

## Research Article

# Laparoscopic Ureteroureterostomy in Children

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**Keywords**

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**Abstract**

**Introduction:** The indications for laparoscopic ureteroureterostomy in children include proximal ureteral stricture, retrocaval ureter, ureteral endometriosis, proximal ureteral obstruction, ureteral ectopia and some duplication anomalies of the urinary tract and iatrogenic or traumatic injuries of the proximal 2/3rd of the ureter. We report our experience with laparoscopic Ureteroureterostomy in children.

**Materials and methods:** We retrospectively reviewed the hospital case records of all children who underwent laparoscopic ureteroureterostomy at our hospital.

**Results:** During the study period, Laparoscopic ureteroureterostomy was performed in 18 children. The mean age of the children was 7.5±3.77 years (range 2 to 16 years). The average time for surgery was 90 minutes. There were no major intra-operative complications including bleeding. At a mean follow-up of 33 months, all children were asymptomatic, and postoperative USG demonstrated significantly reduced dilatation of pelvicalyceal system in all children.

**Conclusions:** LIUU is a safe, feasible and effective technique in the management of proximal ureteral obstruction/strictures, retro-caval ureters and duplication anomalies in children. It can be performed with minimal morbidity, blood loss, postoperative pain and excellent outcome.

**ABBREVIATIONS**

RCU: Retrocaval Ureter; IVP: Intravenous Urography; CT: Computerized Tomography; MRI: Magnetic Resonance Imaging; INR: International Normalized Ratio; TP: Trans Peritoneal; DJ: Double-J; UU: Ureteroureterostomy; UPJ: Ureteropelvic Junction; RAL: Robot-Assisted Laparoscopy

**INTRODUCTION**

In the last 30 years, there has been a revolution in the urological techniques that; traditional open surgery has been largely replaced by endoscopic and laparoscopic techniques. This radical leap has gained widespread acceptance due to well-documented advantages of minimally invasive surgery. Since the introduction of laparoscopy in the field of urology, the number of surgeon's actively practicing laparoscopy has steadily increased. It is well acknowledged that laparoscopy provides surgical outcomes similar to those associated with open surgery [1]. This reason alone is responsible for many centers and clinics adapting to this change. The indications of laparoscopy have dramatically expanded over the years, because of its clear advantages over open surgery, in terms of morbidity, pain, cosmesis and early return to activity [2].

The indications for laparoscopic ureteroureterostomy include iatrogenic or traumatic injuries of the proximal 2/3rd of the ureter, proximal ureteral stricture (due to stone, radiation, inflammation), retrocaval ureter (RCU) presenting with reduced ipsilateral kidney function or symptomatic, ureteral endometriosis, proximal ureteral obstruction (crossing vessels, neoplasia, aberrant ureteral position, valves), ureteral ectopia and some duplication anomalies of the urinary tract (functioning upper pole hydronephrosis without ureterocele). Imaging modalities such as intravenous urography (IVP), computerized tomography (CT) urography, magnetic resonance imaging (MRI) are necessary to demonstrate the exact site of ureteric problem or intrinsic or extrinsic pathology leading to hydronephrosis. However if these imaging modalities are inconclusive then a cystoscopy and retrograde pyelography may be useful to demonstrate the pathological process.

Chandrasekharam and Jayaram [3] reported on their experience on ipsilateral ureteroureterostomy in infants and children and opined that, it was a good minimally invasive surgical option in obstructed duplex ureters and that it could be effectively performed with minimal blood loss, minimal postoperative pain, excellent cosmesis and good success. We

report our experience with Laparoscopic ureteroureterostomy in children.

## MATERIALS AND METHODS

We retrospectively reviewed the hospital case records of all children who underwent laparoscopic ureteroureterostomy at our hospital. This study was undertaken with permission obtained from the Institutional/University ethical committee. All children underwent routine preoperative laboratory tests, including total blood count, kidney function tests, and coagulation tests such as, prothrombin time, partial thromboplastin time, and international normalized ratio (INR)]. Imaging modalities included ultrasonography, CT (Figure 1a & 1b) and MR Imaging (Figure 2a).

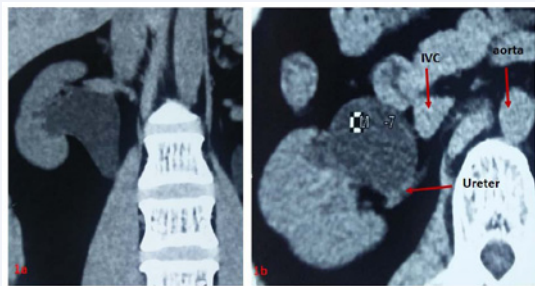
### Preoperative auxiliary instrumentation

Laparoscopic ureteroureterostomy was performed with the transperitoneal (TP) approach. Preoperatively a cystoscopy was done and a double-J (DJ) stent was inserted on the side to be operated. In case of ureteric strictures or obstruction in the ureteral segment, the DJ stent was inserted, after cystoscopy, close to the obstruction as possible. This method helped to identify the pathological ureteral segment.

