Laparoendoscopic single-site surgery for treatment of urachal remnants

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Introduction: *To evaluate safety and excellent cosmetic outcome with laparoendoscopic single-site surgery (LESS). In this study, we compared the usefulness and efficacy of LESS versus conventional laparoscopic surgery for the treatment of urachal remnants.*

Materials and methods: *We retrospectively reviewed the medical records of 20 consecutive patients who underwent either conventional laparoscopic surgery or LESS from January 2007 to February 2015 at Kansai Medical University Hospital. Ten patients underwent surgery using the standard laparoscopic 3-port technique, and 10 patients underwent LESS. The patients included 12 males and 8 females (mean age, 24.5 years; range, 10-68 years). The patients' characteristics, surgical data, and postoperative pain assessment results were retrospectively collected and analyzed.*

Results: *The median operative time, pneumoperitoneal surgery time, and estimated blood loss did not differ between the LESS and conventional laparoscopic groups. However, the total incision length was longer in the conventional laparoscopic group than in the LESS group. The degree of pain at 2 to 5 days postoperatively according to the Wong-Baker FACES Pain Rating Scale was lower in the LESS group than in the conventional laparoscopic group ($p < 0.05$).*

Conclusions: *Less is a possible option in the surgical treatment for urachal remnants. In this very small cohort, there is no conversion to traditional laparoscopic surgery or open surgery. This technique is possibly feasible and may achieve less pain. Accumulation of surgical outcomes especially in safety and cosmesis is required to be an established method.*

Key Words: urachal remnant, laparoscopic single-site surgery, pain scale

Introduction

The urachus is a normal embryonic remnant of the primitive bladder dome. It generally exists as a fibrous cord extending from the dome of the bladder to the umbilicus. It also occupies the potential midline space between the peritoneum and the transversalis fascia. The urachus has usually regressed by the fifth month of gestation. A canal persists in more than 70% of adults, and this canal is continuous between the umbilicus and bladder in one-third of these individuals.[1] Urachal remnants are relatively rare, but they may cause various symptoms and are associated with an increased risk of adenocarcinoma.[1]

Urachal remnants can be divided into five groups: congenital patent urachus, urachal cyst, umbilical cyst and sinus, vesicourachal diverticulum, and alternating sinus.[2] Urachal cysts represent up to 54% of pediatric urachal anomalies.[3]

Open surgery is usually performed for resection of urachal remnants. After the introduction of laparoscopic surgery in the treatment of a urachal remnant in 1993[4] laparoscopic techniques have largely replaced open surgical approaches. Laparoendoscopic single-site surgery (LESS) has recently been applied in several surgical procedures.[5] LESS for urachal remnants was first described by Patrzyk et al[6] in 2010. Laparoscopic surgery for urachal disease was first applied in our

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institution in 2007. We also reported two patients who underwent LESS for urachal remnants in 2012.[7]

LESS is minimally invasive and provides excellent cosmetic results. In this study, we examined the usefulness and efficacy of LESS versus conventional laparoscopic surgery for treatment of urachal remnants.

Materials and methods

We retrospectively reviewed the medical records of 20 consecutive patients who underwent either conventional laparoscopic surgery or LESS for treatment of urachal remnants from January 2007 to February 2015 at Kansai Medical University Hospital. Ten patients underwent surgery with the standard laparoscopic 3-port technique, and 10 patients underwent LESS. The patients comprised 12 males (60%) and 8 females (40%) with a mean age of 24.5 years (range, 10-68 years). Eight patients who underwent LESS and seven patients who underwent conventional laparoscopic surgery presented with chronic umbilical discharge and recurrent umbilical infections secondary to abscessation of the urachal remnant. Two patients who underwent LESS and three patients who underwent conventional laparoscopic surgery presented with urinary symptoms such as micturition pain.

