# Robot-Assisted Laparoscopic Excision of Symptomatic Retrovesical Cysts in Boys and Young Adults

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**Abbreviations and Acronyms**

3D = 3-dimensional
EBL = estimated blood loss
LUTS = lower urinary tract symptoms
MD = müllerian duct
MRI = magnetic resonance imaging
PU = prostatic utricle
RALE = robot-assisted laparoscopic excision
RV = retrovesical
SV = seminal vesicle
UDT = undescended testicle
VCUG = voiding cystourethrography
VUR = vesicoureteral reflux

Submitted for publication April 11, 2011.
Study received institutional human research committee approval.
* Supported by a grant from CHA Medical School, South Korea.
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**Purpose:** We review our surgical experience with the management of retrovesical cystic anomalies using robot-assisted laparoscopic techniques.
**Materials and Methods:** We retrospectively reviewed the presentation, diagnosis and treatment of 6 patients 28 months to 22 years old with retrovesical cystic anomalies who underwent robot-assisted laparoscopic excision at our hospital between January 2006 and November 2010.
**Results:** Presenting signs and symptoms included urinary retention, lower urinary tract symptoms, abdominal pain and repeated epididymitis. Associated anomalies consisted of hypospadias, vesicoureteral reflux, renal agenesis, 5alpha-reductase deficiency, premature adrenarche and cryptorchidism. Cystic anomalies ranged from 3 to 6 cm long. The final diagnoses were prostatic utricular cyst, müllerian duct cyst and seminal vesicle cyst. Ectopic insertion of vas into the cyst was found in 4 cases, requiring ligation of the affected vas in 3. Mean ± SD operative time including cystoscopy was 198 ± 23.8 minutes, and estimated blood loss ranged from 5 to 10 ml. Mean ± SD hospital stay was 1.33 ± 0.52 days. All patients had resumed their regular activities within 2 weeks postoperatively. De novo contralateral epididymitis developed 2 months postoperatively in 1 patient. Otherwise, there was no recurrence of cystic mass or presenting signs or symptoms during followup of 3 to 56 months.
**Conclusions:** In the management of retrovesical cystic anomalies robot-assisted laparoscopic excision affords a natural extension of conventional laparoscopy with the additional advantages of 3-dimensional vision and ease of instrument control.

**Key Words:** laparoscopy, müllerian ducts, robotics, seminal vesicles, urogenital abnormalities

In males retrovesical cysts arising from müllerian duct remnants or the seminal vesicles are uncommon. Dilatation of the müllerian duct remnants can result in an enlarged prostatic utricle or a müllerian duct cyst. Seminal vesicle cysts arise from anomalous development of the distal mesonephric duct. Müllerian duct cyst is known to be present in 4% of newborns and 1% of adults.[1] Seminal vesicle cyst was reported in 0.005% of 10,919 autopsies.[2] However, the prevalence of symptomatic cysts is not well known.

Clinically and on radiographic evaluation the various types of RV cysts often are difficult to differentiate from each other. Patients with RV cysts may present with symptoms, although most are asymptomatic. RV cysts are often managed surgically in cases that are symptomatic, which can be challenging due


0022-5347/11/1866-2372/0
THE JOURNAL OF UROLOGY®

Vol. 186, 2372-2378, December 2011
Printed in U.S.A.
DOI:10.1016/j.juro.2011.07.113

to the rarity of this disorder, the anatomical inaccessibility and the close proximity to the ejaculatory ducts, pelvic nerves, rectum, vas deferens and ureters. Drainage and transurethral fulguration of RV cysts have been attempted. However, they are usually associated with a high failure and recurrence rate.[3] Currently open excision through various approaches (transtrigonal, posterior sagittal) provides a more effective method of treatment. Unfortunately because of the inaccessibility of these cysts, the open technique has significant associated morbidity, including bladder, urethral and rectal injuries.

