Original Article

Efficacy and safety of laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty in patients with congenital cervical and complete vaginal atresia: a pilot study

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Background: Hysterectomy places a huge physical and mental burden on young female patients with congenital cervical and complete vaginal atresia. Thus, it is necessary to develop a method to detach the obstruction and simultaneously preserve the vagina and uterus in these patients. This study sought to evaluate the efficacy and safety of laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty in patients with congenital cervical and complete vaginal atresia.

Methods: Between April 2013 and June 2022, 9 patients with congenital cervical and complete vaginal atresia at Henan Provincial People's Hospital were enrolled in this prospective study. All the patients were treated with laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty. Baseline clinical features (such as age, uterus size, etc.) were collected. The surgical success rate and adverse events were assessed.

Results: The 9 enrolled patients had a median [interquartile range (IQR)] age of 15.0 (14.0–18.0) years, and 5/9 patients presented with pelvic adhesions. The surgeries were successful in all (9/9) patients, who preserved their vagina and uterus with a normal menstrual cycle. After a median follow-up duration of 48 months, the neovagina had a median length of 7.5 cm. Post-surgical complications occurred in 3/9 patients, which were cured by an appropriate treatment. The 5/9 married patients reported being satisfied with their sexual life.

Conclusions: Even though the current study preliminary exhibits the efficiency of laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty in patients with congenital cervical and complete vaginal atresia, due to the small sample size, lack of a control group, and relatively high incidence of the adverse events, further studies are still needed to verify the current findings. The current study put forward a further direction for preserving the vagina and uterus simultaneously for those patients with congenital cervical and complete vaginal atresia.

Keywords: Cervical atresia; cervicoplasty; complete vaginal atresia; laparoscopic surgery; vaginoplasty

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Introduction

Congenital vaginal atresia is a rare malformation of the female reproductive tract, which can be divided into partial and complete vaginal atresia (1,2). Congenital vaginal atresia can obstruct menstrual blood flow and can also lead to a series of clinical problems, such as amenorrhea, abdominal pain, pelvic mass, and endometriosis, which require timely surgical dissociation to relieve the obstruction (3,4). Complete vaginal atresia is usually associated with cervical dysplasia or cervical atresia (5-7). Currently, the main surgical method for patients with complete vaginal atresia is vaginoplasty with or without sparing the uterus (8,9). However, hysterectomy places a huge physical and mental burden on young females and their families (10-13). Thus, it is necessary to develop a method to detach the obstruction, prevent endometriosis, and simultaneously preserve the vagina and uterus.

Currently, many nonsurgical and surgical methods are commonly applied to create a neovagina. For the nonsurgical method, Frank's method is usually recommended by clinicians; however, this method needs long-term dilation, which exhibits a low adherence (14). For the surgical method, there is no available consensus or guideline for clinically guiding the surgical methodology in treating patients with congenital cervical and complete vaginal atresia currently. Some surgical techniques, such as Davydov's laparoscopic technique, laparoscopic Vecchietti technique, etc. are frequently used in these patients (15,16). However, these surgical techniques are complicated to operate, besides, the application of cervicoplasty with vaginoplasty concurrently is rarely reported. Hence, this present prospective study sought to evaluate the efficacy and safety of laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty in patients with congenital cervical and complete vaginal atresia. We present the following article in accordance with the AME Case Series and STROBE reporting checklists (available at https://atm.amegroups.com/article/view/10.21037/atm-23-217/rc).

Highlight box

Key findings

- Laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty are effective and safe in patients with congenital cervical and complete vaginal atresia, and can preserve the vagina and uterus simultaneously.

What is known and what is new?

- Currently, the main surgical method for patients with complete vaginal atresia is vaginoplasty with or without sparing the uterus. Hysterectomy places a huge physical and mental burden on young females and their families.
- The current study treated patients with congenital cervical and complete vaginal atresia using the peritoneal flap and cervicoplasty.

What is the implication, and what should change now?

- Our findings provide a new direction for the management of patients with congenital cervical and complete vaginal atresia, which should further elevate the quality of life of and decrease the mental burden placed on young females.

