



# Laparoscopic Reconstruction for Obstructive Megaureter in Children: A Case Series with Intermediate and Long Term Follow-Up Outcomes

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## Abstract

**Objective:** To narrate our technique of laparoscopic reconstruction for obstructive megaureters in children and report the intermediate and long term outcome.

**Materials and Methods:** All children underwent detailed pre operative work up. Children with obstructive megaureter and salvageable renal unit underwent laparoscopic reconstruction. The operative exercise included trans peritoneal access, ureteric adhesiolysis till the pathological segment, dismemberment, excisional tapering, intra corporeal suturing and a non refluxing ureteral re implantation following Lich Gregoir principle. Operative and postoperative parameters were recorded. Follow-ups were scheduled 3 monthly in the first post operative year and annually thereafter. Follow-up imaging included Ultra Sound (US) and Voiding Cysto Urethro Gram (VCUG), done at 6 months and 1 year post procedure, and then at yearly intervals. Magnetic Resonance Urogram (MRU) was performed at 1 year post procedure.

**Results:** 7 children (8 units, 6 unilateral and 1 bilateral) underwent laparoscopic tailoring and re implantation for obstructive megaureter. Mean age was 60.6 months. All patients were males. Mean BMI was 16.44 kg/m<sup>2</sup>. Presenting complaints were flank pain (n=5) and recurrent urinary infection (n=7). All procedures were completed via laparoscopic approach. Mean operation duration was 158.33 minutes and mean blood loss was 79.16 millilitres. Mean duration of hospital stay was 2.5 days. No major intra operative or postoperative events were recorded. All patients were asymptomatic at follow-up with preserved renal function. Follow-up US and MRU revealed improvement in grades of hydroureteronephrosis with satisfactory drainage in all. VCUG revealed Grade I VUR in 1 child.

**Conclusion:** Our technique of laparoscopic reconstruction of obstructive megaureters in children is a safe and feasible approach with satisfactory intermediate and long term outcomes.

## Introduction

Obstructive megaureter affects 1 in 10000 children with a male preponderance and increased affection of the left renal unit than the right renal unit. Bilateral affection is reported in 10-20% cases. It results from structural alteration in the muscular layers of the distal ureter, the most common changes being diminished or absent longitudinal muscle fibers, hypertrophic or hyperplastic circular muscle fibers, or increased connective tissue deposition. This leads to partial obstruction in drainage of urine through the pathological segment and consequent progressive hydroureteronephrosis. Obstructive megaureter demands addressal due to abdominal pain, hematuria or recurrent urinary infection [1]. Additionally, long standing atonic ureters impair the drainage of urine from the renal unit and consequent back pressure effects may result in parenchymal loss and renal failure. Armamentariums of approaches have been in vogue for definitive management of obstructive megaureter [2-5]. Most conventional operative exercises for this pathology are undertaken through open approach. The sufferer is thereby subjected to access related morbidity in addition to the procedure related morbidity, and the recovery is prolonged. Laparoscopic approach is increasingly favored in present era for most surgical exercises that were conventionally performed by open approach, as it offers superior cosmesis and better morbidity profile [6]. Despite widespread utilization in reconstruction of other urological pathologies [7], laparoscopic approach for reconstruction for obstructive megaureters has not been widely practised till date. Possible reasons could be the limited experience with laparoscopic reconstruction of ureteral pathologies and the

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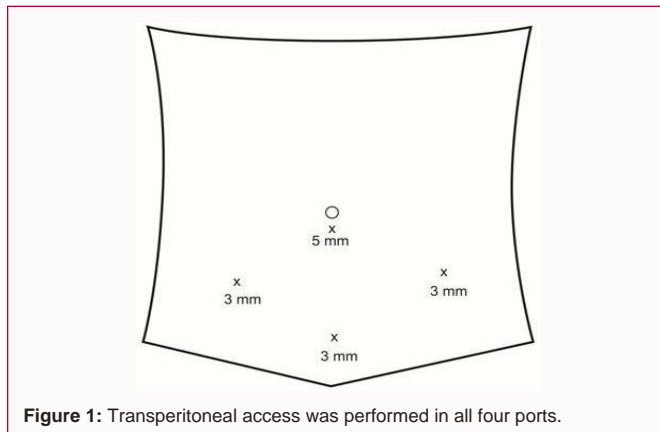
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**Figure 1:** Transperitoneal access was performed in all four ports.