The development of laparoscopic techniques provides a feasible alternative to open surgical excision of RV cysts, with decreased morbidity resulting in decreased postoperative pain, shorter hospital stay and reduced convalescence.[4–8] However, laparoscopic excision of RV cysts through a transperitoneal approach is challenging. The tight confines of the RV space and the close proximity of surrounding structures, such as the rectum, bladder, SV and ureters, require precise dissection. With the benefits of improved 3D imaging and greater dexterity, robotic assistance might facilitate this procedure. The current literature contains sporadic case reports on the use of RALE for RV cysts.[9–14] We evaluated our cumulative experience with RALE for the management of this disorder and reviewed the published literature.

## MATERIALS AND METHODS

With approval from our institutional human research committee, we retrospectively reviewed the records of 6 patients 28 months to 22 years old with RV cysts who underwent RALE by a single surgeon (HTN) between January 2006 and February 2010. We used the da Vinci® Si™ Robotic Surgical System. Presenting conditions included urinary retention, LUTS, abdominal pain and repeated epididymitis (table 1). Associated anomalies consisted of hypospadias, VUR, renal agenesis, 5alpha-reductase deficiency, premature adrenarche and cryptorchidism. One patient (5) had a history of transrectal drainage for RV cyst several years before. Two patients (1 and 6) had a history of treatment for penoscrotal hypospadias, UDTs and VUR.

RV cyst was diagnosed by various imaging modalities, including pelvic ultrasound, pelvic MRI, VCUG and cystoscopy. Cyst length ranged from 3 to 6 cm. The decision for surgical intervention was made based on the presence of symptoms and cyst size. Blood loss was estimated by subtraction of fluids used in surgical irrigation from volume in suction reservoir by considering the volume of cystic fluid in case of rupture during surgery.

In this procedure the patient is placed in the dorsal lithotomy position, and the bladder and stomach are decompressed with tube drainage. Cystoscopy is performed at the start of the procedure to place a catheter into the RV cyst (if possible) or the urethra to aid in identification. A Veress needle is introduced through an infraumbilical incision, and the abdomen is insufflated with $CO_2$ to 15 mm Hg. The Veress needle is replaced with a 12 mm trocar, through which a 10 mm 30-degree lens is inserted. The patient is then placed in the Trendelenburg position to move the bowel out of the pelvis. Two 8 mm trocars are placed lateral to the rectus muscles bilaterally (in the mid clavicular line approximately 1 cm below the camera port) under direct visualization. An additional 5 mm assistant port is used. The robotic surgical system is then positioned between the legs of the patient, and the ports are secured to the robotic system.

**Table 1.** *Baseline characteristics*

| Pt No.—Age | Presentation | Associated Disease | Treatment History | Cyst Configuration on Imaging |
|---|---|---|---|---|
| 1—29 mos | Repeated epididymitis | Perineal hypospadias, bifid scrotum, bilat VUR, bilat UDTs | Staged hypospadias repairs, scrotoplasty, bilat orchiopexy | 3 × 3 cm prostatic utricular cyst on ultrasound; reflux of urine into cyst, rt SV and rt vas on VCUG |
| 2—13 yrs, 9 mos | Urgency, frequency, hesitancy | None | None | 3 cm round retrovesical cyst with no communication with vas, SV or ureter, suggesting müllerian duct cyst on MRI |
| 3—17 yrs, 9 mos | Penile pain, urinary retention | Rt renal agenesis, lt compensatory hypertrophy | None | 4 × 3 cm ovoid retrovesical cyst on midline and slightly on rt side; dilated tortuous rt vas/SV; dilated cyst behind rt SV on MRI |
| 4—17 yrs, 7 mos | Low abdominal pain | Rt renal agenesis | Appendectomy | 6 × 5 cm large pelvic cyst located on midline and slightly on lt side |
| 5—17 yrs, 2 mos | Penile pain, urinary retention, epididymitis | Lt renal agenesis | Transrectal drainage of cyst several yrs prior | 4 cm ovoid cyst originating from lt seminal vesicle with intermittent signal intensity on MRI, located posterior to bladder |
| 6—22 yrs, 6 mos | Acute epididymitis | Lt renal agenesis, rt VUR, bilat UDTs, penoscrotal hypospadias, premature adrenarche | Hypospadias repair, bilat orchiopexy, rt ureteral reimplantation | 4 cm round retrovesical cyst extending upward, communicating with 5 by 3 cm cystic mass on MRI |

