

Retroperitoneoscopic Surgery in Children - An Overview

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Abstract: Retroperitoneoscopic surgery in children is mainly used in pyeloplasty, nephrectomy, varicocele ligation and adrenal surgery. Many reports confirm the feasibility of these surgeries but there are few comparative studies to show the superiority of retroperitoneal route over transperitoneal access in laparoscopic surgery.

INTRODUCTION

Retroperitoneoscopy is frequently used in children for urological surgery. In 1969, Bartel did the first retroperitoneoscopy without insufflation¹. He used a mediastinoscope inserted through the flank to biopsy a lymph node. Retroperitoneoscopy has the advantages of direct access to the retroperitoneal organs without violating the peritoneal cavity thereby preventing possible adhesive obstruction of the intestine. The disadvantages are limited working space, distortion of anatomy and some amount of paralytic ileus setting in due to retroperitoneal dissection. Common surgeries performed retroperitoneoscopically are pyeloplasty, nephrectomy, adrenalectomy, renal cyst de-roofing, surgery for retrocaval ureter, pyelolithotomy, ureterolithotomy and varicocele ligation.

RETROPERITONEOSCOPY ASSISTED PYELOPLASTY

Problem with retroperitoneal surgery is lack of space. This becomes a strong deterrent when retroperitoneal surgery is attempted in infants. Farhat was the first to describe laparoscopy assisted retroperitoneal pyeloplasty². This was later modified by the authors³. In this a 2 cm incision is made just below the 12th rib; subcutaneous tissue is incised; muscles are split till the Gerota's fascia is exposed which is then divided and the kidney is exposed. A balloon made by tying a glove finger to the end of a feeding tube is inserted into this space and inflated with 60 to 80 ml of air. This creates a space for further dissection. A 5 mm camera port is placed into this space and wound closed with two sutures around the camera port to prevent gas leak. Insufflation pressure is usually set at 8 mm Hg. Higher pressures used earlier in the study caused extensive dissection of gas into the retroperitoneal space. Two 3 mm working ports are inserted on either side of the camera port incision at its anterior end (Fig.1). Blunt 3mm graspers are used for dissection. Peritoneum is stripped of the anterior surface of the kidney and from the ureteric area. Pelvi-ureteric junction is picked up and freed from the surrounding areolar tissue till it is long enough to be brought to the tip of the first trocar (Fig. 2). A spinal needle is introduced into the field and methylene blue is injected to mark the most dependent position of the pelvis. This will help to delineate the anatomy and prevent anastomosis to non-dependent part of pelvis once pelvis is pulled out through the incision.

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Figure 1: Location of ports for retroperitoneoscopic pyeloplasty



Figure 2: Retroperitoneoscopic view of dissected renal pelvis and ureter

In our earlier report³ we were marking both the upper and lower limits of the pelvis to be resected with methylene blue. However subsequent experience has shown that this is not necessary. Pelvi ureteric junction (PUJ) is held with one grasper and the first trocar removed. The wound is opened up; PUJ is visualized, slinged with a vessel loop and brought out of the wound. Redundant pelvis is excised; narrow segment of the ureter is excised; ureter is spatulated and anastomosed to the pelvis. This has the advantages of meticulous suturing of open surgery and minimal invasiveness of laparoscopic surgery. It is especially suitable for small children in whom laparoscopy - either retroperitoneal or transperitoneal - is difficult for want of working space. We have done 96 pyeloplasties using this technique with 4 failures. The mean operative time was 147 min (range 60-270 min). Caione et al have described a single port

technique for laparoscopy assisted pyeloplasty⁴. In this he used a 10mm trocar with a 5 mm working channel. Port site incision varied from 1.4 to 2.9cms.

RETROPERITONEOSCOPIC PYELOPLASTY

Patient is positioned laterally or semi prone. Semi prone has the advantage of peritoneum falling away from the camera thereby giving better exposure. A roll of sheet is placed under the ribs to increase the space between the iliac crest and the 12th rib. Usually 3 ports are used. Camera port is placed just below the twelfth rib. A small incision is made according to the size of the port. Subcutaneous tissue is incised; muscles are split till the Gerota's fascia is exposed. This is then divided and kidney exposed. A balloon made by tying a glove finger is used to create space as described in lap assisted pyeloplasty. Working ports are inserted one at the costo-spinal angle and another just above the iliac crest under vision. Retroperitoneal space is enlarged by blunt dissection. The ureter and the PUJ are identified and mobilized. The renal pelvis and the narrow segment of the ureter are divided and excised. Spatulated ureter is anastomosed to the reduced pelvis over an indwelling double 'J' (DJ) stent.

There is an on going controversy as to the superiority of retroperitoneal pyeloplasty versus transperitoneal pyeloplasty. Both have their own advantages and disadvantages. Retroperitoneal pyeloplasty has the advantage of not violating the peritoneum. It has the disadvantage of limited working space and distortion of anatomy. Canon et al, on comparing retroperitoneal and transperitoneal pyeloplasties⁵, did not find any difference in outcome except prolonged operating time in retroperitoneal group (239 vs. 185 minutes respectively). This, they attributed to the learning curve in retroperitoneal pyeloplasty.

NEPHRECTOMY

Almost all the nephrectomies in children are performed for non-functioning kidneys resulting from vesico ureteric reflux, obstructive uropathy or dysplasia with ectopic insertion of ureter. A retroperitoneoscopic approach is feasible for most of these cases. It is difficult to detect a dysplastic kidney, especially in an abnormal position, during retroperitoneoscopy if this is not located pre-operatively. However, CT or MRI can be used to detect the dysplastic kidney before surgery⁶. Although retroperitoneal excision of multicystic dysplastic kidney is technically easy and safe, the indications for nephrectomy are debatable; the acceptable indications being increase in size of cysts, hypertension or infection⁷.

