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Umbilicus-sparing laparoscopic versus open approach for treating symptomatic urachal remnants in adults

Zheng Liu, MD, PhD, Xiao Yu, MD, PhD, Jia Hu, MD, PhD*, Fan Li, MD, PhD, Shaogang Wang, MD, PhD

Abstract

The traditional surgical approach for removing a symptomatic urachal remnant is via a lower midline laparotomy and infraumbilical incision or a laparoscopic approach with umbilicoplasty. We reviewed our experience with umbilicus-sparing laparoscopic urachal remnant excision in a single-center study and evaluated its efficacy versus open approach (OA). This study was a retrospective study. Between March 2012 and September 2016, 32 consecutive patients with symptomatic urachal remnants underwent the umbilicus-sparing laparoscopic approach (USLA) (n = 17) or OA (n = 15). The efficacy, recovery, and long-term outcomes were reviewed. Our Results showed that the clinical characteristics of the patients in each group, such as age, gender, body mass index (BMI), and disease type, had no significant differences ($P > .05$). No significant difference was found in the surgical procedure times (76.1 ± 15.4 vs 69.2 ± 13.9 minutes, $P = .189$) and intraoperative blood loss (29.4 ± 13.3 vs 32.2 ± 12.9 mL, $P = .543$) between the USLA groups and OA groups. However, the mean postoperative hospital stay (patients with bladder cuff excision: 4.1 ± 1.8 vs 6.1 ± 1.4 days, $P = .040$ and patients without bladder cuff excision: 1.8 ± 0.5 vs 3.6 ± 0.8 days, $P < .001$) and the time of full recovery (11.2 ± 1.9 vs 15.6 ± 3.1 days, $P < .001$), the USLA group were both significantly shorter than that of the OA group. No infected recurrence and malignant transformation had occurred at a mean follow-up of 32.4 ± 8.1 and 34.1 ± 8.8 months in USLA group and OA group, respectively. In conclusion, to minimize the morbidity of radical excision, umbilicus-sparing management of benign urachal remnants in adults is a safe and efficacious alternative with superior cosmetic outcomes, postoperative recovery compared with an OA or umbilicoplasty.

Abbreviations: CT = computed tomography, LESS = laparoscopic single-site surgery, OA = open approach, USLA = umbilicus-sparing laparoscopic approach.

Keywords: laparoscopy, minimally invasive surgery, umbilicus-sparing, urachal remnants

1. Introduction

The urachus is the embryological remnant of the allantois, which originally communicates with the vertex vesicae to the umbilicus.[1] Different portions of the urachus may not be fully obliterated, which can lead to the formation of a cyst, sinus, diverticulum, or patent urachus.[2] The most common form of urachal abnormalities in adults is a urachal cyst, and infection is the usual mode of acquisition.[3] Infected and symptomatic urachal remnants routinely require intervention, including antibiotics and drainage of the abscess cavity.[4] Drainage alone is inadequate because of possible recurrent infection and malignant transformation later in life. Therefore, complete removal of the urachal remnant is generally recommended.[5]

Laparoscopic surgery has been considered an alternative to conventional open resection of urachal remnants, and it has the benefits of minimal postoperative pain, better cosmetic results, and rapid recovery of normal activities.[5–7] However, there is no consensus about the resection extent of the urachal remnant. En bloc umbilical resection followed by umbilicoplasty and routine resection of a bladder cuff have been described by several groups as good methods.[8,9] Our research objectives include determining whether umbilicus-reserved and selective excision of a bladder cuff achieves superior cosmetic results and more rapid recovery of patients.

To date, studies reporting the clinical safety and outcomes on above approach are scarce because of the rarity of this pathology. In this study, we currently report the large known series of umbilicus-sparing laparoscopic management of symptomatic urachal remnants in adults and the mid- and-long-term follow-up results.

