

Surgical management of urachal remnants in children: open versus laparoscopic approach

A STROBE-compliant retrospective study

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Abstract

Urachal remnants (UR) represent a failure in the obliteration of the allantois, which connects the bladder to the umbilicus, at birth. Surgical management of UR in children is controversial. The traditional surgical approach involves a semicircular intraumbilical incision or a lower midline laparotomy. Recently, many reports have supported the laparoscopic approach (LA) for removing UR. However, there is a paucity of data comparing the benefits of LA those of the open approach (OA).

We retrospectively reviewed all children (aged ≤ 16 years) with UR who underwent surgical procedures. Age at surgery, sex, operative time, intraoperative or postoperative complications, total wound length, and length of hospital stay length after operation were analyzed.

Overall, 30 children aged between 9 months and 16 years (mean 9.0 years) underwent surgical procedures: 15 were treated by OA and 15 were treated by LA. The only statistically significant variable was the operative time. Furthermore, we reanalyzed the age distributions of the older children (aged ≥ 10 years). In this group, no significant difference in the operative time between OA and LA was observed; however, there was a statistically significant difference in the total wound length.

Our review indicated that LA required longer operative time than OA without any cosmetic advantage. However, in older children (aged ≥ 10 years), the difference in the operative time was not significant; moreover, LA provided greater cosmetic advantage. LA is recommended for older children (aged ≥ 10 years) because of its cosmetic advantage.

Abbreviations: LA = laparoscopic approach, OA = open approach, UR = urachal remnant.

Keywords: laparoscopic surgery, pediatric surgery, urachal remnants

1. Introduction

The urachus is a normal embryonic structure that joins the fetal bladder and the allantois. Occasionally, this structure fails to disappear completely at birth, leading to a persistent urachal

remnant (UR). This congenital anomaly occurs in 1.6% of children and 0.063% of adults. URs can cause umbilical discharge, infections, umbilical granulation, abdominal pain, and urinary symptoms.^[1-6] It should be completely excised because of the risk of recurrent inflammation and malignant degeneration.^[1,3,7-10]

The traditional approach for removing UR has been the open approach (OA) with a semicircular intraumbilical incision or a midline laparotomy. Recently, several reports have supported the laparoscopic approach (LA) for removing UR.^[1,2,4,7-10] However, surgical management of UR in children remains controversial. There is a paucity of data with respect to comparisons between OA and LA.^[1,2] We report our experience in managing UR in children comparing these 2 surgical approaches.

2. Materials and methods

We retrospectively reviewed all UR patients younger than 16 years who underwent open and laparoscopic surgeries at the Jikei University Hospital Group (Jikei University Hospital, Kashiwa Hospital, Daisan Hospital and Katsushika Medical Center) between March 2007 and July 2018. UR included urachal sinus, urachal cyst, and urachal duct. All patients were symptomatic and underwent surgical treatment after receiving therapy for acute inflammation using antibiotics and/or drainage. UR was examined by abdominal ultrasonography, computed tomography (CT) or magnetic resonance imaging (MRI). Patients were analyzed according to age at surgery, sex, surgical procedure, total wound length, and length of hospital stay after operation.

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Statistical analyses were performed using Stat View (Stat View software, ver.5.0, SAS Institute, Cary, NC). All data were compared using nonparametric statistical analysis with Student *t* test, Chi-square test, and Fisher exact test for categorical variables. In all analyses, $P < .05$ was considered statistically significant.

This study was approved by the Ethics Committee of University hospital Medical Information Network center with the Helsinki Declaration of 1975 (revised 1983).

2.1. Operative methods

Both surgical procedures were performed with the patient under general anesthesia and in the supine position.

2.2. Open approach

OA involved a semicircular intraumbilical incision or a midline laparotomy without insertion of a bladder catheter. UR was dissected from the abdominal wall toward the dome of the bladder.

2.2.1. Laparoscopic approach. Bladder catheter was inserted in each patient. The first port was placed in the right abdomen or umbilical portion as the camera port. Two or 3 additional ports were inserted under laparoscopic vision. The trocar site was modified to improve operability. UR was dissected from the abdominal wall toward the bladder dome via the transperitoneal approach using energy devices. UR was completely removed via the umbilical site with a small incision.

All wounds were closed without drainage tube in both procedures. Cephem antibiotics were administered for few days.

3. Results

Overall, 30 children (21 boys and 9 girls) underwent surgical procedures for the management of UR. The median age of patient was 9.0 years (range, 9 months–16 years). We introduced LA from 2013; 15 patients were treated using LA, whereas 15 were treated using OA (Table 1).

