ureteric reimplantation for POM in infancy. This is the first study to document long-term outcomes of intravesical ureteric reimplantation in infancy for POM. The recently published British Association of Paediatric Urologists consensus statement supports delaying definitive reimplantation surgery for POM that requires intervention until after 1 year of age. There is little evidence presented for this recommendation. Our study confirms the safety and feasibility of intravesical ureteric reimplantation for POM in infants under age 1, with an operative success rate of 97%, and high renal function preservation rate. UTI risk improved after surgery in children >6 months old and remained stably low in those <6 months of age. Postoperative rates of LUTD were low. Hypertension occurred in only three cases with congenital renal dysplasia.

Conclusions
Ureteric reimplantation in infants under 1 year of age is a safe and effective option for managing POM that requires intervention, and compares favorably with those undergoing reimplantation over 1 year of age.

Table Summary of preoperative characteristics and postoperative results.

	Study group (reimplanted <12 months)	Comparison group (reimplanted >12 months)	*p* (study vs. comparison group)
Preoperative			
Total	34 (71%)	14 (29%)	
UTI	16 (47%)	11 (79%)	0.047*
Ipsilateral function < 45%[a,b]	13 (42%)[a]	8 (62%)[b]	0.22
Renal impairment (raised creatinine)	1 (3%)	0	–
Temporizing operation	10 (29%)	3 (21%)	0.57
Age at reimplantation in months, median (range)	5.2 (0.1–9.2)	48.1 (12.8–131.1)	<0.001*
Time from diagnosis to reimplantation in months, median (range)	3.4 (0.1–8.6)	3.8 (0.1–106)	0.75
Postoperative			
Follow-up (years)–median (range)	5.5 (1.1–12.4)	4.0 (1.3–10.7)	0.34
Redo surgery for restenosis	1 (3%)	2 (14%)	0.05*
Decline in renal function[c]	1 (3%)	1 (7%)	
Improved renal function[d]	2 (6%)	2 (14%)	0.52
Stable impaired renal function[d]	13 (38%)	6 (43%)	
UTI[e]	5 (15%)	2 (14%)	0.05* favors infants
LUTD[f]	4 (12%)	3 (21%)	0.37
Hypertension	3 (9%)	0	0.25

Note. Values are *n* (%) unless otherwise stated. LUTD = lower urinary tract dysfunction; UTI = urinary tract infection.
* Significant *p* value (<0.05).

[a] Of cases with a functional contralateral kidney (3 single kidneys excluded).

[b] Of cases with Mag3 done (1 case > 12 months excluded).

[c] Includes newly raised creatinine, and decline in ipsilateral function in cases with normal ipsilateral function preoperatively.

[d] Of cases with raised serum creatinine preoperatively and/or reduced ipsilateral function preoperatively.

[e] Excludes JJ stent-associated UTI.

[f] Of cases over toilet-training age at end of follow-up.

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Introduction

It is suggested that primary obstructed megaureter (POM) in infants should be managed with temporizing measures, delaying definitive reimplantation until after age 1 year [1]. This study aims to show that intravesical ureteric reimplantation for POM in infants under 1 year of age is effective and safe with minimal morbidity, with outcomes similar to those undergoing reimplantation after 1 year of age.

Materials and methods

From the operating theater databases of the only state tertiary pediatric hospital and private pediatric urology center, we identified all patients who underwent intravesical ureteric reimplantation for POM in the 12 years between 2003 and 2014 inclusive. Ethics approval was given by the Princess Margaret Hospital for Children (GEKO Approved Activity 6781).

Data were compiled from patients' medical records using Microsoft Excel (Redmond, WA, USA) 2011. Follow-up was until November 2015. The severity of hydroureteronephrosis was graded by ultrasound measurement of the anteroposterior diameter (APD) in millimeters and the distal ureteric diameter in millimeters.

The criteria for diagnosing POM included hydroureteronephrosis with distal ureter >7 mm in diameter, with either obstructed curve on nuclear medicine studies or evidence of obstruction on intraoperative examination by cystoscopy, retrograde studies, or magnetic resonance urography (MRU). All antenatally detected cases and all cases diagnosed after treatment of urinary tract infection (UTI) were placed on prophylactic antibiotics until definitive surgery.