2. Materials and methods

2.1. Patients

This study was approved by the Ethical Committee of Tongji Hospital of Tongji Medical College of Huazhong University of Science and Technology. From March 2012 to September 2016, 32 consecutive patients with symptomatic urachal remnants who met the inclusion criteria were treated at our institution. Of these

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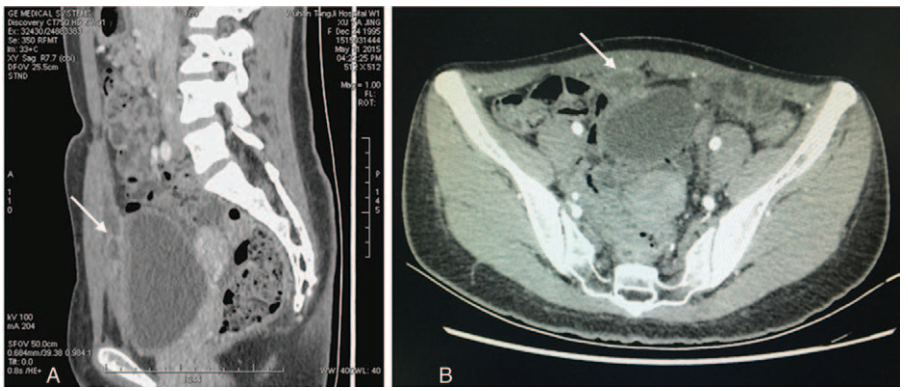

Figure 1. Abdominal enhanced CT scans show urachal cyst (arrow) in the subumbilical region with abscess formation. (A) Coronal view. (B) Transverse view.

patients, 17 patients underwent USLA and 15 patents underwent OA. Infected or inflamed urachal remnants may manifest with bloody discharge from the umbilicus or an indurated and fluctuant umbilicus. Microscopic or gross hematuria and pyuria presented when infected urachal remnants is communicated with bladder. Bacterial cultures and sensitivities were obtained preoperatively with appropriate antibiotics administered for 2 to 5 days at the time of surgery in order to relief the acute symptoms. Diagnostic evaluation includes cystoscopy and abdominal contrast-enhanced computed tomography (CT). It is necessary by using cystoscopy for the diagnosis whether communication urachal remnants with bladder. Cystoscopically, a lesion at the dome of the bladder is the hallmark finding. CT may reveal a periumbilical cyst or abscess, and a dome lesion in the bladder that suggested that cyst might be adherent or communicating with bladder dome (Fig. 1). Before the surgical procedure, all patients were informed about the details of the different kinds of urachal remnants resection procedure and the possible risks and complications of surgery. Patients were actively involved in the decision-making process, and their preferred treatment option was chosen.

2.2. Surgical technique

2.2.1. Umbilicus-sparing laparoscopic urachal remnants resection. All patients underwent general anesthesia and were placed in the steep Trendelenburg position to allow the small bowel contents to migrate out of the pelvis for better visualization. A 3-port technique is used. A 10-mm trocar is placed supraumbilical (3–4 cm) for the laparoscope and 2 lateral rectus, paraumbilical trocars are placed 10 mm on the right and 5 mm on the left, respectively. An optional 5-mm trocar can be placed approximately 2 cm cephalad and medial to the anterior superior iliac spine (Fig. 2). A 30° laparoscope is used in all procedures. First, some cases need to separate the omentum from the umbilicus (Fig. 3A); then, the median and lateral umbilical ligaments are identified (Fig. 3B). Second, the entire urachus with wide peritoneal wings is dissected all the way to the level of the umbilicus in the layer of the posterior rectus sheath (Fig. 3C). The urachus is divided at this level. When the entire urachus is dissected free, the retropubic space and anterior bladder wall are separated (Fig. 3D). Third, the entire urachus, urachal remnants, and median umbilical ligament are excised (Fig. 3E). For some patients with bladder communication or adhesion of the urachal cyst to the bladder evaluated by preoperative urinanalysis, imaging or cystoscopy and then intraoperative confirmation need to excise 1 piece of the bladder cuff. Then, the bladder defect is laparoscopically closed using 3–0 vicryl (Fig. 3F). Intraoperative bladder affusion was performed to demonstrate the absence of leakage. Samples are sent for pathological examination.