Methods

Patients

Between April 2013 and June 2022, 9 patients with congenital cervical and complete vaginal atresia who underwent surgical treatment were enrolled in this prospective, observational study. To be eligible for inclusion in this study, the patients had to meet the following inclusion criteria: (I) have primary amenorrhea in adolescence; (II) have a karyotype of 46,XX; (III) have no vaginal orifice based on a gynecological examination; (IV) have a functional uterus as confirmed by magnetic resonance imaging (MRI) or color doppler ultrasound; and (V) be about to receive laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty. Patients were excluded from the study if they met any of the following exclusion criteria: (I) presented with part of an upper vaginal segment; and/or (II) were about to receive vaginoplasty using other material or a hysterectomy. For patients aged older than 18 years, both the patients and their guardians signed the written informed consent form; for patients aged younger than 18 years, their guardians signed the written informed consent form. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the medical ethics committee of Henan Provincial People's Hospital (No. 2012-2015).

Surgical procedure

All the surgeries were performed by the same experienced surgeon. Patients were placed in the lithotomy position, and general anesthesia was then administered. Next, the laparoscope was used to examine the pelvic cavity, and the corresponding operation was carried out if there were structural abnormalities. The peritoneum flap (with a

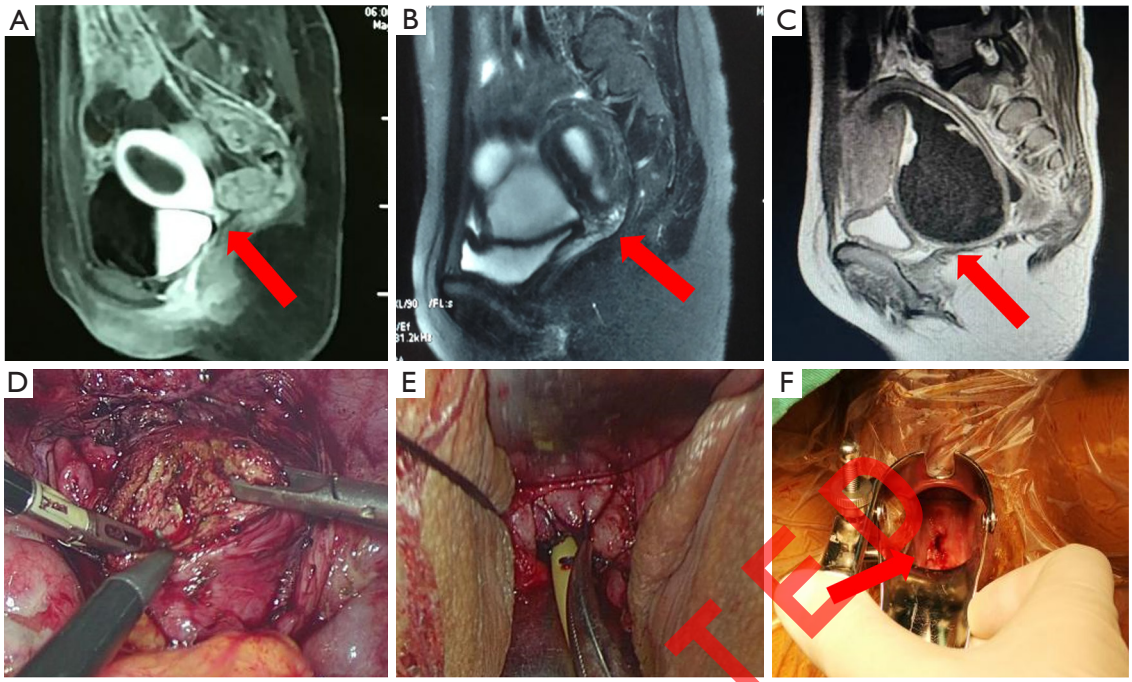

Figure 1 MRI image of a vagina and uterus, and the surgical procedure for patients with congenital cervical and complete vaginal atresia. (A) Cervical dysplasia accompanied by uterine effusion, and the red arrow indicated the atresia of cervix; (B) uterine effusion concurrent with stenosis, effusion, and partial atresia of the cervical duct, and the red arrow indicated the atresia of cervix; (C) a normal uterus and cervix; the inferior uterine segment and the cervix were obviously dilated and showed effusion, and the red arrow indicated the atresia of cervix; (D) the orifice of the cervix was laparoscopically dissected in the shape of a "+", and a No. 12 dilator rod was inserted through the cervical orifice; (E) the cervix was pulled down into the neovaginal cavity to form a "vaginal vault", and the apical vagina was sutured with the superior cervical segment; (F) the cervical orifice was normal and the "vaginal vault" disappeared 1 year after the surgery, and the red arrow indicated the artificial neo-cervix. MRI, magnetic resonance imaging.