Conventional laparoscopic surgery and LESS techniques

Our LESS technique using an additional port was briefly in previous reports.[7] Before surgery, a transurethral foley catheter was inserted into the urinary bladder to allow for retrograde filling of the bladder during surgery. For both techniques, the patient was placed in the supine position with both arms close and parallel to the body. When the intestinal tract interfered with the operation, the male was positioned in an approximate 10° Trendelenburg position and the female was positioned in lithotomy position. The skin was disinfected and sterile drapes were placed. A 2.5 cm semicircular incision was created around the caudal ridge of the umbilicus. After the fascia of the rectus muscle had been incised, the rectus muscle was divided to identify the umbilical ligament lying on the peritoneum, which was isolated under direct vision. The ligament was then ligated and cut at the base of the umbilicus. The peritoneal cavity was subsequently opened, and the ligament connecting the urachus was excised as far as possible toward the side of the bladder under direct vision. In conventional laparoscopic surgery, a camera port was placed into the abdominal cavity through this incision at the umbilicus; in LESS, a SILS Port (Covidien, Norwalk, CT, USA) was inserted through the incision. In conventional laparoscopic surgery, two 3 mm or 5 mm trocars were placed at the middle between the camera port and anterior superior iliac spines on both sides; in LESS, three 5 mm trocars for the camera and the working ports were placed through the SILS Port. Pneumoperitoneum was established with carbon dioxide to allow for observation of the abdominal cavity using a 0° 5 mm flexible camera (Olympus, Tokyo, Japan) in LESS and a 10 mm rigid or flexible camera (Olympus, Tokyo, Japan) in conventional laparoscopic surgery. The proximal edge of the urachus (bottom of the umbilicus) was identified and liberated distally down to the roof of the urinary bladder. The top wall of the urinary bladder, which was attached to the urachus, was exposed by opening the space of Retzius. To obtain an appropriate incision line, auxiliary observation was performed via the cavity of the urinary bladder using a flexible cystoscope. The urinary bladder wall was incised under the guidance of projected light from the cystoscope. For this purpose, another endoscopic monitor set was required. The urachus with the bladder cuff was then cut and removed through the surgical wound site. The open bladder wall was closed with a continuous suture of 3-0 vicryl. In the first five patients who underwent LESS, a 3 mm trocar was added to the left lower quadrant to suture the bladder wall. However, in the latter five patients, a knot pusher was used through a 5 mm port at the SILS Port, and suturing was performed without an additional port. To prevent postoperative adhesion between the bowel and abdominal wall, Seprafilm (Genzyme Corporation, Cambridge, MA, USA) was placed into the abdominal cavity. Drainage tubes were placed on the top wall of the urinary bladder in all patients who underwent conventional laparoscopic surgery. However, drainage tubes were not placed in the latter five patients who underwent LESS. The fascia on the back of the umbilicus was tightly sutured to prevent hernia formation. This was followed by closure of the fascia and finally the skin using a running intradermal monofilament absorbable 4-0 PDS suture. The skin was disinfected and a sterile dressing was placed onto the wound.

Statistical analysis

We evaluated pain using the number of analgesic drug administrations and the Wong-Baker FACES Pain Rating Scale after conventional laparoscopic surgery and LESS. We administered nonsteroidal anti-inflammatory drugs (NSAIDs) as analgesics. Differences in continuous variables were compared with the Mann–Whitney U test. A p value of < 0.05 was considered statistically significant.

TABLE 1. **Patients' characteristics**

	LESS (n = 10)	Laparo (n = 10)	p value
Age (yrs)	27 (10-63)	24 (15-68)	ns
Sex (M:F)	7:3	5:5	ns
Body mass index (kg/m^2)	22.1 (17.2-31.2)	20.6 (17.5-27.0)	ns
Symptom			
Discharge from the umbilicus	8 (80%)	7 (70%)	ns
Miction pain	2 (20%)	3 (30%)	ns
Blichert-Toft classification			
Umbilical-urachus sinus	5 (50%)	5 (50%)	ns
Urachal cyst	5 (50%)	5 (50%)	ns

LESS = laparoendoscopic single-site surgery; laparo = laparoscopic surgery; ns = not significant

Results

Demographic data are shown in Table 1. Both groups had similar clinical characteristics including age, sex, body mass index, symptoms, and urachal remnant classification. LESS was completed successfully in all 10 patients, and no conversion to conventional or open surgery was observed.