Next, the peritoneal lining of the posterior aspect of the bladder is opened, and the RV space is carefully developed. A rectal tube or gauze packing placed in the rectum allows easy identification of the posterior limit of the dissection. Dissection of the RV cyst is then carried out. Injection of methylene blue through the catheter placed at the time of cystoscopy helps to identify the PU cyst. Meticulous dissection of the RV cyst with identification of the vas, ureter and bladder neck is carried out to preserve future fertility and continence. The RV cyst is dissected to the level of the bladder neck, excising as much of it as possible to preserve the continence mechanism and avoid residual cyst and recurrence after the procedure. Unilateral vasectomy was selectively performed in 3 cases in which the vas deferens drained ectopically into the RV cyst.

In patients with a PU cyst (as in patient 1) the cystic structure is transected at its insertion into the prostatic urethra (fig. 1). The opening is then oversewn with 3-zero polyglactin suture, with injection through the catheter placed at cystoscopy helping to ensure complete closure of the defect. The peritoneal incision over the bladder is reapproximated with polyglactin sutures and no drains are used. The specimen is removed intact through the camera port using a retrieval bag. The trocar sites are then closed. The Foley catheter is left in place and removed on postoperative day 1. In this study followup ultrasound was performed at 2 to 4 weeks, 3 months and 1 year postoperatively.

## RESULTS

In patient 1 the PU cyst was located in the midline behind the bladder as seen on ultrasound (fig. 2). Cystoscopy revealed an abnormal orifice at the verumontanum, which had connections with the MD remnant leading urinary reflux into it, and also into the right seminal vesicle and vas as confirmed on VCUG (fig. 3). Insertion or direct connection of the vas into the cyst was found in 4 patients (1, 4, 5 and 6), and the vas was clipped unilaterally in 3 patients, excluding patient 4, in whom bilateral vasa drained into the cyst without any history of epididymitis (table 2). Mean ± SD operative time including cystoscopy was 198 ± 23.8 minutes. EBL ranged from 5 to 10 ml.

Immediate postoperative convalescence was uneventful in all patients. The Foley catheter was removed within 24 hours postoperatively in all patients but 1, whose urethra was close to the cyst and whose catheter was left in place for 2 days postoperatively. Mean ± SD time for resuming oral intake was 8.50 ± 2.17 hours postoperatively, and hospital stay was 1.33 ± 0.52 days (range 1 to 2). All patients had resumed their regular activities within 2 weeks postoperatively. Minimal hematoma, which was less than 1 cm at its longest diameter, was found in 2 patients (2 and 6) on the first postoperative ultra-