2.2.2. Open urachal remnants resection. OA was also performed under general anesthesia with the patient in the supine position. Lower midline laparotomy is used. The open operative procedures were similar to those of laparoscopic group, but the umbilicus is excised and the specimen is removed en bloc

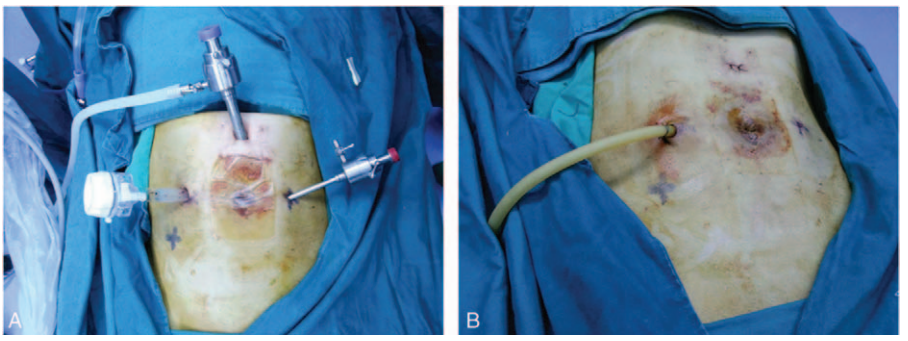

Figure 2. Three-port approach for laparoscopic urachal remnants excision. (A) A 10-mm trocar is placed supraumbilical 3–4 cm for the laparoscope and 2 lateral rectus, paraumbilical trocars are placed 10 mm on the right and 5 mm on the left, respectively. A layer of protective film was put on infected umbilicus surface to prevent the bacteria from growth and migration. (B) Postoperative port site after surgery.

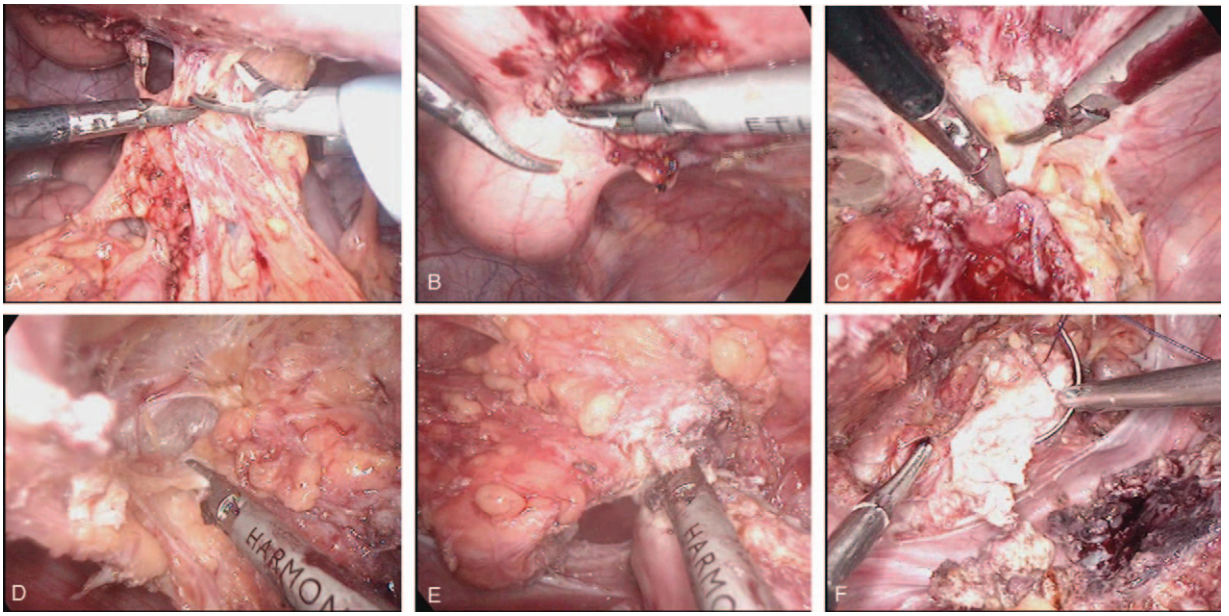

Figure 3. The surgical procedures for laparoscopic urachal remnants excision. (A) To separate the omentum from the umbilicus. (B) Laparoscopic view of the urachal remnant. (C) The entire urachus with wide peritoneal wings is dissected in the layer of the posterior rectus sheath. (D) To separate the retropubic space and anterior bladder wall. (E) One piece of the bladder cuff is excised. (F) To close the bladder defect by using 3–0 vicryl.

via the umbilicus and then sent for pathological evaluation. The fascia is then closed and umbilicoplasty.

