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Transperitoneal Laparoscopic Pyeloplasty in Children

HARPRIT SINGH, M.S., ARVIND GANPULE, M.S., DNB, VINEET MALHOTRA, M.S., T. MANOHAR, M.S., DNB, V. MUTHU M.S., MCh, and MAHESH DESAI, M.S., FRCS, FRCS

ABSTRACT

***Background and Purpose*: Ureteropelvic junction (UPJ) obstruction remains the most common cause of hydronephrosis in newborns and children. Open pyeloplasty has been the gold standard for management of UPJ obstruction in these patients. We report our technique and outcome with laparoscopic transperitoneal dismembered pyeloplasty in children.**

***Patients and Methods*: Nineteen patients, ages 2 to 14 years, underwent laparoscopic pyeloplasty at our center between June 2004 and December 2006. Thirteen pyeloplasties were on the left side and six on the right side. A transmesocolic approach was used in five left-sided UPJ obstructions. All operations were performed by the transperitoneal route using either three or four ports.**

***Results*: Sixteen patients underwent dismembered (Anderson-Hynes) pyeloplasty, while three had a nondismembered Foley's Y-V pyeloplasty. Mean operative time was 198 minutes (range 105–300 min). Mean estimated blood loss was 45 mL (range 30–130 mL). Mean length of stay was 4 days (range 3–5 d). Mean follow-up was 13.8 months (range 2–30 mos). Postoperatively, one child had a urinary tract infection that necessitated hospital admission and administration of intravenous antibiotics. Eighteen of 19 patients demonstrated improved drainage with no evidence of obstruction on diuretic renography and/or excretory urography. One patient is awaiting follow-up. There was no conversion to open surgery.**

***Conclusion*: Laparoscopic pyeloplasty in children is a safe, minimally invasive treatment option that duplicates the principles and techniques of definitive open surgical repair. It is technically challenging; with increasing expertise, operative times are reduced significantly.**

INTRODUCTION

URETEROPELVIC JUNCTION (UPJ) obstruction is the most common cause of hydronephrosis in newborns and children. Open pyeloplasty has been the gold standard for UPJ obstruction in adults and children, with an overall success rate of 90% to 100%.[1–3] Open pyeloplasty has several shortcomings, including significant postoperative pain, prolonged convalescence, and a prominent skin incision.[4,5] Procedures such as antegrade and retrograde endopyelotomy, although less invasive, have lower success rates of 70% to 89% in highly selected patients,[6,7]

In 1993, Schuessler and associates[8] first described the dismembered laparoscopic pyeloplasty in adults. Tan and colleagues[9] reported the first pediatric series of transperitoneal laparoscopic dismembered pyeloplasties. We report our technique and outcome of laparoscopic dismembered pyeloplasty via a transperitoneal approach in children.

PATIENTS AND METHODS

The diagnosis of UPJ obstruction was established in all patients based on history, physical examination, and radiographic studies. All patients were evaluated preoperatively with ultrasonography, diuretic renography, and/or excretory urography.

Indications for surgery were children with symptoms who had an obstructive pattern seen on a diuretic scan, a repeated urinary tract infection, or antenatal hydronephrosis with increasing hydronephrosis or deteriorating renal function on a subsequent renal scan.

An informed written consent was obtained before surgery.

All patients underwent cystoscopy and retrograde pyelography to confirm the site and length of the lesion. Placement of a 3F to 5F ureteral or pigtail catheter before pyeloplasty facilitated identification and dissection of the renal pelvis.

Two types of repairs were performed, depending on the an-

Muljibhai Patel Urological Hospital, Nadiad, Gujarat, India.

atomic findings at the time of dissection of the UPJ. In patients with a large renal pelvis and /or crossing vessels, dismembered pyeloplasty was done. Nondismembered, Foley's Y-V pyeloplasty was performed in patients with a small renal pelvis, with no crossing vessels, short segment stricture, and high ureteral insertion. The transmesocolic approach to the UPJ on the left side was taken if the mesentery had less fat, and an extrarenal large pelvis was well visible through the mesocolon. It was also determined that the vascularity of the mesocolon was convenient for the approach to the pelvic ureteral junction[10] (Fig. 1A and B).

Operative time started at the time the patient was placed in the lithotomy position for cystoscopic examination to the placement of a double J stent retrograde after completing the anastomosis.