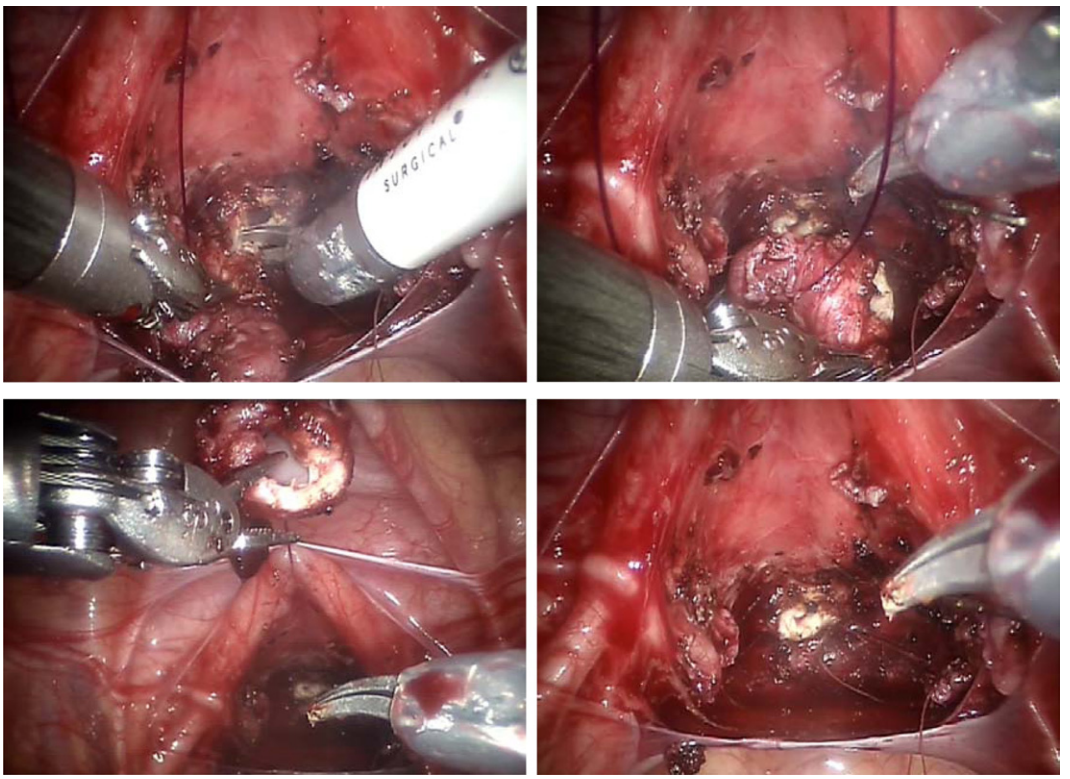


**Figure 1.** Excisional procedures during RALE of PU cyst in case 1. Neck of cyst was cut from posterior urethra after right vas was cut and clamped.

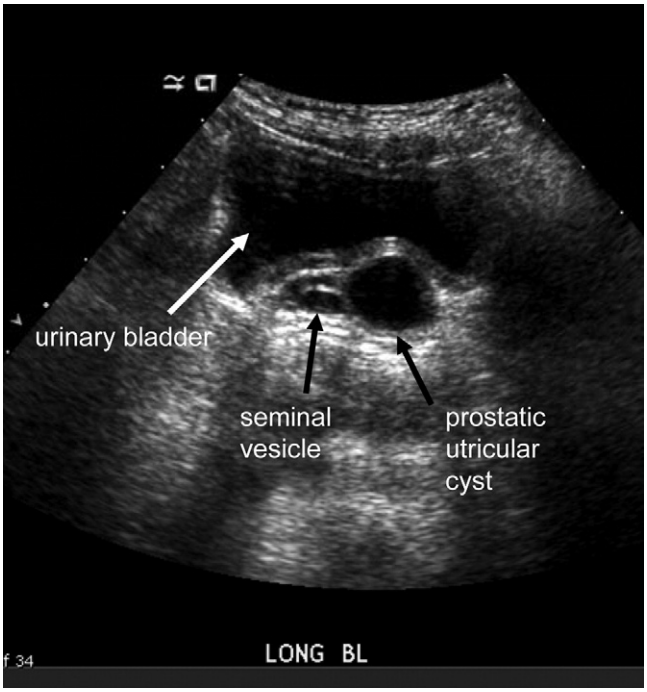


**Figure 2.** Sagittal image of PU cyst in case 1

sound and eventually resolved on followup ultrasound at 3 months postoperatively without any symptoms. De novo contralateral epididymitis developed 2 months postoperatively in patient 1 and was treated conservatively (appropriate antibiotic, analgesic and bed rest) without sequelae. Otherwise, there was no recurrence of mass or symptom in any patient during a mean ± SD followup of 24.33 ± 18.18 months (range 3 to 56).