2.2.3. Perioperative care and follow-up. The perioperative outcomes were reviewed to assess the operative time, complications, pathological evaluation, duration of hospital stay, and recovery. All patients received every 6 to 12 months follow-up at outpatient clinics. Routine physical examinations, abdominal ultrasound, and/or CT were performed for the patients during the follow-up.

2.3. Inclusion criteria

The inclusion criteria were that imaging tests evaluated and confirmed the diagnosis of an infected urachal remnants (urachal cyst, fistula, and diverticulum). And an imaging and cystoscopy diagnosis of suspicious malignant transformation was excluded from this analysis.

2.4. Statistical analysis

All data were analyzed by the SPSS 17.0 software program (IMB Inc., Chicago, IL). Student *t* test was used to compare continuous variables among groups, which were expressed as mean ± standard deviation (SD). χ^2 test or Fisher exact test was used to compare categorical variables. *P* value less than .05 was considered as statistically significant.

3. Results

3.1. Patient characteristics

The patient clinical characteristics are given in Table 1. Subcutaneous lump resection was previously performed in 2 patients (USLA group) and 1 patient (OA group) due to umbilical infection, and all pathological evaluation revealed an epidermoid cyst. The 2 groups had comparable demographic characteristics, including age, gender, BMI, and disease type ($P > .05$).

3.2. Perioperative outcome

Laparoscopic and open wide local excision were both successfully completed in all cases. None was converted to open procedure in USLA group. No perioperative mortality was observed in both groups. The final pathological examination confirmed the diagnosis of a benign urachal remnant in each specimen. Bladder cuff resection were respectively performed in 5 patients in both groups due to bladder involvement.

The mean operative times were 76.1 ± 15.4 minutes in the USLA group and 69.2 ± 13.9 minutes in the OA group. No significant difference was found in the surgical procedure times between the 2 groups ($P = .189$). The mean operative blood loss of the USLA group was less than the OA group (29.4 ± 13.3 vs 32.2 ± 12.9 mL), but there was no statistical significance ($P = .543$). No intraoperative transfusion was needed in both groups. All patients resumed their diet and began ambulating on postoperative day 1 to 2. The Foley catheter was removed an average of 3.2 ± 1.8 days in the USLA group and 3.6 ± 2.0 days in

Table 1

Clinical and demographic features of patients.

Variables	USLA (n = 17)	OA (n = 15)	*P*
Age, y, mean ± SD	22.9 ± 4.4	24.1 ± 4.1	.436
Gender (male: female)	5:12	6:9	.712
Body mass index, kg/m^2, mean ± SD	24.9 ± 2.82	24.2 ± 3.7	.889
Urachal remnants: n (%)			
Urachal diverticulum	1 (5.9%)	1 (6.7%)	1.000
Urachal cyst	16 (94.1%)	14 (93.3%)	
Clinical symptoms: n (%)			.360
Abdominal pain	5 (29.4%)	4 (26.7%)	
Umbilical drainage	10 (58.8%)	10 (66.6%)	
Irritative voiding	2 (11.8%)	1 (6.7%)	
Associated fever, n (%)	2 (11.8%)	2 (13.3%)	1.000
Past history of abdominal surgery, n (%)	2 (11.8%)	1 (6.7%)	1.000

OA = open approach, USLA = umbilicus-sparing laparoscopic approach.

Table 2

Patient perioperative outcomes in the USLA and OA groups.