All patients were assessed for symptoms at follow-up evaluation. An ultrasonographic scan and urine culture was performed at 1-month follow-up. Failure was defined as persistence of symptoms or no improvement in the drainage pattern on diuretic renography.

At 3-month follow-up, objective assessment of the repair was performed with diuretic renography or excretory urography.

Preoperative preparation and patient positioning

An enema was administered the night before surgery to ensure that the bowels were empty. All patients received perioperative prophylactic antibiotics.

The patients were positioned in the lateral position with adhesive straps. Patients were placed as close as possible to the edge of the operating table. The ureteral and Foley catheters were placed in the operative field, which allowed manipulation of the ureteral catheter /pigtail catheter intraoperatively.

Surgical technique

Pneumoperitoneum was achieved by standard Veress needle access. The abdomen was insufflated with carbon dioxide at pressures of 10 to 12 mm Hg. First, a 5-mm port was placed at the midpoint of the spino-umbilical line (on the midclavicular line); however, position varied, depending on the level of UPJ obstruction. Two ports (5 mm) each were placed under vision, one at the costal margin lateral to the rectus muscle, and the other roughly corresponding to the hilum (as seen on intravenous urography, Fig. 2).

In right-sided pyeloplasty, an extra 5-mm port was needed for retraction of the liver. Occasionally, an extra 5- or 3-mm port was placed for retraction or to help to follow sutures.

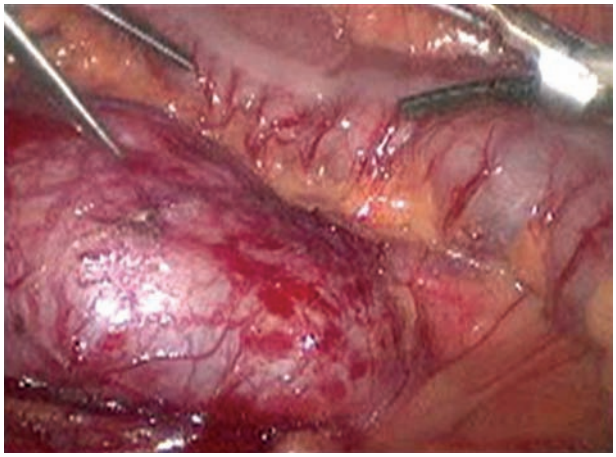
Initially, the colon was mobilized by incising along the avascular line of Toldt. The bowels were pushed medially. The pelvis and UPJ were dissected, and the ureter was identified. Before excision of the UPJ, pyelolysis was performed. The proximal ureter and renal pelvis were mobilized. If the pelvis was large, it was stabilized using a single transabdominal "hitch stitch" (Fig. 3). This was accomplished by passing a 2-0 silk suture on a straight needle through the full thickness of the abdominal wall, transfixing the renal pelvis, and passing back the suture through the abdominal wall.

After stabilizing the pelvis, pyelotomy was accomplished using endoscissors (Fig. 4A). The ureter was dismembered with a small cuff of the renal pelvis. The lateral wall of the ureter was opened longitudinally and spatulated to sufficient length (Fig. 4B). The cuff of renal pelvis, UPJ, and proximal ureter attached to the spatulated ureter helped to orient and hold the ureter.

The ureteropelvic anastomosis was performed using 4-0 polyglactin sutures on a half circle, round-bodied needle; in younger children, we have used 6-0 suture material. The first suture was placed at the apex of the spatulated ureter from outside in and then driven through the most dependent part of the pyelotomy (Fig. 5A). The posterior layer anastomosis was completed running up the length of the spatulated ureter and pelvis, followed by anterior layer anastomosis (water tight, dependent, and funnel shaped) (Fig. 5B). The redundant pelvis and UPJ were excised. In patients with crossing vessels we ensured that the anastomosis was anterior and away from the crossing vessels.

After antiseptic irrigation and complete hemostasis, a drain was placed through one of the port sites (Fig. 6A). Anastomosis was retroperitonealized by suturing the colon to the lateral wall and closing the mesocolic window (Fig. 6B). Ports (fascia and the skin) were closed with absorbable sutures.