Table 2 compares the perioperative parameters of each group. One case of among the conventional laparoscopic groups was excluded. Because strong adhesion of small and large intestine to urachal abscess was observed and a long time was consumed to dissect intestine. Then, the median operative time (142.5 versus 176.5 minutes), median pneumoperitoneal surgery time (93.5 versus 106.9 minutes), and median

TABLE 2. **Perioperative outcomes**

	LESS (n = 10)	Laparo (n = 10)	p value
Total operation time (yrs)	142.5 (116-229)	176.5 (112-281)*	ns
Pneumoperitoneal surgery time (min)	93.5 (33-156)	106.9 (45-202)*	ns
Incision length (cm)	3.0 (3.0-3.5)	4.5 (3.8-5.5)	0.027
Blood loss (mL)	7.5 (5-110)	16.0 (5-118)	ns
Hospital stay (days)	5.0 (3-7)	7.6 (5-10)	0.023

LESS = laparoendoscopic single-site surgery; laparo = laparoscopic surgery; ns = not significant
*one case was excluded, because strong adhesion of small and large intestine to urachal abscess was observed. A long time was consumed to dissect the intestine. Excluded case: total operation time was 483 minutes; pneumoperitoneal surgery time was 434 minutes.

TABLE 3. **Postoperative pain assessment**

	LESS (n = 10)	Laparo (n = 10)	p value
Number of pain medications (times)	1.0 (0-2)	0.9 (0-3)	ns
Wong-Baker Face Scale			
POD1	1 (1-2)	1 (0-2)	ns
POD2	1 (1-2)	2 (0-3)	0.035
POD3	0 (0-1)	1 (0-2)	0.016
POD5	0 (0-1)	1 (0-2)	0.019
POD7	0 (0-1)	0 (0-2)	ns

LESS = laparoendoscopic single-site surgery; laparo = laparoscopic surgery; ns = not significant

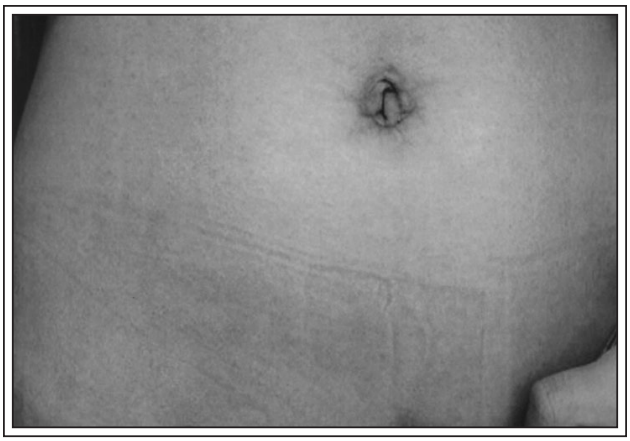

Figure 1. Postoperative scar (postoperative day 30).

estimated blood loss (7.5 versus 16.0 mL) did not differ between the LESS and conventional laparoscopic groups, respectively. However, the total incision length (3.0 versus 4.5 cm) was longer in the conventional laparoscopic group than in the LESS group. The results of pain scales are shown in Table 3. The degree of pain at 2 to 5 days postoperatively was lower in the LESS group ($p < 0.05$), although the number of analgesic drug administrations did not differ between the two groups. No postoperative complications occurred in the conventional laparoscopic surgery group, while one patient in the LESS group developed a wound infection that healed with conservative treatment. Patients in the LESS group had a less visible scar than patients in the laparoscopic surgery group 6 months postoperatively, Figure 1.