Variables	USLA (n=17)	OA (n=15)	*P*
Operative time, min	76.1±15.4	69.2±13.9	.189
Intraoperative blood loss, mL	29.4±13.3	32.2±12.9	.543
Intraoperative blood transfusion, n (%)	0	0	
Bladder cuff resection, n (%)	5 (29.4%)	5 (33.3%)	1.000
Conversion to open surgery, n (%)	0	/	
Postoperative complications, n (%)			
urine leakage	0	0	
Incisional infection	0	1 (6.7%)	
Foley catheterization, d	3.2±1.8	3.6±2.0	.590
Duration of postoperative hospital stay, d			
Bladder cuff resection	4.1±1.8	6.1±1.4	.040
Without bladder cuff resection	1.8±0.5	3.6±0.8	<.001
Return to normal activities, d	11.2±1.9	15.6±3.1	<.001
Follow-up, mo	32.4±8.1	34.1±8.8	.601
Follow-up results, n (%)			
Umbilical discharge or infection	0	0	
Malignant transformation	0	0	

OA=open approach, USLA=umbilicus-sparing laparoscopic approach.

the OA group following the operation ($P=.590$). More importantly, a shorter length of postoperative hospital stay was noticed in the USLA group (patients with bladder cuff excision: 4.1±1.8 vs 6.1±1.4 days, $P=.040$ and patients without bladder cuff excision: 1.8±0.5 vs 3.6±0.8 days, $P<.001$). The mean time to full recovery, defined as return to a normal life without pain, was also significantly shorter in USLA group (11.2±1.9 vs 15.6±3.1 days, $P<.001$). The patients with bladder cuff resection had delayed full recovery. One of postoperative complications, incisional infection, was observed in 1 of the 15 patients (6.7%) after OA. The patient needed additional management, including debridement, suture, and antibiotics. This complication was improved at the time of discharge. Perioperative outcomes are summarized in Table 2.

3.3. Outcome of follow-up

During a mean follow-up of 32.4±8.1 months in USLA group and 34.1±8.8 months in OA group, we did not detect any symptom recurrence (including umbilical discharge or umbilical infection) and malignant transformation.

4. Discussion

A urachal remnant has generally been considered exceedingly rare, occurring in 1.6% of children under 15 years of age and in 0.063% of adults with an incidence in the adult population of approximately 1:5000 and 1:150,000 in the pediatric population.[1] The following 5 types of urachal abnormalities were defined: patent urachus, where the entire tubular structure fails to close; urachal cyst, where both ends of the urachal canal close, leaving an open central portion; urachal fistula, which drains proximally into the umbilicus; vesicourachal diverticulum, which communicates distally with the urinary bladder; and alternating fistula, which can drain to either the bladder or umbilicus.[2,10] The management of symptomatic urachal remnants in adults differs from that in children. Spontaneous resolution with nonoperative management is likely for an urachal remnant in patients younger than 6 months.[11,12] By contrast, infection and malignant transformation are common complications of urachal remnants in adults,[3,13] and approximately 30% recurrence is seen when complicated urachal cysts are managed conservatively with drainage and antibiotic therapy.[4,14] Therefore, an operation is the preferred method for treatment.[5,11]

Technical advancements and growing experience make the laparoscopic excision of urachal cysts a simple procedure, allowing for better outcomes. Several studies using laparoscopic excision[6,8,12,14–16] or robot-assisted laparoscopic excision[9,17,18] of urachal cysts have been reported. However, the necessary extent of resection remains elusive. A procedure in which the urachal remnant is dissected from the umbilicus to the bladder dome and then removed intact via the umbilicus, which is followed by umbilicoplasty, has been described as the proper method for complete resolution of related symptoms, whether it is a laparoscopic approach or open way.[8,9] In our study, we demonstrated the innovative approach of umbilicus-sparing laparoscopic urachal remnant excision and did not perform an umbilectomy. The postoperative periumbilical discharge improved immediately in this study, and long-term follow-up results revealed that no patients had symptomatic recurrence or malignant transformation. These results are similar to umbilicus-dissected open approach. In our experience, complete and adequate dissection of the urachal remnant along with its inflammatory tissue (including adjacent inflamed tissue) is more important than performing an umbilicoplasty. In addition, the umbilicus-sparing laparoscopic urachal remnant excision procedure is easily repeatable with no increased morbidity. Another advantage is the superior cosmetic result with this approach, especially for younger patients. This viewpoint is further supported by the study by Siow et al[15] that also performed the umbilicus-reserved laparoscopic procedure to manage symptomatic urachal remnants; the authors reported that the mean duration of hospital stay was 1.3±1.38 days and only 1 patient had persistent discharge postoperatively, which was due to incomplete resection of inflamed tissue, and all other patients healed quickly.