## DISCUSSION

In boys the differential diagnosis for cystic lesion in the pelvis includes RV cysts (PU, MD and SV), intraprostatic cysts, ejaculatory duct cysts, hydronephrotic pelvic kidneys or ureters, bladder diverticula and ureteroceles.[15,16] These conditions may be differentiated based on the position (median, paramedian, lateral), fluid content within the cyst, associated anomalies in the urogenital system and characteristics on imaging.

SV cysts arise from malformations of the distal mesonephric duct during the fourth week of gestation. Consequently urinary anomalies are associated in two-thirds of cases, with the most common being unilateral renal agenesis with ectopic insertion of the ipsilateral ureter, as seen in our series. These cysts are located laterally behind the bladder and contain seminal fluid with or without spermatozoa.

PU cysts and MD cysts may result from incomplete regression of the MD or incomplete androgen mediated closure of the urogenital sinus,[17] and both are usually midline in location. There is debate in the literature as to whether PU cysts and MD cysts are separate embryological entities.[18] Regardless, there are some distinct clinical differences between these 2 disease entities. PU cysts communicate with the urethra and have a tubular shape, and the majority tend to arise in younger patients in association with hypospadias or intersex disorders. In the present study a case of PU cyst involved not only hypospadias, but also bilateral cryptorchidism and low grade VUR. By comparison, MD cysts do not communicate with the urethra, generally develop later in life and are associated with normal external genitalia.[19] Anatomically MD cysts tend to be round, and size varies from a few centimeters to massive cysts filling the pelvis. They are located in the midline behind the prostate or bladder neck.

Patients with RV cysts are usually asymptomatic but some may present with conditions such as LUTS, urinary retention, epididymitis, hemospermia, pelvic pain, rectal mass and obstructive azoospermia.[16] Development of symptoms appears to be determined by the relative size of the cyst; anatomical relation with pelvic organs; degree of obstruction of the bladder neck, SV or ejaculatory ducts; and presence of associated infection. In our series urinary retention developed in 2 patients with SV cysts. Although these cysts arise from the SV and are lateral in position, they can enlarge, expanding toward the midline, and consequently can obstruct the bladder neck.

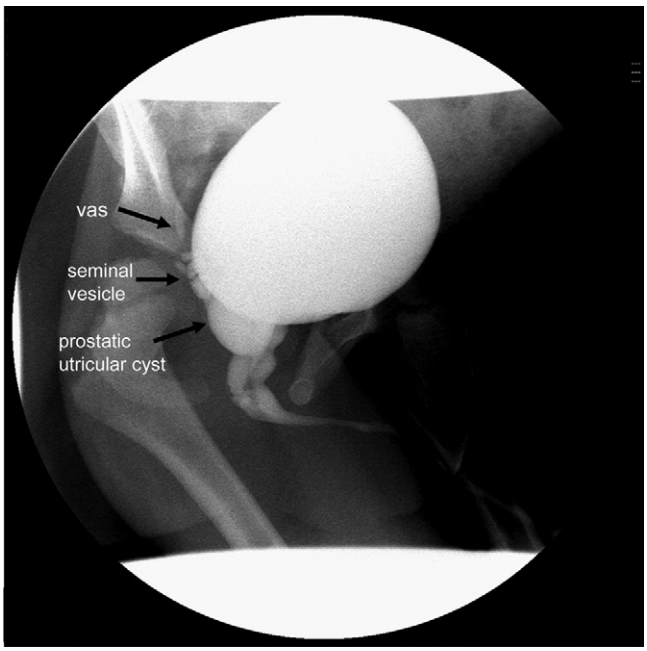


**Figure 3.** VCUG shows reflux of contrast material into PU cyst, right SV and right vas in case 1.

RV cysts can affect fertility. Men with MD cysts may have the characteristic seminal finding of small volume ejaculate with acidic pH and little or no fructose.[20] In our series we did not routinely obtain semen analysis preoperatively, but in the future we will do so in our older patients. We also believe that baseline semen analysis may be helpful in the followup of their future fertility.