length of 8–10 cm and a width of 5 cm from the surface of the bladder at the peritoneal-reflection site) and the peritoneum flap (with a length of 8 cm and width of 5 cm in the middle of the bilateral sacroiliac ligament and in front of the rectum) were detached by monopolar electrocautery or an ultrasonically activated scalpel. The vaginoplasty was then performed. Specifically, a total of 300 mL of dilute pituitrin in normal saline (6 U:500 mL) was injected into the recto-vesical space. The vaginal orifice was transversely incised, and the recto-vesical space was dissected bluntly to the cervical site. Next, the cervical location was confirmed by the laparoscopic pushing of the uterus toward the neovaginal direction. The cervical-vesical space and recto-cervical space were also then bluntly dissected to unclog the pelvic cavity. Subsequently, the peritoneum flaps from the surface of the bladder and rectum were transferred to the neovaginal cavity, which was pulled to the vaginal orifice with laparoscopic assistance, after which, the peritoneum flap from the surface of the bladder was sutured, and fixed at 2 o'clock and 10 o'clock, respectively, with a No. 7 surgical suture, and the peritoneum flap from the surface of the rectum was sutured and fixed at 4 o'clock and 8 o'clock, respectively, with a No. 7 surgical suture.

The cervicoplasty was then performed. Patients with different uterine or cervical malformations were treated with different types of surgeries. In total, the following 3 types of uterine or cervical malformations were observed: A type: cervical dysplasia concurrent with parenchyma absence, accompanied by uterine effusion (patients 1, 3, and 5; *Figure 1A*); B type: cervical dysplasia concurrent with cervical duct incomplete atresia and cervical duct and uterine effusion, which was more remarkable in the uterine (patients 2, 4, 7, and 9; *Figure 1B*); and C type: a normal uterus and cervix, but the external orifice of the cervix was blocked, and the cervix was obviously dilated (patients 6 and 8; *Figure 1C*).

The detailed surgical procedure for A- and B-type patients was as follows: the uterus was turned over, and the cervix was laparoscopically dissected at the orifice of the cervix in the shape of a "+" by electrocautery (*Figure 1D*); the uterus was then pulled down into the neovaginal cavity, and the cervix was dilated to drain the blood in the uterus; a No. 12 dilator rod was inserted into the uterine cavity through the cervix, and a No. 1 absorbable suture was applied for suturing. The detailed surgical procedure for C-type patients was as follows: the cervix was dissected at the orifice of the cervix in the shape of a "+" by electrocautery through the neovaginal cavity, and the rest of the procedure was the same as that described for the A- and B-type patients. The peritoneum flap and skin at the neovaginal orifice were sutured intermittently with a 2-0 absorbable suture in the direction of 0 to 12 o'clock, and the bilateral walls were sutured intermittently with absorbable sutures to ensure that the peritoneum flap covered the neovaginal cavity completely. The cervix was pulled down into the neovaginal cavity to form a "vaginal vault" (*Figure 1E*). The anterior and posterior peritoneum flaps of the apical vagina were laparoscopically sutured with the superior cervical segment to fix the uterus and seal the pelvic cavity.

Afterward, an 18-gauge Foley catheter was placed in the uterine cavity through the neovagina and cervix, which was removed on the next menstrual period. The vaginal mold was placed in the neovagina for 6 months, and was substituted each day. The vaginal mold was only placed in the neovagina during the nighttime and not during the daytime, and was removed after the patient's sexual life started.

