

Transumbilical single-incision laparoscopic vaginoplasty hybrid transperineal approach using a sigmoid colon segment: initial twenty-five cases

Mingle Zhang¹ · Suolin Li² · Xianghua Huang¹ · Hui Du¹ · Chengshu Wang¹ · Lijuan Zhang¹ · Yanan Li¹ · Jingkun Zhang¹ · Zhenhai Wang¹

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Abstract

Objective To validate the technical feasibility and anatomical and functional outcomes of transumbilical single-incision laparoscopic (SIL) sigmoid vaginoplasty hybrid transperineal approach in women with Mayer–Rokitansky–Kuster–Hauser (MRKH) syndrome.

Methods Twenty-five patients who underwent transumbilical SIL sigmoid vaginoplasty hybrid transperineal approach were retrospectively evaluated. Operation time and postoperative complications were analyzed. The length and breadth of the neovagina, lubrication and the Female Sexual Function Index were evaluated to assess the anatomical and functional outcomes of the surgery.

Results All the cases were successfully performed without any intraoperative morbidity. The mean operative time and postoperative hospital stay were 162 ± 38 min and 11 ± 3 days, respectively. The postoperative complications included one case of a stress ulcer, one case of a neovaginal ulcer and two cases of umbilical incision infection. Sixteen women had regular intercourse and were satisfied with both the surgical outcome and subsequent sexual activity.

Conclusion Transumbilical SIL sigmoid vaginoplasty hybrid transperineal approach offers a feasible scarless

method with cosmetic advantage for women with MRKH syndrome to establish new functional vagina.

Keywords Sigmoid vaginoplasty · MRKH syndrome · SILS

Introduction

The Mayer–Rokitansky–Kuster–Hauser (MRKH) syndrome occurs in about 1 per 5000 female births and is the most common cause of vaginal absence. Most women present with normal secondary sexual characteristics and entirely normal ovarian function. The aim of all treatments for this condition is not only the creation of a vagina that is functional both in terms of its length and in sexually satisfaction for the couple, but also improved quality of life and psychologic well-being of the women [1]. This has challenged gynecologists to create both nonsurgical and surgical approaches with efficiency, safety and aesthetic.

The dilation treatment was a recommended nonsurgical method, but it requires a long and persistent self-dilatation. Thus, it is hard to be accepted by many women. Sigmoid colon vaginoplasty is an alternative surgical technique for vaginal reconstruction. The advantages of this procedure include adequate vaginal length and width, self-lubrication and no shrinkage [2, 3]. The first case of laparoscopically assisted sigmoid vaginoplasty was described by Ohashi et al. [4]. Since then, the feasibility of the laparoscopic approach for the treatment of MRKH syndrome has been demonstrated in several studies [5–7]. Although conventional laparoscopic sigmoid vaginoplasty is a minimally invasive procedure, it still has a few disadvantages, including multiple small incisions for port access and a minilaparotomy for extracting the sigmoid. Additionally, cosmetic

✉ Suolin Li
lisuolin@263.net

✉ Xianghua Huang
huangxh2003@163.com

¹ Department of Obstetrics and Gynecology, The Second Hospital of Hebei Medical University, No. 215 West Heping Road, Shijiazhuang 050000, Hebei, China

² Department of Pediatric Surgery, The Second Hospital of Hebei Medical University, No. 215 West Heping Road, Shijiazhuang 050000, Hebei, China

appearance after the laparoscopic surgery is better than the open surgery, but it is still not perfect.

In an effort to further improve the cosmetic outcome, new laparoscopic approaches that reduce the number of abdominal incisions have been developed recently. These approaches use either a single-incision or natural orifices to gain access for endoscopic surgery. The authors adapted transumbilical single-incision hybrid natural orifice transluminal endoscopic surgery (NOTES) as a novel approach for sigmoid vaginoplasty for MRKH syndrome. We hypothesize that this procedure is feasible with comparable outcomes compared to the other published series. The operation time, perioperative complications, hospital stay anatomical outcomes and patient-reported outcomes were evaluated.