Digital rectal examination and pelvic ultrasound are useful initial studies for evaluating patients suspected of having RV cysts. By identifying the connection to the urethra and opacifying the cysts, VCUG or retrograde urethrography may be helpful in the diagnosis of prostatic utricle cysts, whereas müllerian duct and seminal vesicle cysts generally do not communicate with the urethra and are not identified on these studies. Computerized tomography and MRI can visualize various types of pelvic cysts but often do not provide additional diagnostic information compared to ultrasound. Cystoscopy may be useful in evaluating the connection of the RV cysts to the urethra and ruling out other potential etiologies. In some patients SV aspiration, needle biopsies or seminal vesiculography may be used to differentiate SV cysts from MD cysts, ejaculatory duct obstruction or the rare malignancy.[21]

In our series ultrasound, MRI, VCUG and cystoscopy were used selectively. We observed that cystoscopy performed before the start of the operation allowed for cannulation of the utricular opening and injection of contrast material to define communication of the urethra with the cystic mass and to determine the anatomical relationship of the mass with the seminal vesicles, urethra and bladder. Continued injection during the procedure allowed for easier identification of the cyst.

Operative management of RV cysts should be considered primarily in symptomatic cases. Various techniques have been proposed. While transurethral resection and aspiration may be satisfactory initial management for small cysts positioned caudally, larger cysts positioned cephalad may be more difficult to access and drain adequately using this approach. Open surgery performed through a transvesical, retrovesical, transperineal, transcoccygeal or transrectal route had been considered the definitive treatment option because of the reported high success.[22–26] However, the associated morbidity was also considerable and included bladder, urethral and rectal injuries.[3,27] In addition, a large abdominal incision may be needed in cases where associated ipsilateral nephrectomy or ureterectomy is required.

In the 1990s laparoscopy through a transperitoneal approach gained acceptance as the modality of choice in the surgical management of RV cysts. The laparoscopic approach was associated with less postoperative pain, lower morbidity, shorter hospital stay and reduced convalescence.[4–8] With the increasing popularity of robot-assisted surgery, a few cases of RALE for RV cysts have been reported with satisfactory outcomes (table 3).[9–14]

To our knowledge this study is the largest single center experience with RALE for RV cysts, although 2 patients (2 and 5) had been described in our previous study.[14] In this series robotic assistance provided excellent visualization with 3D vision and easy manipulation of instruments, including suturing in the small working space, allowing for efficient and less invasive surgery (ie small blood loss and low risk of nerve injury). EBL in this study ranged from 5 to 10 cc, which is less than or similar to published conventional laparoscopic series, although methods of quantitating blood loss could be different among studies. Finally, robotic assistance allows for a shortened learning curve, rendering its use more attractive.[28] In our experience the procedures were performed by the same surgeon at the start of the learning curve without encountering major technical difficulties and with an acceptable operating time. Even with a limited number of cases, given the rarity of RV cysts, proficiency could be achieved.

There are potential limitations to using RALE in the management of RV cysts. The positioning of robotic ports centered in the pelvic area may limit access to the upper abdomen for the removal of dysplastic kidneys. However, we found that this problem could be solved by re-docking the robot to the upper quadrant and creating 1 additional port in the midline above the camera port. Another limitation is the cost of the procedure. Given the greater cost of the instruments and potentially longer operative time due primarily to setup and docking, the total cost of RALE can be significantly higher than that of conventional laparoscopy. However, we found that with increased experience the setup and docking time could be decreased. In our series the docking time had decreased from roughly 40 to 15 minutes between the first and most recent cases.