A



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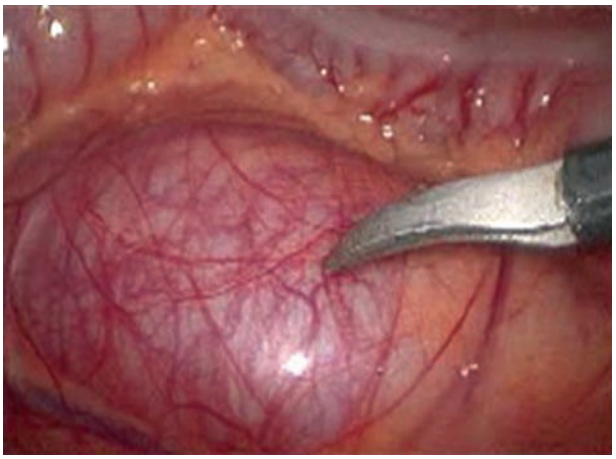


FIG. 1. (**A**) Pelvis/ureteropelvic junction are viewed through the transmesocolic window. (**B**) Transmesocolic window is opened.

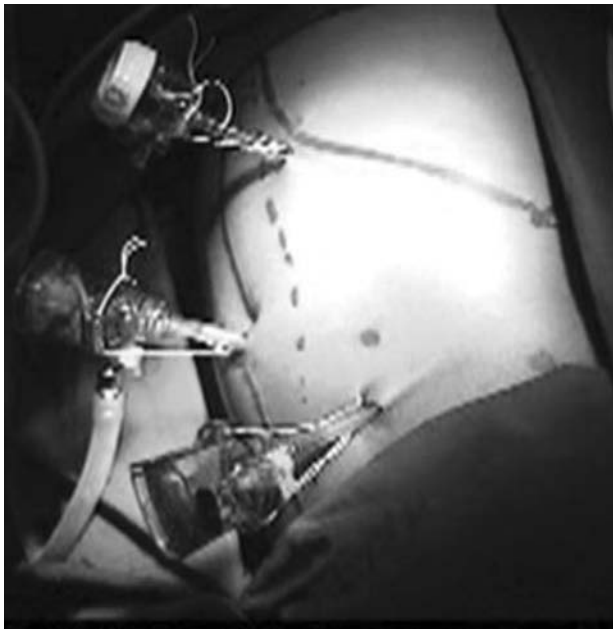


FIG. 2. Ports for left-sided laparoscopic pyeloplasty are placed.

An appropriate size double J stent (4.5/16—6/24) was placed retrograde after closing the ports. A pediatric diclofenac suppository (12.5 mg) was placed at the end of the procedure.

Postoperatively, the drain was removed on postoperative day 1, although drainage was no more than 20 mL. The Foley catheter was removed on the next postoperative day. Oral fluids and feeding were initiated when peristaltic sounds were heard. The double J stent was left in place for 4 weeks.

RESULTS

Nineteen children underwent laparoscopic pyeloplasty between June 2004 and December 2006. Mean age was 7.10 years (range 2 to 14 years). There were 14 boys and five girls. Thirteen obstructions were on the left side and six were on the right side. A transmesocolic window was used in five patients for left-sided UPJ obstruction.

The approach was transperitoneal in all patients. Crossing vessels, seen in 15.7% of patients, were transposed posteriorly and away from the anastomosis (Table 1).

Mean operative time was 198 minutes (range 105–300 min), and mean blood loss was 45 mL (range 30–130 mL). The procedure was completed in all patients without conversion to open surgery. No major intraoperative complications occurred.

Mean hospital stay was 4 days (range 3–5 days). Mean follow-up was 13.8 months (range 1–30 months). Postoperatively, one child had a urinary tract infection that necessitated hospital admission and administration of intravenous antibiotics (Table 2).

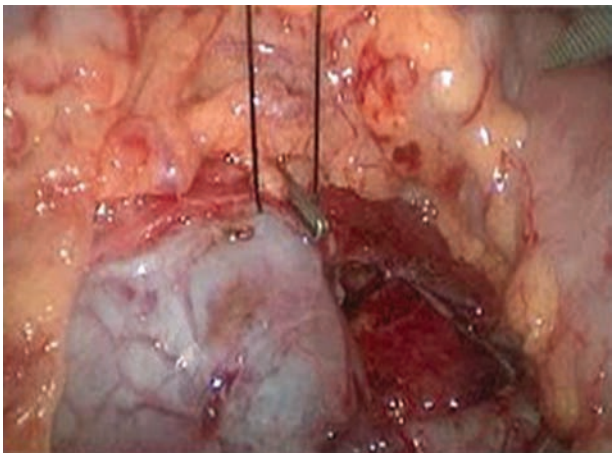


FIG. 3. Hitch stitch stabilizes the renal pelvis.