Discussion

Whether to completely resect the urachal tissue around the bladder during surgical treatment of urachal remnants is controversial. Resection of only the abscessed lesion may be an adequate surgical treatment of benign urachal disease. However, Sheldon et al[1] reported that cancer of the urachus often develops near the connection between the urachus and bladder when the urachus remains after surgery. In light of this fact, we perform full-length resection of the urachal cord from the umbilicus to the bladder with full-thickness partial resection of the bladder wall. Although this procedure requires a long skin incision by open surgery from the umbilicus to near the pubic bone, laparoscopic surgery can be performed with a minimal wound size.

LESS was recently applied to various surgeries to achieve good cosmesis. LESS has been introduced throughout the field of urologic surgery. For example, the performance of LESS for radical nephrectomy, donor nephrectomy, adrenalectomy, and pyeloplasty is gradually increasing. The advantage of LESS is its minimal invasiveness. Fan et al[8] performed a systematic review and meta-analysis of 27 studies involving 1094 patients who underwent LESS-nephrectomy (LESS-N); 2 of these studies were randomized clinical trials. In their review, LESS-N was found to be a safe and efficient alternative to conventional laparoscopic nephrectomy and was associated with less pain, a shorter recovery time, and a better cosmetic effect. In addition, these data were corroborated by matched-pairs studies.[9,10] Wang et al[10] reported that transumbilical LESS-N is a feasible, safe, and efficacious procedure with favorable perioperative outcomes including significantly improved control of postoperative pain, more rapid recovery of bowel function, and increased cosmetic satisfaction.

The performance of LESS for treatment of urachal remnants was first described by Patrzyk et al[6] in 2010. We also reported two patients who underwent LESS for urachal remnants in 2012.[7] Patrzyk et al[11] recently reported another study involving 18 cases of 3-port conventional laparoscopic surgery and three cases of LESS. They did not compare the perioperative data of the two patient groups and concluded that neither surgery is more effective. We performed the first comparison of conventional laparoscopic surgery and LESS (n = 10 patients each). In this study, perioperative parameters such as the total operation time, pneumoperitoneal surgery time, and blood loss were comparable between LESS and conventional laparoscopic surgery. Significant differences were noted between the two procedures in terms of the incision length and Wong-Baker FACES Pain Rating Scale results soon after surgery. Many of the patients with benign urachal disease were younger women, and the cosmetic benefit may be more important in such patients than in those with other diseases. LESS involved an only 2.5 cm semicircular wound at the caudal edge of the umbilicus, and the wound was usually hidden in the dimple of the umbilicus. Thus, LESS for the treatment of benign urachal disease was shown to be a more useful procedure than urologic surgery.

The most difficult points of LESS in urachal surgery are suturing and knotting. Suturing is possible by moving the bladder edge and peritoneal edge to the appropriate angle for the needle driver. However, knotting is very difficult and time-consuming because the angles of the two needle drivers are almost parallel. Therefore, we placed an additional 3 mm port in the right lower abdomen for the first five cases. With

the use of a knot pusher, however, knotting was feasible without the additional port in the latter five cases. Alternatively, a V-Loc wound closure device (Covidien) is also available. Furthermore, when treating the peritoneum, one approach is to leave the opening in the peritoneum while another approach is to close it. When LESS is performed to treat a urachal remnant, the port is oriented tangentially to the direction in which suturing is performed, and the incision is relatively long. Abdominal insufflation results in stretching of the peritoneum, making closure extremely difficult.

We presented the possible benefit of LESS for the treatment of urachal disease. However, this study was retrospectively designed and included a very small number of patients; therefore, additional evidence is required to validate our findings. Additionally, because urachal remnants often occur in younger individuals, these procedures should also be compared in terms of aesthetics.

LESS is an excellent option for radical resection of urachal remnants. Compared with conventional laparoscopic surgery, LESS requires only one incision and might be superior in terms of cosmesis and safety.

Conclusions

LESS is a possible option in the surgical treatment for urachal remnants. In this very small cohort, there was no conversion to traditional laparoscopic surgery or open surgery. This technique is feasible and may achieve less pain. Accumulation of surgical outcomes, especially in terms of safety and cosmesis is required to make this an established method. □

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