Data collection and measurement of efficacy and safety outcomes

At baseline, patients' clinical features, including age, reproductive system malformations and lesions, previous surgical history, were recorded. The primary outcome was the surgical success rate, which was defined as a 2-finger-wide neovaginal cavity was created, the uterine orifice could be observed using the speculum, and menstrual period blood could drain normally (*Figure 1F*). During the intraoperative and postoperative period, patients' vagina and cervix adhesion atresia status, length of vagina, pelvic cysts (based on a pelvic ultrasound), menstruation discharge status, operation time, intraoperative blood loss, and sexual satisfaction as reflected by the Female Sexual Function Index, were also assessed. Furthermore, the surgical complications were also recorded, including fever, intraoperative injury, etc. Once the surgical complications occurred, the symptomatic treatment would be given to the patients.

Statistical analysis

SPSS v.24.0 (IBM Corp., USA) was used for the statistical analysis. The continuous variables are presented as the mean ± standard deviation, or the median [interquartile range (IQR)] as appropriate. The categorical variables are presented as the numerators and denominators.

Results

Patient features

The 9 enrolled patients had a median (IQR) age of 15.0 (14.0–18.0) years, a median (IQR) uterus size of 54.0 (33.0–84.7) cm^3, and a median (IQR) duration of abdominal pain of 12.0 (1.6–42.0) months. Among the patients, 5/9 presented with pelvic adhesions. Other detailed information is provided in *Table 1*.

Surgical information

The median (IQR) surgical duration was 230.0 (182.0–250.0) minutes with a median (IQR) bleeding volume of 100.0 (80.0–200.0) ml during the surgery. Among the patients, 7/9 patients' cervixes were dissected at the orifice of the cervix in the shape of a "+", and a No. 12 dilator rod could be inserted into their neo-cervix orifices. However, in the remaining 2/9 patients, only a No. 9 dilator rod could be inserted into their neo-cervix orifices. Endometriosis was observed in 4/9 patients, which was subsequently dissected by excision or electrocautery evaporation. Pelvic adhesion was observed in 5/9 patients, which was further detached by the separation surgery (*Table 2* and Table S1).

Adverse events during surgery

Fever occurred in 5/9 patients, which was alleviated by symptomatic treatment (*Table 2*). Intraoperative injury occurred in 2/9 patients. Specifically, a bladder injury was observed in 1/9 patient with a lesion size of 1.5 cm, which was repaired by the neoplasty, thereafter, the bladder was 2-layer sutured with a 2-0 absorbable suture. The urethral catheter was removed 2 weeks after the operation, and

Table 1 Clinical characteristics of the patients

Items	Patients (n=9)
Age (years)	
Median (IQR)	15.0 (14.0–18.0)
Range	11.0–28.0
Uterus size (cm^3)	
Median (IQR)	54.0 (33.0–84.7)
Range	17.9–108.5
Duration of abdominal pain (months)	
Median (IQR)	12.0 (1.6–42.0)
Range	0.1–96.0
Pelvic adhesions, n	5
Uterine or cervical malformations, n	
A type	3
B type	4
C type	2
Follow-up duration (months)	
Median (IQR)	48.0 (34.0–54.0)
Range	12.0–109.0

IQR, interquartile range.

Table 2 Surgical information and intraoperative adverse events.

Items	Patients (n=9)
Surgical information	
Surgical duration (min)	
Median (IQR)	230.0 (182.0–250.0)
Range	105.0–270.0
Bleeding volume (mL)	
Median (IQR)	100.0 (80.0–200.0)
Range	50.0–300.0
Cervical orifice dissection, n	7
Dilator rod usage, n	
No. 12	7
No. 9	2
Pelvic adhesion separation, n	5
Endometriosis excision or electrocautery, n	4
Intraoperative adverse events, n	
Fever	5
Intraoperative injury	2
Bladder injury	1
Rectal injury	1

IQR, interquartile range.

the normal function of the bladder was verified by urinary ultrasound. Another 1/9 patient suffered an intraoperative rectal injury, and the lesion was 1 cm away from the neovaginal orifice. The patient's rectum was repaired with a 3-0 absorbable suture and a No. 4 suture through the neovagina, and the wound was covered with a peritoneum flap (*Table 2*). For this patient, postoperative rectal decompression and drainage were performed for 5 days with a 26-gauge silicone tube placed in the anus, and the patient was cured following fasting and intravenous infusion with nutrition for 1 week. After a 7–10-day hospitalization, all the patients were able to exchange the vaginal mold by themselves and were discharged from the hospital.