Materials and methods

Patients

From August 2010 to March 2014, twenty-five women with MRKH syndrome underwent transumbilical single-incision laparoscopic (SIL) sigmoid vaginoplasty hybrid transperineal approach. The age spanned from 19 to 31 years (mean: 23.2 year). The mean body mass index (BMI) was 20.55e mea. They presented with vaginal absence, normal secondary sexual organs, typically female hair growth and normal vulva development. The preoperative diagnosis included pelvic ultrasound, and a rudimentary uterus with normal ovaries was found. Four women were observed congenital abnormalities including Meckel's diverticulum and indirect inguinal hernia (found in operation), absence of right kidney, scoliosis and cheilopalatognathus. Two women had diabetes (Table 1). Dilation treatment was recommended to the women at first, but was refused because of requiring a long and persistent self-dilatation and making them feel embarrassed or shameful. All women were informed about the advantages and disadvantages of surgical techniques (Vecchietti's method, McIndoe's method,

Williams's technique, SIL-assisted sigmoid vaginoplasty and their modifications), and SIL-assisted sigmoid vaginoplasty was their final choice. Informed consent was obtained from all cases.

Surgical procedure

Before the operative procedure, a thorough bowel preparation that included 1-day low-residue semifluid diet, 1-day liquid diet and 1-day fasting was administered. A cleaning enema with warm soap water was given on the day before surgery. Metronidazole (0.4 g, tid) was given orally for 3 days before operation. Prophylactic antibiotic (2 g of ceftazole) was administered intravenously two hours before operation.

After introduction of general endotracheal anesthesia, each patient was placed in lithotomy position. A Foley catheter was inserted. An approximately 25-mm incision was made at the left edge of the umbilicus to gain initial entry into the peritoneal cavity. Next, a multichannel single port (IMD-LES-804, Innovex Medical Device, Shanghai) was placed through the incision (Fig. 1). A capnoperitoneum was established, maintained and monitored. The patient was brought into a right-sided Trendelenburg position, and a 30° optic was introduced first for a diagnostic exploration to confirm the MRKH syndrome. Subsequently, a U-shaped incision was created at the deepest depression of the vaginal vestibule and a separated plane was developed between the urethra, bladder and rectum. Intraoperatively, the authors observed instruments collided resulting from the restricted freedom of movement and the proximity of the instruments. To make up for these disadvantages, with the framework of NOTES, another 12-mm trocar was inserted into the pelvic cavity transvaginal dimple between

Table 1 Population characteristics of the group

	Patients (<i>n</i> = 25)
Age at initial procedure	23.20t ini
BMI	20.55t ini
Associated malformations	Meckel's diverticulum and indirect inguinal hernia (1/25)
	Absence of right kidney (1/25)
	Scoliosis (1/25)
	Cheilopalatognathus (1/25)
	Diabetes (2/25)



Fig. 1 Positioning of the porous puncture outfit at the umbilicus

the urethra, bladder and rectum and assisted the working port. It reduced the complexity and technical challenges of the operation without increasing incisions in abdomen.

After selecting a sigmoid segment based on the vascular anatomy and mesenteric length, the procedure was started by the mobilization of the lower part of the descending colon and sigmoid using a harmonic knife to initiate left parietal separation. Once the sigmoid colon was released, the next step was to ensure the vascularization required for sigmoid segment survival. After opening the mesosigmoid, the sigmoid and rectum were dissected with an endoscopic linear cutter (Endo RLC6035L, Reach Surgical, Beijing) which was a double row of staples and a knife through the 12-mm trocar in the vaginal vestibule (Fig. 2). The porous puncture outfit was withdrawn to allow the mobilizing sigmoid with its vascular pedicle to be exteriorized through the umbilicus incision. The sigmoid colon was transected approximately 12–15 cm to the distal end and well vascularized by the inferior sigmoid artery. The distal end of the isolated sigmoid segment was sealed with a continuous suture in two layers to form the apex of neovagina using a 3/0 Vicryl suture and placed back in the abdomen for vaginoplasty. The anvil of a curved intraluminal stapling device (CDH29, Johnson and Johnson, Somerville, NJ) was fixed at the descending colic oral with purse-string suture and introduced into the abdominal cavity. The porous puncture outfit was replaced in the incision, and the laparoscopic procedure was resumed; then, an end-to-end colorectal anastomosis was performed using a CDH29 stapler through the anus and rectum (Fig. 3). After removing the vestibule trocar, the canal between the urinary bladder and the rectum was enlarged to 2-finger wide under the laparoscopic guidance. The isolated pediculated sigmoid colon segment was reversed and pulled through the canal to create a

neovagina that was performed a colon-perineal anastomosis with interrupted absorbable 3/0 Vicryl sutures. A vaginal prosthesis was put in place for several days. At the end of the operation, the pelvis was reevaluated under the laparoscope to ensure vascularization of the sigmoid transplant. The umbilical incision was closed with interrupted sutures (Fig. 4).