DISCUSSION

Laparoscopic pyeloplasty in children remains a technical challenge, although it has become an established procedure in

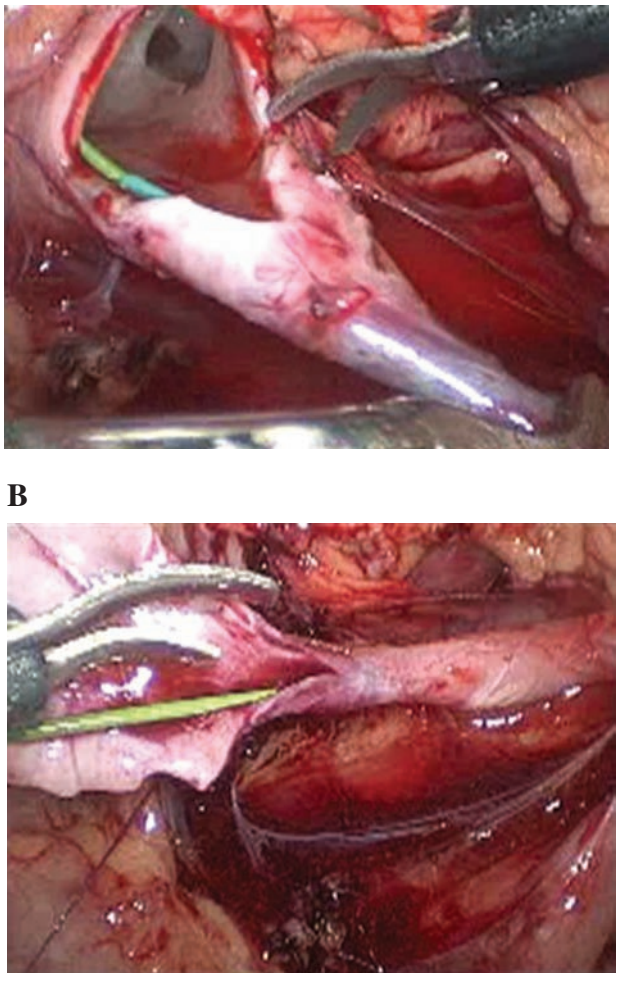
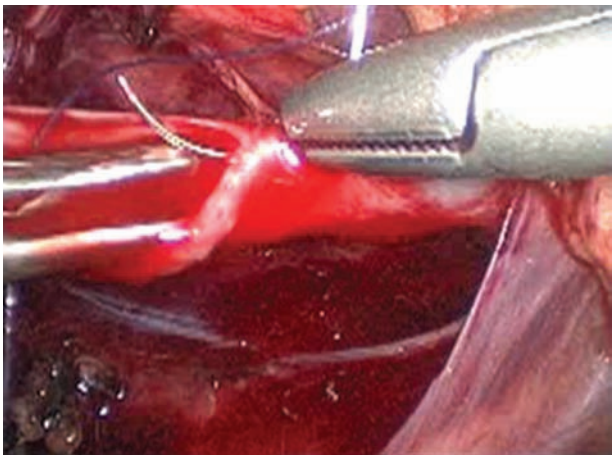


FIG. 4. (**A**) Pyelotomy is accomplished. (**B**) Ureter is opened longitudinally and spatulated.

A



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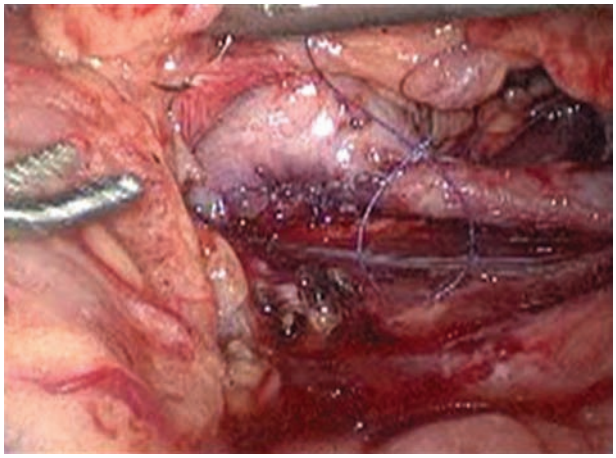


FIG. 5. (**A**) Ureteral angle stitch is demonstrated. (**B**) The anastomosis is watertight, dependent, and funnel shaped.

adults.[11] Success rates are comparable to those of open surgery.[12,13] Laparoscopy has the perceived advantages of minimally invasive surgery, such as less pain, early postoperative recovery, and better cosmetic outcome.