### Laparoscopic ureteroureterostomy-Surgical technique

The principles of laparoscopic ureteric reconstruction are no different from those established for open surgery. These include ensuring good vascular supply on both ureteric ends with care to preserve the adventitia, complete excision of pathological lesions or nonviable tissue, good drainage with stenting and a wide spatulated and adequate ureteric end to end tension-free anastomosis of mucosa to mucosa [4].

A Foley's urethral catheter was inserted and the child was secured in a modified flank position over the kidney break at a 45-60° angle. A Veress needle is used to create a pneumoperitoneum and a 10-mm camera port was inserted at the level of umbilicus just lateral to the rectus abdominis muscle. On the occasion that the child was slim; umbilicus was used for this purpose. For the right sided LUU, a 5-mm and a 10-mm port were inserted at the 1/3rd caudal and 1/3rd cranial points along a virtual line between xiphoid process and anterior superior iliac spine. Whereas, in case of left sided LUU, 5 and 10-mm port were inserted vice versa.



**Figure 1** a. CT images showing a dilated pelvic calyceal system on the right side. 1b. CT images showing the ureter stretched and passing behind the IVC].



**Figure 2** (A) - MRI images showing a proximal ureteric narrowing on the left side.] (B)-retrograde pyelogram (Pre-operative) showing dilated upper ureter with proximal ureteric narrowing and poor drainage.

After proper port placement, the line of told was incised and the colon was deflected medially to provide exposure of the RP (retroperitoneal) structures including inferior vena cava, ureter, gonadal vein, duodenum and renal pelvis on the right side; ureter and gonadal vein on the left side. Subsequently, the ureter was found with proper RP dissection and problematic segment was visualized (Figure 3). This problematic ureter was then resected, making sure to reach healthy, well vascularized ureteral ends. In situations where-in the injury was due to thermal injury, then wide debridement was done.

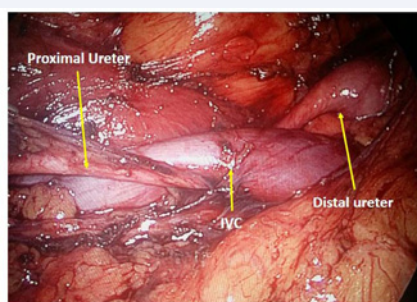
Spatulated ureteroureterostomy (UU) has been the gold standard technique in children with good vascular supply at both the ureteric ends and the ureteric length adequate enough for a tension-free anastomosis. The kidney was mobilized to gain some extra ureteric length whenever a tension free anastomosis was not possible. After adequate exposure of the ureter, both the upper and the lower ureteric ends were transected sharply and spatulated laterally and medially as needed. Spatulation helped in creating a meticulous watertight anastomosis. One of the essential roles of the spatulation process was the preservation of the longitudinal ascending and descending branches of the ureteral arteries. The placement of stay sutures helped to properly direct the incisions while minimizing trauma to the tissues. A tension-free watertight UU was fashioned (over a DJ stent) using posterior and anterior wall closures of interrupted stitches with absorbable suture materials such as 4-0 or 5-0 polyglactin/polydioxanone sutures (Figure 4a & 4b).

### Post-operative care and follow-up

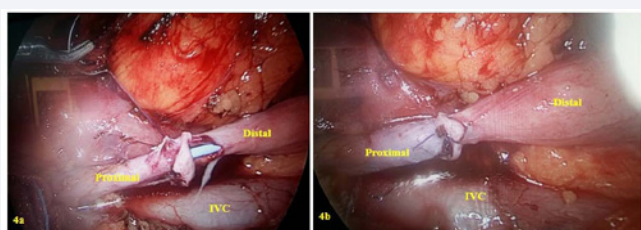
The DJ stent was removed 4-6 weeks postoperatively. Urine examination was done following the DJ stent removal to rule out infection. An IVP/CT urogram was done about 3 months after the operation to demonstrate the patency of anastomosis. Some of the children also underwent postoperative radionuclide study (Diethylenetriaminepentaacetic acid- DTPA) to confirm postoperative drainage.

## RESULTS AND DISCUSSION

During the study period Jan 2006 to Dec 2015, Laparoscopic



**Figure 3** Laparoscopic view of retro caval ureter.



**Figure 4** (A) the two ends of the ureter are spatulated and brought together. (B) the two ends are sutured using 4/0 or 5/0 absorbable sutures.

ureteroureterostomy was performed in 18 children. The mean age of the children was  $7.50 \pm 3.77$  years (range 2 to 16 years). Seven were males and the remaining 11 were females. The presenting symptoms of these children included fever, pain in abdomen, recurrent urinary tract infection (UTI) and vomiting. The indications for LIUU in these children were as shown in Table 1.