Postoperative course

Second-generation cephalosporin was given intravenously for 5 days. Patients were fasted for the first 3–5 days after their operations and then were followed with a liquid diet and a semifluid diet. On the seventh day after their operations, patients were allowed to have a normal diet. On the

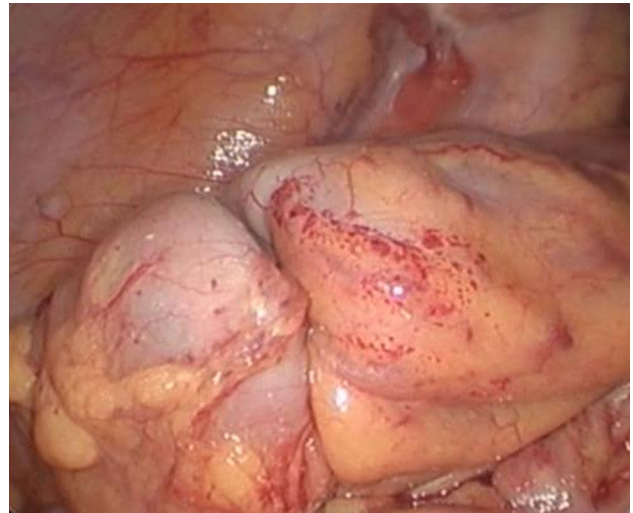


Fig. 3 Reestablishment of gastrointestinal continuity with CDH29 stapler

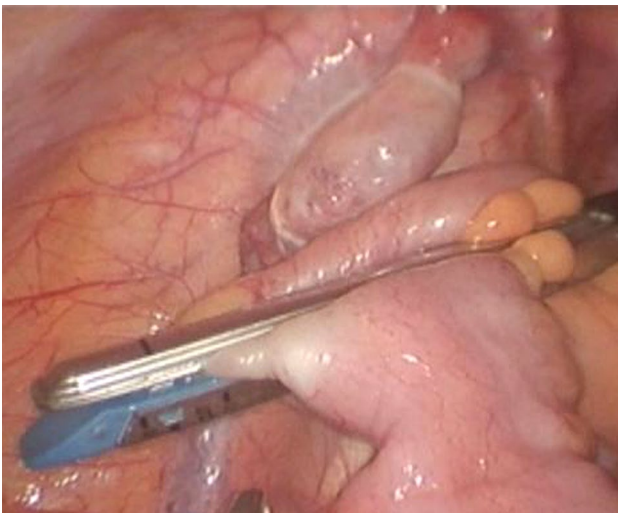


Fig. 2 Dissection of sigmoid colon with endoscopic linear cutter



Fig. 4 Umbilical scar at the end of the procedure

fifth day after operation, the Foley catheter was removed, the vaginal mold was changed, and the neovagina was rinsed with 0.1 % benzalkonium bromide solution once a day until discharge. A postoperative sexual activity was encouraged at 3 months after surgery. In the absence of sexual intercourse, women were instructed to practice self-dilation twice a week.

Follow-up

Patients were scheduled for routine follow-up at 3 months after surgery or first month in which they begin intercourse and yearly thereafter. At every follow-up, patients underwent pelvic examination and depth measurements with ruler and those who had intercourse were asked to fill the Rosen's FSFI.

Results

A total of twenty-five women with MRKH syndrome underwent SIL sigmoid vaginoplasty hybrid transperineal approach. The patient with Meckel's diverticulum underwent diverticulum excision at the same time. All the procedures were successfully performed without any intraoperative morbidity. The mean operative time and postoperative hospital stay were 162 ± 28 min and 11 ± 3 days, respectively. The mean hemoglobin level was 15.30 ± 12.50 g/dL. Those patients with diabetes had an extra 10 days of hospital stay to control their blood glucose levels before surgery. All patients accepted the training of replacing vaginal mold before discharge. The postoperative complications included one case of grade 2 stress ulcer, one case of grade 1 neovaginal ulcer and two cases of grade 1 umbilical incision infection (Table 2). The patient with stress ulcer after surgery required blood transfusion (RBC 4U). The gynecological examinations before discharge showed that the length of the neovagina was 12.3 ± 1.0 cm. All the neovaginas admitted two fingers in breadth.