The mean age was 7.7 years (range, 9 months–15 years) in the OA group and 10.3 years (range, 1–16 years) in the LA group. Mean operative time was 87.8 min (range, 45–198 min) in the OA group, and 145.9 min (range, 40–242 min) in the LA group. The total wound length was 40.0 mm (range, 20–60 mm) in the OA group, and 33.9 mm (range, 20–47 mm) in the LA group. There was no blood loss in either groups. LA group did not require conversion to laparotomy. There were no intraoperative or postoperative complications and recurrences during the in-clinic follow-up period. Length of hospital stay after operation was 1.87 days (range, 1–4 days) for the OA group, and 2.93 days

Table 1

Patient characteristics.	
All UR patients	30
Sex (M: F)	21:9
Age at surgery	9 y (9 mo–16 y)
Open: laparoscopic	15:15
Complication of surgical procedure	None
Recurrence	None

UR = urachal remnants.

Table 2

Comparison between open approach and laparoscopic approach.

	OA: LA	P
Patients	15:15	
Sex (M: F)	12.3:9.6	.427
Age at surgery, y	7.7:10.3	.182
Operative time, min	87.8:145.9	.004
Total wound length, mm	40.0:33.9	.077
Length of hospital stay after operation, day	1.87:2.93	.104

LA = laparoscopic approach, OA = open approach.

(range, 1–9 days) for the LA group. Pathological examination confirmed a benign UR in all patients. The only statistically significant variable was the operative time (Table 2).

We re-analyzed the age distributions of the older children (aged ≥ 10 years). The operative time for OA and LA were not significantly different (OA = 98 min, LA = 151.1 min). However, the total wound length was a statistically significant variable (OA = 48.3 mm, LA = 34.7 mm) (Table 3).

At our hospitals, the cost of disposable surgical instruments using LA (about \$1500) was 5 times more expensive than that using OA (approximately \$300).

4. Discussion

Embryologically, the urachus arises as a result of the separation of the allantois from the ventral cloaca in the embryonic period. As fetal development progresses and the bladder grows and descends, the attachment between the umbilicus and urachus becomes looser and the tract then obliterates shortly by birth, forming the median umbilical ligament. The failure of this regression causes UR. Although UR is asymptomatic, it occasionally becomes infected. Infection in UR leads to abscess formation, which causes discharge, urinary symptoms, and umbilical granulation.^[1,2,6]

The radical treatment for UR is surgical excision.^[2] The recommended surgical management consists of the radical excision of UR including the urachus and median umbilical ligament, from the umbilicus to the bladder dome as well as to the adjacent peritoneum.^[2,7] The traditional approach via the umbilicus involves a laterally expanded incision, or a midline vertical incision.^[2] Recently many reports have recommended surgical management by LA. However, there is a paucity of data comparing the benefits of LA and those of OA.^[1,2]

Our study included 30 children who underwent surgical procedures for the management of UR in 4 hospitals during a span of 12 years. In this study, the operative time was the only statistically significant variable. There were no recurrences or

Table 3

Comparison between open approach and laparoscopic approach in children aged ≥ 10 years.

	OA: LA	P
Patients	6:9	.273
Sex (M: F)	5.1:4.5	.287
Age at surgery, y	13.2: 13.6	.698
Operative time, min	98.0:151.1	.109
Total wound length, mm	48.3:34.7	.003
Length of hospital stay after operation, day	2.33:2.56	.749

LA = laparoscopic approach, OA = open approach.

complications in either group. Moreover, the total wound length and length of hospital stay were not significantly different. Many reports have indicated that LA had good cosmetic outcomes but did not provide supporting evidence.^[9] Our data indicated that the total wound length for OA versus LA was not significantly different.

We then re-analyzed the age distributions of the older children (aged ≥ 10 years). The operative time observed for OA and LA in this group were not significantly different. However, there was a statistically significant difference in the total wound length.

In the older children, LA provides better cosmetic outcomes than OA while requiring similar operative time.

LA allows better visualization and recognition of the distal UR. However, surgical management with LA using some trocars and energy devices is expensive compared with that with OA.^[10] At our hospitals, the cost of disposable surgical instruments using LA was 5 times more expensive than that using OA.

In conclusion, our review indicates that OA and LA are safe and have similar effectiveness. We recommend choosing the surgical approach according to the surgeon's experience, patient's age, and hospital's specialty. Furthermore, LA is recommended for older children (aged ≥ 10 years) because of its cosmetic advantage.

Author contributions

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Data analysis: Keiichiro Tanaka.

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