Surgical outcomes

The median (IQR) follow-up duration was 48.0 (34.0–54.0) months. The surgery was successful in all 9/9 of the patients. During the post-surgical follow-up, the "vaginal vault" disappeared in all patients 1–2 months after the surgery. The neovagina had a median (IQR) length of 7.5 (7.0–7.5) cm. Post-surgical complications occurred in 3/9 patients with a B-type cervix. Among these 3/9 patients, a cervical adhesion-caused amenorrhea occurred in 1/9 patient 2 years after the surgery, but the patient recovered after 1 month of hysteroscopic dissociation and the preventive use of the No. 18 Foley double-lumen catheter. A reduced menstrual volume accompanied by abdominal pain and cervical stenosis was reported in another 1/9 patient at 2 years post-surgery, who was cured after a 3-menstrual-cycle dilation of the uterus. Finally, 1 of the 3 patients had multiple vaginal polyps with bleeding during sexual intercourse 6 months after the surgery, which was cured by surgical resection (*Table 3*).

The 5/9 patients who had a sexual life reported that they were satisfied with their sexual life. In total, 1/9 patient with an A-type cervix fell pregnant 3 times; unfortunately, all pregnancy outcomes were terminated by spontaneous abortion (*Table 3*).

Table 3 Surgical outcomes

Items	Patients (n=9)
Surgical successful rate, n	9
Length of neovagina (cm)	
Median (IQR)	7.5 (7.0–7.5)
Range	6.5–8.0
Satisfaction with sexual life, n	
Satisfied	5
Unknown	4
Post-surgical complications, n	3

IQR, interquartile range.

Discussion

Complete vaginal atresia is commonly concurrent with cervical dysplasia or cervical atresia (3,7). Patients with complete vaginal atresia always suffer from abdominal pain, fallopian tube dilation, cyst formation, and pelvic endometriosis due to the hematocele in the uterine or cervical duct and the reflux of menstrual blood into the pelvic cavity (5,17). Currently, the main treatment method for patients with complete vaginal atresia is surgery. During the surgery, the simultaneous preservation of the uterine is important for females who wish to bear children (18-21). The surgical method employed in the present study was convenient and simple. The uterus and vagina were successfully preserved in all the 9/9 patients who underwent laparoscopic peritoneal vaginoplasty plus cervicoplasty, and the patients had satisfying outcomes after 12 to 109 months of follow-up.

Rock *et al.* (8) suggested that cervical malformations with complete vaginal atresia can be divided into the following 2 types: type I: cervical hypoplasia (the complete absence of the cervix without the presence of cervical stroma); and type II: cervical dysplasia. Type II patients can be further divided into the following subtypes: (I) cervical fragmentation; fragmentation of the cervix is noted; (II) cervical dysplasia presenting as a fibrous band or cord; the diameter of the cord and the characteristics of the matrix may vary; and (III) cervical obstruction: an intact cervical body with obstruction of the cervical orifice.

In this study, the following 3 types of cervical and vaginal malformations were observed in the 9 patients with complete vaginal atresia as diagnosed by MRI imaging: A type: cervical dysplasia concurrent with parenchyma absence; B type: cervical dysplasia concurrent with cervical duct incomplete atresia, and cervical duct and uterine effusion, which was more remarkable in the uterine; and C type: a normal uterus and cervix presentation with a blocked external cervical orifice and an obviously dilated cervix. In the A-type patients, the cervical ostomy operation was complicated, and the operation time was long; however, these patients had a regular postoperative menstrual cycle, and a satisfactory sexual life, and 1 patient successfully fell pregnant. In B type and C type patients, the cervical ostomy operation procedure was simple, and only included the dissection of the external cervix and subsequent suturing. Further, no fibrous cord or band or cervical fragmentation was observed in any of the 9 patients.