Twenty-five women accepted the surgery, six women were lost to follow-up, two women were contacted with phone, and both of them had satisfied intercourse. Seventeen women returned for a follow-up visit, and fourteen of them had regular intercourse. The scar in umbilic was hardly found unless observing it in purpose, and most of the women believed the favorable cosmetic results increased their confidence when faced with their families or friends. No length shrinkage or colpatresia was observed, but stenosis ring was found at up 1/3 of neovaginal in two women. All women had transient excessive vaginal discharge, but did not need to wear a pad. Four weeks postoperatively, the amount of vaginal discharge was clearly reduced. Fourteen women had regular intercourse, and they were

Table 2 Perioperative data of the group

	Patients (<i>n</i> = 25)
Operating time (min)	162 ± 28
Concomitant procedures	Diverticulum excision (1/25)
Hemoglobin (g/dL)	15.30 ± 12.50
Hospital stay postsurgery (days)	11 ± 3
Complications	Grade 1 stress ulcer (1/25) Grade 2 neovaginal ulcer (1/25) Grade 1 umbilical incision infection (2/25)

satisfied with the surgery and subsequent sexual activity. Five of them answered the Rosen's FSFI [8], and the mean total score was 28.10 ± 1.75 (Table 3). Others refused to answer the Rosen's FSFI because details of sexual life were involved, which made them feel embarrassed. One woman complained neovaginal bleeding at the first time of intercourse (no need of special treatment or blood transfusion). Three women did not have intercourse because they were unmarried. They were instructed to practice self-dilation twice a week to prevent neovaginal introital stenosis.

Discussion

Evaluation for associated congenital anomalies and psychological preparation of the patient are the most important steps in the effective management of MRKH syndrome [9]. The diagnosis with the physical manifestation being the absence of the womb and vagina seemed to change their perceptions of the self and threatened sexual, social and reproductive functioning. Women with MRKH syndrome need to establish a new and positive self-esteem [10] including a sense of achievement and self-confidence, because positive self-esteem was associated with a favorable treatment outcome [11]. So it is important to construct a good functional vaginal substitute, which is aesthetic, requires less postoperative manipulation and provides long-term sexual satisfaction.

Infertility and the lack of normal sexuality may be the factors that have the greatest impact on the quality of life. MRKH syndrome may be diagnosed during adolescence, but treatment is usually delayed until the patient is ready to start sexual activity. A successful treatment should construct a neovagina with adequate size and normal lubrication when sexually aroused, free from scars, stenosis or contracture and provides a cosmetic appearance. In brief, neovagina should allow the patient to perform sexual activity satisfactorily. The most widely used methods are Frank's nonsurgical method [12, 14], the laparoscopic Davydov method [13, 15], the laparoscopic Vecchietti's

Table 3 Female Sexual Function Index (FSFI) outcomes for various vaginal reconstructions

Study	Procedure	N	Desire	Arousalability	Lubrication	Orgasm	Satisfaction	Comfort	Total score
This study	Sigmoid	5	4.40 ± 0.34	4.40 ± 0.62	5.30 ± 0.17	4.40 ± 0.40	4.67 ± 0.23	4.93 ± 0.61	28.10 ± 1.75
Ding et al. [17]	SIS graft	16	3.47 ± 0.55	4.05 ± 0.74	4.91 ± 0.88	4.13 ± 0.89	4.36 ± 0.54	4.69 ± 1.55	25.60 ± 3.15
	Laparoscopic Davydov	25	3.70 ± 0.48	3.97 ± 0.67	4.73 ± 0.92	3.87 ± 1.25	4.41 ± 0.52	5.10 ± 1.05	25.78 ± 2.74
Cao et al. [15]	Laparoscopic peritoneal	21	4.27 ± 0.11	4.18 ± 0.07	4.14 ± 0.15	3.97 ± 0.32	4.5 ± 0.17	4.38 ± 0.32	25.29 ± 0.51
	Laparoscopic sigmoid	11	4.19 ± 0.24	4.19 ± 0.07	4.19 ± 0.07	4.07 ± 0.32	4.41 ± 0.25	4.22 ± 0.33	24.79 ± 1.17
Morcel et al. [18]	Frank	20	4.5 ± 1.0	4.4 ± 1.6	4.2 ± 2.0	4.0 ± 1.8	4.7 ± 1.6	3.4 ± 1.9	25.3 ± 7.5
Carrard et al. [12]	Laparoscopic sigmoid	48	4.36 ± 0.9	4.74 ± 0.7	5.18 ± 0.9	4.44 ± 1.1	5.35 ± 0.6	3.93 ± 1.2	28.00 ± 3.1
	Frank	11	4.65 ± 1.3	5.10 ± 1.0	5.10 ± 1.1	4.80 ± 0.9	5.40 ± 1.2	5.20 ± 1.1	30.25 ± 6.2
Liao et al. [16]	Dilator only	36	3.5 ± 1.2	3.6 ± 1.7	4.2 ± 1.7	3.3 ± 2.0	4.0 ± 2.0	N/A ^a	N/A ^a
Allen et al. [13]	Laparoscopic Davydov	6	3.9 ± 1.2	4.0 ± 1.1	4.4 ± 1.0	3.3 ± 1.6	4.0 ± 1.8	1.9 ± 1.9	21.4 ± 5.3
Csermely et al. [14]	Laparoscopic Vecchietti	23	4.5 ± 0.7	5.9 ± 0.8	4.3 ± 0.8	4.6 ± 0.9	5.2 ± 0.6	4.7 ± 0.7	30.1 ± 3.8
Rosen et al. [8]	Normal women	131	4.1 ± 1.1	5.0 ± 1.0	5.5 ± 0.9	5.0 ± 1.2	5.1 ± 1.2	5.5 ± 1.1	30 ± 5