For lateral retroperitoneal approach, the child is positioned lateral with sufficient flexion to expose the area between the last rib and the iliac crest. Access to retroperitoneal space and port positioning are as described for retroperitoneoscopic pyeloplasty. Psoas muscle, the posterior landmark is first identified. The kidney is dissected and renal pedicle is approached posteriorly. The renal vessels are then dissected, ligated and divided. On the left side, the vein is ligated distal to the genital and adrenal branches. Ureter is dissected and excised at lumbar level. In cases with reflux, the dissection is continued inferiorly and the ureter is excised as close to the vesico ureteric junction as possible. Anterior dissection of kidney completes the nephrectomy and the specimen is retrieved through the main incision.

Although the retroperitoneoscopic nephrectomy is technically more challenging due to limited working space, a meta-analysis of 51 articles on transperitoneal and retroperitoneal nephrectomies in 689 children by Kim et al⁸ did not find any difference in operating time,

complications or postoperative hospital stay between these two approaches. Borzi et al⁹ also found similar results in a study of 186 cases from a single centre. Accidental opening of peritoneum during surgery can occur but does not require conversion to open surgery¹⁰.

Retroperitoneoscopic nephrectomy is advantageous in children with end-stage renal disease who require immediate postoperative peritoneal dialysis as this avoids the breach of peritoneal integrity. Avoiding post-nephrectomy hemodialysis decreases patient morbidity, preserving vessels for future vascular access. Szymanski et al¹¹, in their 11 consecutive retroperitoneoscopic nephrectomies could initiate peritoneal dialysis at a median of 9 hours after surgery. In a few cases with severe congenital nephrotic syndrome bilateral nephrectomies may be needed¹². To avoid change in positioning during surgery, this can be done through a posterior retroperitoneoscopic approach with the child in prone position¹³.

Retroperitoneoscopic partial nephrectomies are also safely done in the pediatric population. Le Clair et al¹⁴ concluded that the possibility of vascular damage to the remaining moiety warrants a very cautious dissection of the renal pedicle and should lead to conversion when clear visualization of vascular anatomy is not ascertained. The need for conversion during upper polar nephrectomy was due to difficult exposure of vascular anatomy while that for lower polar nephrectomy was the difficulty during parenchymal section. Upper polar nephrectomy is technically challenging especially in small infants with massively dilated collecting systems. In a study comparing retroperitoneal versus open partial nephrectomy with 154 children in each group, hospital stays were found to be significantly shorter in the retroperitoneal group compared to open group, although operating times were significantly longer in the retroperitoneal partial nephrectomy group¹⁵.

Retroperitoneoscopic excision of a non-functioning half of horseshoe kidney is also reported in children. Recognition of its anatomical variation is essential in the management of horseshoe kidney. Surgery is of high risk, even in traditional open procedure, because loss of the remaining half of the kidney is catastrophic¹⁶.

ADRENALECTOMY

Although limited literature exists on minimally invasive adrenalectomy in children, retroperitoneoscopic adrenalectomy is safe and feasible in pediatric age group giving a direct access to the adrenal gland without the need for retraction of intra-abdominal organs^{17,18}. It can be used to safely treat suspected benign and malignant adrenal masses in children with minimal morbidity and a shorter hospital stay. The lack of large studies may also be due to the rarity of benign adrenal lesions in children. Due to the infiltrative nature of neuroblastomas, open surgery is still considered the mainstay of management for these tumours¹⁹. In adults, a mass greater than 15 cm represents a relative contraindication for laparoscopic resection due to limited space availability. In children, an absolute limitation cannot be determined; a 5-cm well-defined lesion is accepted as a cut-off size for adrenalectomy²⁰.

The initial access is through an incision below the tip of 12th rib, with the patient in flank position. The retroperitoneum is entered through blunt dissection of the muscles and space is created by balloon distension. A 5 mm trocar is inserted and pneumoretroperitoneum is established. Two working ports are inserted superior to the first trocar in anterior and posterior axillary lines. On the left side, renal hilum is identified, renal artery is retracted and the adrenal vein is dissected. After ligation and division of the vein,

the adrenal gland is dissected all around with a harmonic scalpel preserving the medial attachment to facilitate retraction. On the right side, the inferior vena cava is identified. Dissection proceeds superiorly to renal hilum and then to adrenal vein, which is divided between clips. The adrenal is released superiorly and then from the upper pole of kidney. The lateral dissection is done last and the specimen is extracted.

As described by Steyaert et al.²¹ in the hands of a trained surgeon, the operation is quite fast, without much blood loss and with very good postoperative recovery. Pampaloni and colleagues in a literature review of 109 cases opine that retroperitoneoscopic resection may be more acceptable for left-sided tumors and laparoscopic for right-sided tumors although there is no consensus²².

OTHER PROCEDURES

Retroperitoneoscopic renal biopsy can be used in cases where percutaneous renal biopsy is contraindicated as in solitary kidney, uncontrolled arterial hypertension, hemostatic disorders, renal artery aneurysm, or failed percutaneous needle biopsy of the kidney. The advantages of this method include reduced blood loss and almost 100% positivity of samples obtained²³. Varicocelectomy in children and adolescents has also been done through a retroperitoneoscopic approach. Cobellis et al has reported 97 left sided varicocele repairs in children. They divided spermatic vessels en masse after bipolar coagulation of the vessel below the renal vein through a subcostal retroperitoneoscopic port. The conversion rate was 17%²⁴.

In conclusion, retroperitoneal surgery in children is feasible and has the advantage of not violating the peritoneum. However the operating space is less and potential for error is high. The available literature does not support superiority of retroperitoneal approach over the transperitoneal approach. So, as of today the route of access still remains the surgeon's choice.

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