Nine children with a mean age of  $10.33 \pm 28$  years had retrocaval ureter. These children were older than the rest of the children and were diagnosed of retrocaval ureter when evaluated for pain in abdomen. Three children with a mean age of  $2.66 \pm 0.47$  years who presented with UTI, fever and pain were diagnosed to have a complete duplication with obstruction of the upper moiety secondary to ureteropelvic junction (UPJ) obstruction in one child and obstructive megareter in the remaining two children.

Four other children with a mean age of  $5.66 \pm 1.88$  years presented with recurrent UTI, pain, vomiting and fever and on evaluation were diagnosed to have incomplete duplication with obstruction of upper moiety in two and obstruction of the lower moiety in the other two. Laparoscopic ureteroureterostomy was planned in all. The average time for surgery was  $90.86 \pm 10.48$  minutes (75 to 120 minutes), with conversion to open required in none of the children. There were no major intra-operative complications including bleeding. None of the children needed blood transfusions. All children needed pain killers/sedatives for up to 24 hours. None of the children needed pain killers more than 36 hours. At a mean follow-up of 33 months, all children were asymptomatic, and postoperative USG demonstrated significantly reduced hydronephrosis/hydronephroureterosis in all children. Post-operative imaging done at around 3 months after surgery revealed patent

anastomosis and free flow of contrast down the ureter.

It is very essential to carefully evaluate the nature, location, and length of the ureteral pathology/stricture, before any surgical repair is planned. Preoperative assessment typically includes an intravenous pyelogram (or antegradenephrostogram or contrast enhanced CT) and a retrograde pyelogram if indicated, because the location and length of the obstruction/stricture heavily influences the options for repair. Other studies such as a nuclear medicine renogram may be necessary to assess renal function. Only on the basis of such information, one can plan an appropriate surgical procedure for the patient.

A short defect involving the upper ureter or mid-ureter, either in the form of stricture or obstruction, is most appropriate for ureteroureterostomy. It may be difficult to determine as to whether or not enough ureteral mobility could be achieved to allow tension-free ureteroureterostomy until the time of surgery, and thus the urologist must be prepared to pursue other options if necessary. The principles of surgery include adequate ureteral dissection and mobilization, sufficient enough to achieve a tension-free anastomosis, after excision of the diseased or pathological portion of the ureter.

A laparoscopic approach to creation of an ureteroureterostomy can be offered to children with ureteral stricture/obstruction/pathology. Nezhat and colleagues [5] first reported on laparoscopic management of an obstructed ureter resulting from endometriosis. In this case, ureteroureterostomy was performed laparoscopically over a ureteral stent after resection of the obstructed ureteral site. Since then a number of case reports or small series have been reported. Reports of laparoscopic ureteroureterostomy to unobstruct a duplicated system in the pediatric population have also appeared. [6,7]. Chandrasekharam and Jayaram [3] reported their experience with laparoscopic ipsilateral ureteroureterostomy (LIUU) for duplex anomalies in eight children (age 6 – 60 months). The surgical procedure consisted of cystoscopy, retrograde studies and cannulation of the recipient ureter. Then, LIUU was performed using three ports. The ectopic (donor) ureter was divided at the pelvic brim; the recipient ureter was opened and end-to-side LIUU was performed with 5/0 vicryl stitches over a double J (DJ) stent placed in the recipient ureter. Bladder catheter was removed after 2 days, and DJ stent was removed after 4 weeks. At a mean follow-up of 19 months (3-36), all children were asymptomatic and continent, with a significant reduction in hydronephrosis on ultrasound. The cosmetic results were excellent.

Wong et al. [8], reported on two children aged 2 and 6 years,

**Table 1:** Type or copy/paste here a brief descriptive title of the table DO NOT use full-stop after table sentence.

No	Indication	Side	No of children
1	Retro-caval ureter	Right	9
2	Complete duplication	-	3
3	Incomplete duplication	-	4
4	Mid Ureteric obstruction	Right	1
5	Low lying UPJ obstruction	Left	1

**Abbreviations:** UPJ- Ureter Pelvic Junction

who underwent laparoscopic ipsilateral ureteroureterostomy for their renal duplex anomalies. Both patients had complete duplex and were investigated by ultrasound, micturating cystourethrogram, magnetic resonance urography, and radioisotope scan. The pathological moieties of both patients were functional. Both patients underwent laparoscopic ipsilateral ureteroureterostomy uneventfully without any intraoperative complications. Postoperative imaging confirmed successful outcomes after surgery. The suturing in laparoscopic IUU is meticulous but similar in complexity to that of laparoscopic pyeloplasty. Surgeons experienced in laparoscopic pyeloplasty are competent enough to handle the ureteral anastomosis in laparoscopic ureteroureterostomy.

## CONCLUSION

Laparoscopic ureteroureterostomy is a safe, feasible and effective technique in the management of proximal ureteral obstruction/strictures, retro-caval ureters and duplication anomalies in children. It can be performed with minimal morbidity, blood loss, postoperative pain and excellent outcome.

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