In previous studies, after the initial fertility preservation operation, some patients still face a high risk of hysterectomy due to vaginal atresia or cervical stenosis atresia caused by repeated operations or infection (22,23). Additionally, the risk of re-atresia exists when the wound is not covered with appropriate materials after cervicoplasty and vaginoplasty (24). Currently, the commonly used materials for covering the vagina include amniotic membrane, a small intestinal submucosa graft, skin, biological materials, peritoneum, and other flaps (22-28). However, most studies on the application of these materials have been case reports, and all these materials (except skin and the peritoneum) require the application of allografts. Further, a neovagina that uses skin as a covering can still maintain keratinized epithelial cells, sebaceous glands, and hair even 2 years after the operation (29). In our study, a peritoneal flap was applied instead of other allografts or skin grafts, which might help to reduce the additional damage to the uterus and decrease the expense of surgery.

The notable surgical outcomes included the management of the cervix and the unclogging of the neovagina. More specifically, the following surgical outcomes were observed: (I) the "+" shape incision created a sufficiently large cervical orifice into which a No. 12 dilator rod could easily be inserted and from which menstrual blood could drain; (II) the formation of a "vaginal vault" by pulling the cervix down into the neovaginal cavity might have prevented cervical retraction and adhesion atresia at the top of the vagina during the process of vaginal peritonealization; (III) the placement of double-lumen balloon tubes in the cervix and uterine cavity after the operation and until the next menstrual cycle promoted the healing and formation of the

cervical canal, and might have prevented cervical adhesion atresia; and (IV) the requirement that the patients strictly follow the doctor's advice for postoperative management and ensure that they correctly wear the mold might have prevented vaginal adhesion or re-atresia.

Currently, there is no standard for the duration of the placement of the balloon, which is largely dependent on the successful drainage of menstrual blood. In general, the double-lumen balloon tube is placed in the cervix and uterine cavity for 1 month until the successful drainage of menstrual blood. If stenosis occurs in the cervical tube, the double-lumen balloon tube should be repositioned for as long as 3 months. If the double-lumen balloon tube falls off without intervention and there is no evidence of restenosis, no treatment is needed except for close follow-up. In the present study, no infection occurred during the placement of the vaginal mold and uterine balloon tube. Among the patients, 1 (patient 1) developed a left oviduct abscess about 6 years after the operation, which was not related to the operation method.

Despite its novelty, the detailed step-by-step description of the procedure, and long follow-up duration (median time: 48 months), this study had some limitations. First, the sample size was small, which limited the type of malformed cervixes. Second, the age of the enrolled patients was young, and consequently few sexual-life-related events could be observed and thus the sexual-life-satisfaction of the patients was difficult to determine. Third, only 1 patient fell pregnant 3 times with concurrent spontaneous abortions, and no patient reached an intermediate or advanced gestation period. Thus, long-term pregnancy outcomes could not be evaluated.

Conclusions

Laparoscopic vaginoplasty using the peritoneal flap and cervicoplasty are effective and safe in patients with congenital cervical and complete vaginal atresia, and can preserve the vagina and uterus simultaneously. However, further research studies with larger sample sizes and longer follow-up periods need to be conducted to validate the findings in this study and observe the efficacy of this surgery on pregnancy outcomes.

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Footnote

Reporting Checklist: The authors have completed the AME Case Series and STROBE reporting checklists. Available at https://atm.amegroups.com/article/view/10.21037/atm-23-217/rc

Data Sharing Statement: Available at https://atm.amegroups.com/article/view/10.21037/atm-23-217/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-23-217/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. For patients aged older than 18 years, both the patients and their guardians signed the written informed consent form; for patients aged younger than 18 years, their guardians signed the written informed consent form. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). This study was approved by the medical ethics committee of Henan Provincial People's Hospital (No. 2012-2015).