complexity of the surgical exercise involved in this reconstruction. Additionally, conducting laparoscopic approach in small children can be challenging in view of limited abdominal working space. The currently reported series on laparoscopic reconstruction of obstructive megaureter mention extracorporeal tailoring [8] and intra corporeal tailoring without dismemberment [9], these surgical steps deviate from the principles of total laparoscopic reconstruction. We narrate our technique of total laparoscopic reconstruction of obstructive megaureter and bring forth the intermediate and long term outcomes.

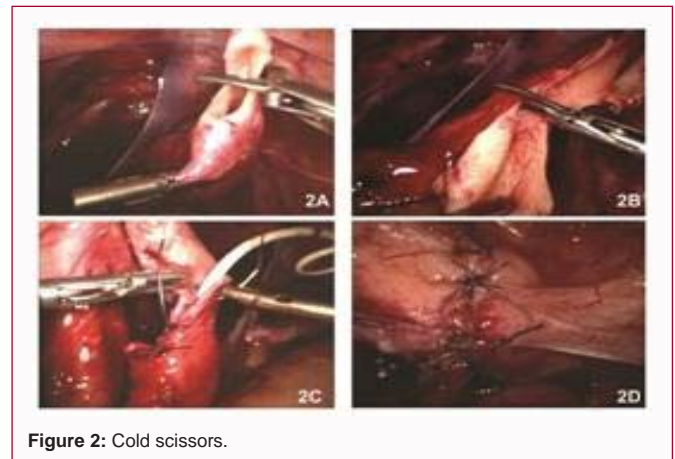
## Methods

### Patient selection

The study cohort comprised children with obstructive megaureters who were operated with the same technique between April 2009 and July 2012. Preoperative assessment included a detailed enquiry of presenting symptoms, prenatal history, previous similar complaints and treatment summary, attainment of developmental milestones. Urinalysis and blood profile were assessed. Preoperative imaging included Voiding Cysto Urethro Gram (VCUG) and Ultra Sound (US) of urinary tract. Hydronephrosis was graded according to the Society of Fetal Urology guidelines [10]. Intra Venous Pyelogram (IVP), Magnetic Resonance Urogram (MRU) and Mercapto Acetyl Glycine (MAG3) renogram were also performed to assess the upper tract drainage status. Patients with obstructive megaureter, salvageable renal unit were offered laparoscopic reconstruction.

### Operative exercise

First, cystoscopy and Retro Grade Urogram (RGU) was performed, and secondary pathologies ruled out. Thereafter, per urethral catheter was inserted and patients were positioned in steep Trendelenberg decubitus. Transperitoneal access was performed in all four ports were employed (Figure 1). The first exercise was adhesiolysis and straightening the tortuous ureter. Ureteric dissection was commenced at a level caudal to the ipsilateral sacroiliac joint. Adhesiolysis was carried out and the ureter was dissected free till the level of pathological segment. The peri ureteral adventitia was meticulously preserved. The usage of thermal energy was restricted during this step. The ureter was dismembered immediately proximal to the pathological segment using cold scissors (Figure 2A). Any additional tortuosities were lysed and the dismembered ureter was straightened. The edge of the dismembered ureter was excised and sent for histo pathological evaluation. The ease of approximation of the dismembered ureter to the bladder was assessed and if any tension was apprehended additional ureteric mobilization was carried out