## CONCLUSIONS

The management of symptomatic RV cysts in males has long been a challenge. Successful surgery requires understanding of anatomical relationships of the cyst to the surrounding pelvic organs. Introduction of laparoscopic surgery has provided better visualization, less postoperative morbidity and earlier recovery in the management of RV cysts. RALE affords a natural extension of conventional laparoscopy with the additional advantages of 3D vision and ease of instrument control.

**Table 2.** *Operative characteristics*

| | Pt 1 | Pt 2 | Pt 3 | Pt 4 | Pt 5 | Pt 6 |
|---|---|---|---|---|---|---|
| Operative findings, including cystoscopy | Wide opening to cyst on verumontanum via cystoscopy; cyst was also connected with rt vas + SV | Cyst had no connection to SV, vas, ureter or urethra, suggesting MD cyst | Bladder neck was elevated high with no opening identified on cystoscopy, cyst was connected with dilated rt SV | Both vasa were draining into cyst | Bladder neck was elevated high with no opening identified on cystoscopy, cyst was connected with lt SV + vas | Cyst was round at bladder neck, changed to ovoid shape upward; lt vas was inserting into cyst |
| Final diagnosis | PU cyst | MD cyst | SV cyst | SV cyst | SV cyst | SV cyst |
| Procedure | Excision of cyst + rt SV, clipping of rt vas | Cyst was excised close to urethra | Cyst was excised, dilated rt SV was partially excised + repaired again | Lt vas was clipped, rt vas was preserved along with narrow strip of cyst for fertility issue | Cysts were excised, including lt SV; lt vas was also ligated | Lt vas was clipped, cyst was excised |
| Operative time (mins) | 215 | 215 | 231 | 172 | 200 | 170 |
| EBL (cc) | 5 | 5 | 5 | 10 | 5 | 10 |
| Length of stay (days) | 1 | 2 | 1 | 1 | 2 | 1 |
| Followup (mos) | 3 | 54 | 36 | 20 | 12 | 21 |
| Complications | Lt epididymitis 2 mos postop | Minimal hematoma eventually resolved at 2 mos postop | None | None | None | Scant hematoma |

**Table 3.** *Published cases of robot-assisted laparoscopic surgery for retrovesical cysts*

| | Carmack et al[9] | Moore et al[10] | Najmaldin and Antao[11] | Selli et al[12] | Allaparthi and Blute[13] | Present Series |
|---|---|---|---|---|---|---|
| No. pts | 1 | 1 | 1 | 1 | 1 | 6 |
| Mean pt age (yrs) | 28 | 16 | Not available | 39 | 34 | 15.2 |
| Presentation | Pain | Abdominal pain, nausea, vomiting, testicular swelling | Not available | Pelvic pain, dysuria, infections | Obstructive LUTS | Epididymitis, urinary retention, LUTS, pain |
| Presumed diagnosis | SV cyst | SV cyst/ipsilat renal agenesis | Müllerian remnant | SV cyst/ipsilat renal agenesis | SV cyst/ipsilat renal agenesis | PU cyst 1, MD cyst 1, SV cyst/ipsilat renal agenesis 4 |
| Mean No. ports (mm size) | 4 (12, 8, 8, 5) | 4 (12, 8, 8, 5) | Not available | 5 (12, 10, 8, 8, 5) | 5 (12, 12, 8, 8, 8) | (12, 8, 8, 5) |
| Mean mins operative time | 120 | 156 | 195* | 180 | 150 | 198 (± 23.8) |
| Mean cc EBL (±SD) | Not available | Less than 10 | Not available | 50 | Less than 25 | 6.67 (± 2.58) |
| Mean days stay (±SD) | 2 | 1 | 5 | 4 | 2 | 1.33 (± 0.52) |
| Mean mos followup (±SD) | 18 | 9 | Not available | Not available | 6 | 24.33 (± 18.18) |
| Complications | None | None | None | Transient lt brachial palsy | None | Self-limiting small hematoma, contralat epididymitis |

* Including bilateral orchiopexy.

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