Ours is a superspeciality hospital dedicated to nephrourology, that serves a large population. During the past 6 years, we have performed more than 1000 laparoscopies, including adult laparoscopies. Our initial laparoscopic procedures were for benign diseases in adults. As our experience increased, we started performing laparoscopic donor nephrectomy and reconstructive laparoscopy that included pediatric laparoscopy.

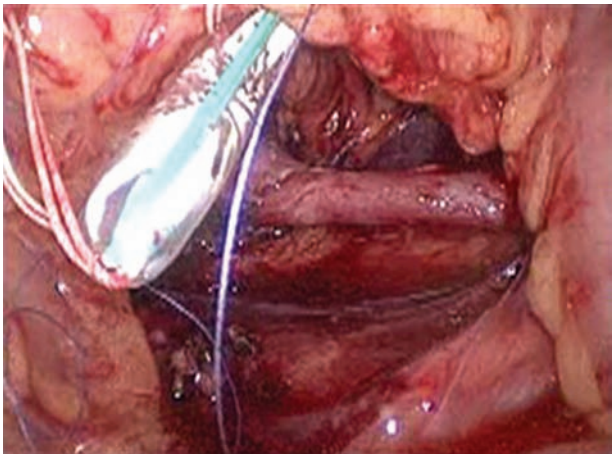
Because a pediatric urology subspecialty division does not exist in our hospital at the moment, all pediatric urology work is done by the general urologist. As the subspecialty grows, pediatric urologists may benefit from the our experience.

Although various techniques have been described for achieving pneumoperitoneum, we routinely use the Veress needle technique and have not encountered any problems. The transperitoneal approach offers ease in identification especially of crossing vessels, and in dissection and mobilization of intraabdominal structures. The potential disadvantages include prolonged ileus, adhesion formation, and injury to adjacent viscera. A few studies, although not directly comparable, report that laparoscopic retroperitoneal pyeloplasty requires a longer operative time, because of the limited working space, which makes suturing more difficult.[14] We have used transperitoneal approach in all our cases, without any major complications.

We always retroperitonealized the anastomosis, because in the event of a urine leak, this will wall off the urinoma and decrease the morbidity, although some may consider it unnecessary.

Regarding placement of a pigtail catheter preoperatively, we place it urethrally before surgery; the pelvis can be distended intraoperatively, which facilitates better pelvic dissection. We withdraw the catheter and just keep the guidewire in place while suturing to help in accurately placing the "V" stitch. Because our operating room is equipped with a C-arm, we do not find exchanging the pigtail catheter with a Double J stent at the end of the procedure to be cumbersome.

A



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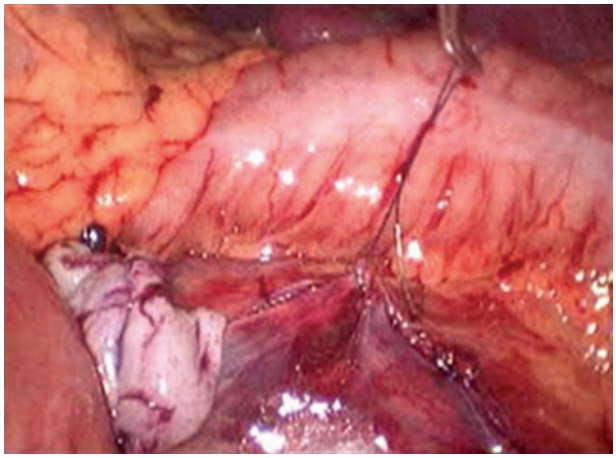

FIG. 6. (**A**) The perinephric drain is brought retroperitoneally in a patient with transmesocolic exposure. (**B**)Ureteropelvic anastomosis is retroperitonealized.

TABLE 1. DEMOGRAPHY

Study period	June 2004 to December 2006
Total (*n*)	19
Age (years)	7.1 (range: 2–14)
Sex (M/F)	14/5
Side (left/right)	13/6
Approach	Transperitoneal
Transmesocolic	5 patients on left side
Crossing vessels %	15.7 (3/15 patients)

Many surgeons use a hitch stitch to lift and secure the renal pelvis.[9,15] We use a hitch stitch in patients large renal pelvis; it helps in stabilization of the pelvis and thus achieves better suturing and anastomosis.