^a Not applicable

technique [14, 18], the laparoscopic peritoneal technique [12, 15] and the sigmoid vaginoplasty [12]. Several reports have validated psychosexual outcomes after these various procedures [12–18], and based on the results of the FSFI scores, sexual function appears satisfactory in most of studies. However, the domain related to arousalability, lubrication and comfort was different from each other and in some research had relative weak scores. It may be due to insufficiency of vaginal length, lacking of communication before answering FSFI, unaesthetic scar and psychologic problems. The responses to the questions about depression and body image show that neither the Frank method nor the surgery solves all problems [12]. The chosen method needs to be individualized depending on the patient's need, motivation and the options [19].

The nonsurgical management, the first choice of vaginal agenesis therapy recommended by the American College of Obstetricians and Gynecologists in 2002 [9], is still a very useful and successful method, but requires a long and persistent collaboration of the patient. Moreover, it is psychologically complicated for these women to go through repeated self-dilation, which sometimes was experienced as embarrassing or shameful [20].

Sigmoid vaginoplasty allows early coitus without the need for prolonged vaginal molding and self-dilation [21]. It also offers adequate length and natural lubrication of the neovagina [22]. There was a significant positive correlation between vaginal length and the sexual satisfaction and function. Women who have less lubrication are tended to have more discomfort during sexual intercourse. The

mean length of the neovagina was 12.3 ± 1.0 cm in our series, which is similar to that previously reported [6, 15]. The result is significantly longer than self-dilation only, which is 5.1 ± 2.6 cm [16], and longer than the published mean vaginal length of 9.6 ± 1.5 cm [23]. Furthermore, the thickness of sigmoid tissue seems to withstand trauma better than small-bowel and skin flaps [6], plus the proximity and easily mobilized vascular pedicle, rarely serious complications like segment necrosis and fistula formation occurred. The wall of a neovagina constructed by sigmoid not only includes histological epithelium, but also contains connective tissue (elastic and collagen fibers), and smooth muscle elements are integrated, which has capacity to be stretched and is less uncomfortable in coitus.

Since MRKH syndrome is rare, these women are frequently very distressed and [24] the aesthetic consequence becomes more important to them. The feasibility of the laparoscopic approach for the treatment of MRKH syndrome with sigmoid segment has been demonstrated by numerous reports [5–7]. In our research, single-incision laparoscopic surgery (SILS) has the same advantages as the laparoscopic approach without increasing operative time, hospital stay or complications, and improves the cosmetic benefits by providing only one incision. It may thus contribute to reducing the physical and psychologic consequences of surgery in these women. However, lack of instrument triangulation is a general issue with SILS. Intraoperatively, the authors observed instruments collided resulting from the restricted freedom of movement and the proximity of the instruments. To make up for these disadvantages, with the

framework of NOTES, another 12-mm trocar was inserted into the pelvic cavity through transvaginal dimple between the urethra, bladder and rectum and assisted the working port. It reduced the complexity and technical challenges of the operation without increasing incisions in abdomen. This technique is well suited to the vaginal reconstruction using a sigmoid colon segment, because the perineal canal created in the operation provides a natural orifice for endoscopic surgery.

Conclusion

Transumbilical single-incision laparoscopic sigmoid vaginoplasty hybrid NOTES offers a feasible scarless approach for women with MRKH syndrome. The anatomical, functional and cosmetic outcomes of this surgical approach are satisfactory. The favorable cosmetic results would be used as an alternative approach to conventional laparoscopy.

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Compliance with ethical standards

Conflict of interest All the authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all cases.

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