Side-to-Side Refluxing Nondismembered Ureterocystotomy: A Novel Strategy to Address Obstructed Megaureters in Children

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Purpose: A nonrefluxing megaureter is a relatively common cause of antenatal hydronephrosis. Although nonoperative management is favored, surgical intervention is sometimes warranted. However, there is controversy regarding the best approach, particularly in young children. We describe our experience with nondismembered side-to-side refluxing ureterocystotomy as a simple option to address obstruction.

Materials and Methods: Between January 2012 and January 2017, 32 patients underwent ureterocystotomy at 4 referral centers in North America. Demographics, surgical indications, complications, need for further interventions and change in hydronephrosis were captured. Patients were monitored clinically and with serial ultrasounds.

Results: Mean age at surgery was 3.7 months (range 0 to 33) and 25 (78%) patients were male. Unilateral procedures were performed in 29 patients. All patients were initially identified based on the presence of antenatal hydronephrosis and symptoms developed in 10. The procedure was conducted for primary nonrefluxing megaureter in 27 patients and to address secondary obstruction in the remainder. Mean followup was 34.3 months (range 6 to 58). At the most recent evaluation most children demonstrated significant improvement in dilation (86%). To date, 6 patients have undergone further procedures, including a circumcision and 2 ureteral reimplantations for recurrent infections.

Conclusions: Our results suggest that side-to-side refluxing ureterocystotomy is a straightforward, minimally invasive alternative for the surgical management of nonrefluxing megaureter. Despite the trade-off of relieving obstruction and creating reflux, it can be considered a potentially definitive procedure in patients who remain infection-free, particularly circumcised boys. Extended followup with close monitoring is critical to document long-term results with this intervention.

Key Words: ureter, hydronephrosis, pediatrics, vesico-ureteral reflux

Abbreviations and Acronyms
AP = anteroposterior
NRMU = nonrefluxing megaureter
SFU = Society for Fetal Urology
UC = ureterocystotomy
US = ultrasound
UTI = urinary tract infection
UVJ = ureterovesical junction
VCUG = voiding cystourethrogram
VUR = vesicoureteral reflux

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with surgical interventions reserved for children with recurrent pyelonephritis, pain, worsening hydronephrosis or compromise in renal function.\textsuperscript{3,4} For these selected cases the surgical options include creation of a cutaneous ureterostomy,\textsuperscript{5} ureteral stenting,\textsuperscript{6} endoscopic dilation\textsuperscript{7} or endoureterotomy\textsuperscript{8} and ureteral reimplantation.\textsuperscript{9–11} Selection can be challenging, and follows assessment of the risks and benefits of each intervention along with parental preferences, surgeon experience and patient characteristics. There are specific concerns regarding ureteral reimplantation in the first year of life\textsuperscript{12} due to the notable size discrepancy between ureter and bladder, and the need for extensive dissection and tailoring if the ureter is tortuous and dilated.\textsuperscript{13} Thus, many favor creating a diverting ureterostomy, accepting the need for a second procedure and apprehension around managing a stoma.

Recently Kaefer et al described a technique of distal ureteral dismemberment and direct (refluxing) reimplantation into the anterolateral aspect of the bladder.\textsuperscript{14} This was conceptualized as a temporizing strategy, with the intention to subsequently perform a formal reimplantation. This procedure addresses many of the shortcomings of ureterostomy. However, it also calls into question the need to dismember the ureter and routinely plan for eventual reimplantation. Based on this and a statement by the British Association of Paediatric Urologists supporting the use of refluxing ureteral reimplantation in children less than 1 year old,\textsuperscript{12} we report outcomes with a modified, nondismembered, side-to-side refluxing ureterocystotomy as a simple and potentially permanent method of internal diversion in cases of NRMU.

**MATERIALS AND METHODS**

We conducted a retrospective review of patients who underwent UC at 2 Canadian academic institutions between January 2012 and January 2017. In addition, cases performed at 2 centers in the United States were entered. Included patients were required to have a diagnosis of NRMU, at least 1 postoperative ultrasound and clinic visit, and a minimum followup of 6 months. We captured age at diagnosis and surgery, gender, hydronephrosis grade, laterality, single vs duplex system, associated abnormalities, indication for intervention, postoperative outcomes (hospital length of stay, complications, need for further procedures), results of followup US and use of other discretionary imaging studies. We hypothesized that the surgical technique presented here would lead to improvement in upper tract changes without subsequent need for routine ureteral reimplantation.

In terms of surgical technique, for all male patients concurrent circumcision is routinely offered (accepting that some families refuse due to personal/cultural reasons). With the patient supine, retroperitoneal access is gained through a small, muscle splitting incision. The ureter is identified adjacent to the medial umbilical ligament. Minimal dissection is allowed, enough to perform a comfortable, tension-free anastomosis proximal to the obstructed/aperistaltic segment at the ureterovesical junction. The medial aspect of the lower ureter and corresponding lateral bladder wall are incised longitudinally (approximately 1 to 1.5 cm) and anastomosed using absorbable sutures, in a refluxing side-to-side watertight fashion, without dismemberment (fig. 1). For cases that involve duplex systems, careful dissection should avoid injury to the uninvolved

![Figure 1](image_url)

Figure 1. Ureter and bladder wall mobilized to skin level via small (2 cm) inguinal incision (A). Side-to-side anastomosis with running 6-zero absorbable suture (B). Diagram of expected result (C). Note anastomosis just proximal to aperistaltic/stenotic segment.
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