**Figure 2:** Cold scissors.

above the level of sacroiliac joint. Excessive dissection of the upper ureter was avoided. Tapering the circumference of the ureter was the next exercise and excisional tailoring was conducted. The lower five centimeters of the dismembered ureter was selected for this purpose. An atraumatic grasper was introduced through the midline supra pubic port and the dismembered ureter held straight with gentle traction maintaining the alignment. Excisional tailoring was carried out using cold scissors (Figure 2B). The tapered ureter was tubularised over a 6 F ureteral stent preserving a ureteral lumen just sufficient to accommodate the stent. 3-0 polyglactin suture was employed for this purpose. Intra corporeal suturing was performed in an interrupted fashion (Figure 2C). Ureteroneocystostomy remains the next exercise. Urinary bladder was delineated after partial filling with saline irrigant through the pre placed per urethral catheter (normal saline, 0.9% weight/volume). Bladder was mobilized sufficiently to ensure a tension free ureterovesical approximation. This step was carried out using harmonic shears. A button hole cystostomy was created. Ureteroneocystostomy was then performed using interrupted 3-0 polyglactin sutures. Anti reflux was then constructed following Lich Gregoir principle. From the point of ureterovesical anastomosis, a detrusor tunnel was constructed for a length about five times the diameter of the tapered lower ureter. A seromuscular tunnel was created using hook electrocautery. The ureter was placed into this detrusor tunnel and detrusorrhaphy completed employing interrupted sutures of 3-0 polyglactin (Figure 2D). Detrusorrhaphy was carried out maintaining optimum tension; however care was taken not to over compress the implanted ureter.

### Procedure completion/postprocedure

After ensuring satisfactory hemostasis, drain was placed and ports closed. All patients were allowed orally once comfortable. Drain was removed as indicated. Catheter was removed at revisit after one week. Any significant intra operative or postoperative happenings were recorded.

### Follow-up

Ureteral stents were removed six weeks post procedure. All patients were followed on a three monthly schedule for the first year. Follow-up imaging (US, VCUG and MR urogram) was performed at six months and one year postprocedure. Renal function and imaging was repeated at three years and five years post surgery.

### Outcome

Absence of symptoms during follow-up, improvement in grade of hydronephrosis and decrease in ureteral diameter in follow-up

imaging with unobstructed drainage and no reflux or Grade I reflux in follow-up VCUg was perceived as successful outcome.

## Results

Seven children (eight units, six unilateral and one bilateral) underwent laparoscopic tailoring and re implantation for obstructive megaureter. Mean age was 60.57 months (range 38-83 months). All patients were males. Mean BMI was 16.44 kg/m<sup>2</sup> (range 15.2-18.2 kg/m<sup>2</sup>). Presenting complaints were flank pain (n=5) and recurrent urinary infection (n=7). One patient with ipsilateral lower caliceal renal calculi and lower ureteric calculi underwent percutaneous nephrolithotomy and laparoscopic ureterolithotomy along with laparoscopic tailoring. All procedures were completed via laparoscopic approach. Mean operation duration was 150.63 minutes (range 150-215 minutes) and mean blood loss was 103.57 millilitres (range 75-150 millilitres). No major intra operative or postoperative happenings were recorded. No patients complained of voiding dysfunction after catheter removal or any significant stent related morbidity. All patients were asymptomatic at follow-up. Mean follow-up duration was 53.71 months (range 36-60 months). All patients demonstrated stable follow-up renal profile (mean preoperative serum creatinine 0.81 mg/dl vs mean postoperative serum creatinine 0.77 mg/dl). In all cases, an improvement in grade of hydronephrosis was noted. Follow-up MRU revealed reduction in ureteral diameter with satisfactory drainage in all. No ureteric strictures were encountered in follow-up. VCUg at six months revealed Grade I reflux in one patient that resolved on conservative management. All patients demonstrated normal renal function and satisfactory imaging at three and five years follow-up post surgery.