Indications for surgery for POM included ipsilateral function <45% at diagnosis or dropping below 45% during surveillance, UTI, severe hydroureteronephrosis, or progression in hydroureteronephrosis.

A standardized intravesical transtrigonal tunneled ureteric reimplantation technique after resection of the stenotic segment was used for all cases. Resection tapering of the ureter was performed at the clinical judgment of the operating surgeon. A small number underwent short-term temporizing surgery (JJ stenting, percutaneous nephrostomy, or drainage of urinoma) prior to reimplantation (see Table 2).

The outcomes of those reimplanted under 1 year of age were assessed. The small group reimplanted after 1 year of age during the same period also had their outcomes assessed as a comparison. The first primary outcome measure was the need for repeat reimplantation surgery for restenosis. "Surgical success" was defined as no restenosis. The second primary outcome measure was renal function preservation. Renal function was examined by differential function on nuclear medicine studies, and serum creatinine in bilateral or solitary kidney POM. Secondary outcomes assessed included postoperative UTI, lower urinary tract dysfunction (LUTD), and hypertension.

Data were statistically analyzed using Microsoft Excel and SPSS Statistics 23 software (IBM, Armonk, NY, USA). Data from the study group (underwent reimplantation < 12 months of age) were compared with the comparison group (reimplanted > 12 months of age). Categorical data were compared using the chi-square test. Medians of continuous data were compared using non-parametric tests. Statistical significance was $p = 0.05$.

Results

Preoperative demographics

A total of 37 POM in 34 infants under age 1 met the criteria for surgical intervention and underwent intravesical ureteric reimplantation (Table 1). Ten (29%) had an abnormal contralateral renal tract, three of whom had bilateral POM. In three (9%), POM was in a solitary functioning kidney.

Twenty-one (62%) cases were detected antenatally. Thirteen (38%) were diagnosed postnatally with no prior antenatal history. All 13 presented with febrile culture-positive UTI. The median distal ureteric diameter was 13 mm (range 7.3–39 mm) and the median renal pelvis APD was 17.8 mm (range 7–46 mm). Thirty-one (91%) had a moderate (10–14.9 mm APD) or severe (≥15 mm APD) degree of hydronephrosis. Of the remaining three cases with 5–9.9 mm APD, two had gross intrarenal dilatation and one had a perirenal urinoma, in keeping with severe obstruction despite the low APD.

All had preoperative micturating cystourethrogram (28 cases, 82%) or cystoscopy and cystogram (6 cases, 18%) to exclude posterior urethral valves and vesicoureteric reflux (VUR). Thirty-two (94%) had a preoperative Mag3 or DMSA, of whom eight (25%) also had additional imaging: four retrograde pyelogram (RGPG) studies at cystoscopy, two anterograde pyelogram studies at nephrostomy, and two magnetic resonance urograms. Two (6%) cases who did not have nuclear imaging had a single functioning kidney with severe POM assessed on RGPG.

Thirteen of 31 cases with two functioning kidneys (42%) had ipsilateral impaired differential function (<45%) preoperatively, of whom three had bilateral POM and one had an abnormal contralateral kidney. The median split function in this group was 39% (range 25–44%). One case had a raised creatinine preoperatively, an infant with POM in a solitary kidney.

Sixteen (47%) cases had a culture-positive preoperative febrile UTI, three of whom were antenatal diagnoses. No cases had hypertension preoperatively.

In comparison, 15 POM ureters in 14 patients were reimplanted over 1 year of age (Table 1). Only three in this group were diagnosed antenatally. Eleven were postnatally diagnosed, nine after a culture-positive febrile UTI and two with abdominal pain from obstruction.

Temporizing measures

Ten infants (29%) (6 antenatally diagnosed) had intervention pre-reimplantation (JJ stenting, percutaneous nephrostomy, or drainage of urinoma) at median age 3.0 months (range 0.1–6.7 months) (Table 2). Definitive reimplantation was performed at median 2.7 months (range 0.1–6.2 months) after temporizing operations, at median age 6.5