References

1. The American Fertility Society classifications of adnexal adhesions, distal tubal occlusion, tubal occlusion secondary to tubal ligation, tubal pregnancies, müllerian anomalies and intrauterine adhesions. Fertil Steril 1988;49:944-55.
2. Grimbizis GF, Gordts S, Di Spiezio Sardo A, et al. The ESHRE/ESGE consensus on the classification of female genital tract congenital anomalies. Hum Reprod

2013;28:2032-44.
3. Xie Z, Zhang X, Zhang N, et al. Clinical features and surgical procedures of congenital vaginal atresia-A retrospective study of 67 patients. Eur J Obstet Gynecol Reprod Biol 2017;217:167-72.
4. Zhang M, Zhang MX, Li GL, et al. Congenital vaginal atresia: A report of 39 cases in a regional Obstetrics and Gynecology Hospital. J Huazhong Univ Sci Technolog Med Sci 2017;37:928-32.
5. Slaoui A, Benzina I, Talib S, et al. Congenital vaginal atresia: about an uncommon case. Pan Afr Med J 2020;37:69.
6. Xu S, Zhang J, Wang S, et al. MRI features and differential diagnoses of congenital vaginal atresia. Gynecol Endocrinol 2019;35:777-81.
7. Mei L, Zhang H, Chen Y, et al. Clinical features of congenital complete vaginal atresia combined with cervical aplasia: A retrospective study of 19 patients and literature review. Congenit Anom (Kyoto) 2021;61:127-32.
8. Rock JA, Roberts CP, Jones HW Jr. Congenital anomalies of the uterine cervix: lessons from 30 cases managed clinically by a common protocol. Fertil Steril 2010;94:1858-63.
9. Lucchetti MC, Tassi A. First-Line Therapy for Vaginal Atresia. Conservative Treatment vs Surgical Techniques: Quandaries Looking at Numbers. J Pediatr Adolesc Gynecol 2022;35:426-8.
10. Darwish M, Atlantis E, Mohamed-Taysir T. Psychological outcomes after hysterectomy for benign conditions: a systematic review and meta-analysis. Eur J Obstet Gynecol Reprod Biol 2014;174:5-19.
11. Shehmar M, Gupta JK. The influence of psychological factors on recovery from hysterectomy. J R Soc Med 2010;103:56-9.
12. Vomvolaki E, Kalmantis K, Kioses E, et al. The effect of hysterectomy on sexuality and psychological changes. Eur J Contracept Reprod Health Care 2006;11:23-7.
13. Rannestad T. Hysterectomy: effects on quality of life and psychological aspects. Best Pract Res Clin Obstet Gynaecol 2005;19:419-30.
14. Frank R. The formation of an artificial vagina without operation. Am J Obstet Gynecol 1938;35:1053-5.
15. Fedele L, Bianchi S, Frontino G, et al. The laparoscopic Vecchietti's modified technique in Rokitansky syndrome: anatomic, functional, and sexual long-term results. Am J Obstet Gynecol 2008;198:377 e1-6.
16. Fedele L, Frontino G, Restelli E, et al. Creation of a neovagina by Davydov's laparoscopic modified technique in patients with Rokitansky syndrome. Am J Obstet Gynecol 2010;202:33.e1-6.
17. Regmi DR, Dangal G, Karki A, et al. Vaginal Atresia with Cervical Agenesis, a Rare Congenital Malformation. Kathmandu Univ Med J (KUMJ) 2021;19:390-2.
18. Kang J, Chen N, Zhang Y, et al. Laparoscopically Assisted Uterovaginal Canalization and Vaginoplasty for Patients with Congenital Cervical and Vaginal Atresia: A Step-by-step Guide and Long-term Outcomes. J Minim Invasive Gynecol 2021;28:1203-10.
19. Rangaswamy M, Machado NO, Kaur S, et al. Laparoscopic vaginoplasty: using a sliding peritoneal flap for correction of complete vaginal agenesis. Eur J Obstet Gynecol Reprod Biol 2001;98:244-8.
20. Zhao XW, Ma JY, Wang YX, et al. Laparoscopic vaginoplasty using a single peritoneal flap: 10 years of experience in the creation of a neovagina in patients with Mayer-Rokitansky-Küster-Hauser syndrome. Fertil Steril 2015;104:241-7.
21. Zhao X, Zhang Y, Zhang M, et al. Comparison of two laparoscopic vaginoplasties using a single peritoneal flap in patients with Mayer-Rokitansky-Küster-Hauser syndrome. Int Urogynecol J 2022;33:2543-9.
22. Fujimoto VY, Miller JH, Klein NA, et al. Congenital cervical atresia: report of seven cases and review of the literature. Am J Obstet Gynecol 1997;177:1419-25.
23. He H, Guo H, Han J, et al. An atresia cervix removal, lower uterine segment substitute for cervix and uterovaginal anastomosis: a case report and literature review. Arch Gynecol Obstet 2015;291:93-7.
24. Committee on Adolescent Health Care. ACOG Committee Opinion No. 728: Müllerian Agenesis: Diagnosis, Management, And Treatment. Obstet Gynecol 2018;131:e35-42.
25. Fedele L, Bianchi S, Frontino G, et al. Laparoscopically assisted uterovestibular anastomosis in patients with uterine cervix atresia and vaginal aplasia. Fertil Steril 2008;89:212-6.
26. Zhang X, Qiu J, Ding Y, et al. Single port laparoscopy combined with vaginal cervicovaginal reconstruction in a patient with congenital atresia of the cervix. Fertil Steril 2020;113:681-2.
27. Acién P, Acién MI, Quereda F, et al. Cervicovaginal agenesis: spontaneous gestation at term after previous reimplantation of the uterine corpus in a neovagina: Case Report. Hum Reprod 2008;23:548-53.