The transmesocolic approach to the left UPJ has been reported.[10] On insertion of the telescope, if the pelvis is large and seen clearly from the mesentery and there are no obvious vessels over it, we prefer this approach. Although there is a risk of ischemia reported with the transmesocolic approach, we have not encountered any problems. The transmesocolic approach appears to be less invasive, and the results are comparable to the approach involving the reflection of the colon. We always close this window after pyeloplasty, and the drain is removed retroperitoneally.

We had one patient with a urinary tract infection 2 weeks after surgery. He presented with a high-grade fever. When results of urine culture were positive, he was admitted to the hospital and intravenous antibiotics were initiated. Preoperatively, this patient had presented with a history of high-grade fever and a palpable lump. At evaluation, he was found to have gross hydronephrosis with internal echoes, thinned out cortex, and an infection caused by *Escherichia coli*.

Preoperatively, percutaneous nephrostomy was achieved. After the urinary infection was controlled, a laparoscopic pyeloplasty was performed. The patient's nephrostomy tube and drain were removed on postoperative day 2 and the Foley catheter on postoperative day 3. The patient was discharged on postoperative day 4.

None of our patients had prolonged discharge through the drain. Maximum discharge through the drain was 20 mL. In last four patients, we did not use a drain. There are reports in the literature where no perinephric drain was kept.[16]

The mean duration of stay for our laparoscopic pyeloplasty patients was 4 days. A similar patient who undergoes pyeloplasty with an open technique stays for 5 to 6 days in hospital. In this part of the world, patients wish to stay hospitalized until stitch removal, partly because of the distances that patients have to patient's have to travel for medical assistance. Also, unlike in western countries, in our country the patient does not pay more if he remains longer in the hospital.

The major difficulty of laparoscopic pyeloplasty is intracorporeal suturing, which prolongs operative time.[12,17] Our operative time (mean 198 minutes) was similar to other published series of laparoscopic pyeloplasty in children. Reddy and associates[18] reported a mean operative time of 160 minutes for dismembered pyeloplasty in children. More recently, El-Ghoneimi and colleagues[16] reported a mean operative time of 228 minutes for dismembered pyeloplasty by the retroperitoneal approach in children. Faith and coworkers[19] demonstrated a mean operative time of 184 minutes with robot-assisted laparoscopic pyeloplasty in children.[19]

There is a definitive learning curve of 10 to 15 cases for intracorporeal suturing. Time taken for nondismembered pyeloplasty is less than that for dismembered pyeloplasty. Our last four patients had an operative time of 120 minutes. Increasing experience can reduce the operative time.

Robot-assisted pyeloplasty is a safe and effective option in the surgical management of infant UPJ obstruction. Robot-assisted pyeloplasty can be safely performed in the pediatric population.[20] At present, our institution does not have a robotic program.

In our study, 19 children underwent laparoscopic pyeloplasty with a mean follow-up of 13.8 months. Today the general consensus for a follow-up regimen after pyeloplasty is a diuretic scan performed at 3 months postoperatively.[21] In our study, diuretic renography and/or excretory urography at approximately 3 months after pyeloplasty showed unobstructed drainage in 18 patients. The remaining patient is awaiting follow-up study.

If diuretic renography shows unobstructed drainage, then we monitor our patients at 3 month intervals with ultrasonography, urinalysis, and urine culture. We repeat functional studies (diuretic renography or excretory urography at the end of 1 year to see the function and drainage of the renal unit. Follow-up should not be discontinued after one study. Although our short-term follow-up shows encouraging results, the outcome of these patients over a period of 5 years will be of interest.

CONCLUSION

Laparoscopic pyeloplasty in children is a safe, minimally invasive treatment option that duplicates the principles and techniques of definitive open surgical repair. It is technically challenging, but with increasing experience, operative times are reduced significantly.

TABLE 2. RESULTS

Mean operative time	198 minutes (range 105–300 minutes)
Mean blood loss	45 mL (range 30–130 mL)
Mean hospital stay	4 days (range 3–5 days)
Mean follow-up	13.8 months (range 2–30 months)
Postoperative diuretic-renography/ excretory urography at 3 months	18 patients
Complication	Urinary tract infection—1

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Address reprint requests to:
Dr. Mahesh Desai
Muljibhai Patel Urological Hospital
Dr V.V. Desai Road
Nadiad, Gujarat, 387001
India

E-mail: mrdesai@mpuh.org

ABBREVIATIONS USED

UPJ = ureteropelvic junction.