In addition, there is no consensus about the necessity for routine resection of the urachal remnant en bloc with a bladder cuff. Some groups recommend wide local resection until the dome of the bladder along with adjacent inflammatory to avoid recurrence and possible carcinoma occurrence in the residual urachal tissue.[14,19] Others argue that excision of a bladder cuff depends on whether there is an adherent, communicating urachal cyst attached to the bladder dome communication observed by imaging or cystoscopy as well as whether there is preoperative suspicion of urachal carcinoma.[5,20] The authors showed that the period of postoperative Foley catheterization was a mean of 7.2 days, while a mean of 0.83 days for patients with sparing the bladder cuff. In this study, we did not routinely resect a bladder cuff in all cases. Each group has only 5 patients who need bladder cuff resection, including 4 cases (USLA group), 3 cases (OA group) with communication between the cyst and bladder based on cystoscopy or radiography, and 1 case (USLA group), 2 cases (OA group) with adhesion of the urachal cyst to the bladder based on intraoperative observation. Those patients who did not undergo bladder cuff resection did not experience complications or recurrence during the follow-up period. Therefore, the indications for resecting the urachal remnant en bloc with a bladder cuff are more crucial. Avoidance of bladder cuff resection allows for early Foley catheter removal, resulting in fewer associated complications and a quicker recovery. In addition, surgical resection should be performed after the inflammation has improved by using appropriate antibiotics or drainage, which can reduce postoperative complications and improve the effective operation rate.

Postoperatively, the Foley catheter is mean left for 3.2 ± 1.8 days in USLA group and 3.6 ± 2.0 days in OA group. We advocated for catheterization for 3 to 5 days after the surgery as routine care for those patients in 2 groups who underwent bladder cuff resection and did not encounter related complications.

It is worth mentioning the various port placement techniques for laparoscopic approach. Usually, the 3-conventional port technique is applied, involving 1 camera and 2 working ports. The most common port positions are based on the position of the 3 ports in the right or left lateral abdominal wall.[8,15,21] Another placement technique is either epigastric or supraumbilical placement for the camera port with right and left mid abdominal wall positions for the working ports, allowing for triangulation.[20,22] We adopted the latter technique, which involves a 10 mm, supraumbilical trocar for the 30° laparoscope and 2 paraumbilical trocars placed away from the umbilicus and potentially infected inflamed tissue. An additional 5-mm port may be placed to assistant with aspiration of purulent material. In our experience, this port configuration allows for adequate identification of the urachus as well as facilitates suture delivery and bladder suturing compared with the former technique. In addition, laparoscopic single-site surgery (LESS), a minimally invasive approach that provides excellent cosmetic results, has also been adopted in several surgical procedures for treating urachal remnants. However, when suturing the bladder wall during LESS, it may be difficult to preform manually, and not as flexible as laparoscopic 3 ports procedure.

Although other small series on this topic have similar results, there are limitations to the present study. The retrospective design of the study is inherently biased, the series size is relatively small, and long-term outcomes of surgical intervention urachal remnants are needed.

In conclusion, the umbilicus-sparing laparoscopic approach is our preferred management strategy for complicated urachal remnants, and it can achieve infection control and symptomatic relief during the follow-up period. More importantly, it had superior cosmetic results and less postoperative pain than umbilicoplasty. In addition, routine resection of a bladder cuff is unnecessary with this approach, allowing for an earlier return to normal activities for patients. Both the small number of patients and single-center retrospective control analysis are limitations of this study. A prospective, larger sample size, multi-institutional, randomized study will be performed in our future research to further assess the clinical safety and outcomes for the umbilicus-sparing laparoscopic approach.

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Author contributions

Zheng Liu and Jia Hu designed and coordinated the approach; Jia Hu and Xiao YU performed the procedures; Jia Hu, Fan Li, and Zheng Liu collected data; Jia Hu and Shaogang Wang analyzed data; Jia Hu wrote the paper.
Conceptualization: jia hu, Zheng Liu.
Data curation: Zheng Liu.
Investigation: Xiao yu, Fan Li.
Project administration: jia hu.
Supervision: Shaogang Wang.
Writing – original draft: jia hu.
Writing – review & editing: jia hu.

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