## Discussion

Any corrective approach for obstructive megaureter should focus on two aspects-the a dynamic lower ureteral segment and the dilated atonic upper part. Therefore, the principles of reconstruction in obstructive megaureter include dismemberment, tapering and re implantation. Dismemberment of the ureter and re implantation allows by passing the pathological segment and reestablishing ureterovesical continuity, thereby ensuring unobstructed upper tract drainage. Additionally the circumference of the lower ureteral segment needs to be reduced to allow restoration of ureteric tone in the healthy proximal ureter. Although both plication and excisional tapering have been practised to reduce the circumference of the proximal ureter [11], excisional tailoring offers superior outcome in presence of grossly dilated (>1.75 cms) and thick ureters [12]. Also, despite the entire ureter being dilated, tapering of only lower four to five centimeters is considered sufficient [13], Tailoring through open approach has been the traditionally performed exercise till date. Currently, laparoscopic approach has been successfully employed for a wide array of urological reconstructions [14]. Despite this, only few centers till date have been routinely performing laparoscopic reconstruction for obstructive megaureters in children. The complexity of surgical reconstruction in megaureters remains a likely explanation. The role of laparoscopic approach for reconstruction of mega ureters therefore remains to be justified. Based on our experience with laparoscopic ureteral reconstructions in adult and pediatric population, we undertook this approach in this subset of patients. Despite technical challenges, all procedures were successfully completed with laparoscopic approach, and without any increased morbidity. The functional outcome remained unaltered in intermediate and long term follow-ups. Few technical steps are

important to ensure a satisfactory reconstruction in this scenario. Dismemberment should be carried out immediately proximal to the pathological segment and all tortuositities in the lower ureter needs to be freed and the ureter straightened. This ensures preservation of optimum length of the ureter to allow a tension-free re implantation to the bladder. Diligent handling of the ureter, preservation of generous peri ureteric adventitia and limited usage of thermal energy are crucial during ureteral adhesiolysis. Mobilization of the upper ureter should be avoided as it runs the risk of devascularising large segments of ureter and consequent ureteric stricture. Another concern during tailoring is the maintenance of the proper orientation of the dismembered ureter. Some operators have advocated extracorporeal suturing of the tailored ureter [14] and others have performed intra corporeal tailoring prior to dismemberment to resolve this issue [15]. Extracorporeal tapering requires mobilisation of longer segments of the ureter to allow extracorporeal extraction. Thereby, the risk of ischemia to long segments of ureter and consequent ureteric stricture formation is increased. Additionally, this exercise is also difficult to achieve in obese children. Intra corporeal suturing allows limited ureteral mobilization and preservation of ureteral vascularity. Although tailoring without dismemberment may help in maintaining the orientation, it limits the straightening of the ureter especially in grossly dilated and tortuous ureters. This results in suboptimal utilization of the available ureteral length and may lead to unnecessary ureteral mobilization. Tapering of ureteral caliber after dismemberment and straightening allows superior coaptation of the ureteral walls and thereby early restoration of ureteric tone may be achieved. Thereby, good functional outcome may be obtained. In all our cases meticulous attention was paid on straightening the ureter and ureteric adhesiolysis was carried out as necessary. Additionally the dismembered ureter was held taut with a grasper and the orientation could be maintained throughout tailoring without difficulty. In pediatric population, non refluxing ureteral re implantations are preferred to avoid long term upper tract changes due to urine reflux. Both intra vesical and extra vesical approaches have been practised for non refluxing re implantation of the re modelled megaureter [16]. We favored extra vesical re implantation as it is an easier laparoscopic exercise and the morbidity consequent to breach of the bladder mucosa can be avoided. No patients in our cohort experienced any bladder spasms, which is a benefit of extra vesical ureteric re implantation. The overall morbidity profile in our patient cohort was appreciable. The incidence of postoperative obstruction and reflux following various corrective procedures for megaureters through incisional access from 0-15% and 0-17% respectively [17]. In our cohort, no patients revealed any postoperative obstruction and grade I reflux was observed in one patient. The reflux resolved on conservative management and the subject was asymptomatic till reflux resolution. All patients demonstrated downgrading of upper tract hydronephrosis at six months follow-up. Limited data exist as to the long term outcome after laparoscopic tailoring. Four patients in our cohort completed five year follow-up and is clinically stable with no hydronephrosis, good drainage pattern and no vesicoureteral reflux.

## Conclusion

Laparoscopic reconstruction for obstructive megaureter is a feasible option with appreciable morbidity profile and durable results. Dismemberment, straightening the lower ureter, tailoring the lower segment and tension free non refluxing ureteroneocystostomy are key steps for this exercise.

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