28. Li M, Zhang Z. Laparoscopically assisted biomaterial graft for reconstruction in congenital atresia of vagina and cervix. Fertil Steril 2013;100:1784-7.
29. Barberini F, Vizza E, Montanino M, et al. Vaginal reconstruction by skin grafts: a scanning electron microscopic evaluation. Ann Anat 1992;174:517-22.

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Supplementary

Table S1 Detailed information about the 9 patients with congenital cervical and complete vaginal atresia

Case	Age (years)	Clinical symptom	Uterus size (cm^3)*	Endometrium (mm)	Surgical type	Surgical duration (min)	Bleeding volume (mL)	Menstruation, sexual life, and pregnancy
1	17	Seasonal abdominal pain for 2 years; amenorrhea	108.5	Absent	Received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty + bladder injury repair + electrocautery for endometriosis	250	50	Normal menstrual cycle, reported satisfaction with sexual life, multiple miscarriages
2	15	Seasonal abdominal pain for 5 months; amenorrhea	90.3	Absent	Received transvaginal amniotic vaginoplasty, and the vaginal mold was removed 1 year later. Presented with amenorrhea with lower abdominal discomfort 6 months later. After 2 years, received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty + rectal injury neoplasty	257	200	Normal menstrual cycle, reported satisfaction with sexual life, not yet pregnant
3	18	Abdominal pain for 3 days; pelvic mass	60.5	Absent	Received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty + right hydrosalpinx excision + right ovarian sac excision + great omentum adhesion separation	230	110	Normal menstrual cycle, reported satisfaction with sexual life, not yet pregnant
4	14	Intermittent abdominal pain for 1 year; amenorrhea	79.1	Absent	Received transvaginal amniotic vaginoplasty. Presented with amenorrhea with lower abdominal discomfort 1 year later. After 1 year, received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty	250	230	Normal menstrual cycle, not yet pregnant
5	28	Intermittent abdominal pain for 8 years; amenorrhea	51.9	Absent	Received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty + right tubal forming + pelvic adhesion separation	270	300	Normal menstrual cycle, reported satisfaction with sexual life, not yet pregnant
6	14	Intermittent abdominal pain for 1 year; amenorrhea	17.9	4	Received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty + electrocautery for endometriosis	182	80	Abnormal menstrual cycle with incessancy bleeding, not yet pregnant
7	11	Seasonal abdominal pain for 3 months; pelvic mass	48.0	5	Received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty + excision of left oviduct mesangial cyst + great omentum adhesion separation	161	100	Normal menstrual cycle, not yet pregnant
8	12	Intermittent abdominal pain concurrent with dysuria for 3 days	17.9	3	Received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty	105	100	Normal menstrual cycle, not yet pregnant
9	21	Seasonal abdominal pain for 5 years; amenorrhea	54.0	6	Received laparoscopic vaginoplasty using the peritoneal flap + cervicoplasty + removal of right ovarian endometriosis cyst + electrocautery for endometriosis	205	50	Normal menstrual cycle, reported satisfaction with sexual life, not yet pregnant

*, uterus size was calculated using the formula as follows: uterus size = the length × width × height × π/6.

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