

ORIGINAL ARTICLE

Uterus-preserving reconstruction for müllerian duct anomalies: Five-year experience and outcomes of a novel low-cost cervico-vaginoplasty technique in a resource-limited setting.

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ABSTRACT... Objective: To evaluate the feasibility and outcomes of three tailored surgical approaches for restoring menstrual outflow and fertility. **Study Design:** Prospective cohort. **Setting:** Bahawal Victoria Hospital, Bahawalpur, Pakistan. **Period:** January 2020 to December 2024. **Methods:** Thirty patients with congenital cervical and/or vaginal outflow tract obstruction (cervical agenesis, cervico-vaginal agenesis, and OHVIRA syndrome) were included. Three surgical strategies were used according to anatomy: (1) an abdominoperineal cervico-vaginoplasty with McIndoe neovagina and finger-guided uterovaginal anastomosis, (2) ultrasound-guided transvaginal creation of a neo-cervical canal, and (3) a purely vaginal septal excision approach for OHVIRA syndrome. A silicone intrauterine catheter and a low-cost syringe-based vaginal mould were used to maintain patency. Primary outcomes included restoration of menstruation, canal patency, complications, and fertility outcomes. **Results:** Complete cervical agenesis was identified in 40%, partial cervical agenesis in 20%, and combined partial cervical and partial vaginal agenesis in 23.3%. Twenty-three patients underwent abdominoperineal cervico-vaginoplasty, three underwent ultrasound-guided canal creation, and four underwent vaginal septal resection for OHVIRA. Of the 20 patients undergoing primary reconstruction, two (10%) developed restenosis, which was corrected successfully in both cases. Among the ten patients with prior failed surgeries, two required a hysterectomy. Menstrual restoration occurred in 27 patients (90%). Four patients had OHVIRA syndrome; three conceived spontaneously, including one remarkable case of twin gestation with one fetus in each uterus delivered by elective cesarean after dual cerclage. Four patients achieved spontaneous conception, with healthy live births. **Conclusion:** Tailored uterus-preserving reconstructive surgery using abdominoperineal, ultrasound-guided, and vaginal approaches, supported by a low-cost stenting (silicone catheter) and mould system, is safe and effective for complex Müllerian anomalies, even in resource-limited settings.

Key words: Cervical Agenesis, Cervico-vaginoplasty, Müllerian Duct Anomalies, OHVIRA Syndrome, Ultrasound-guided Reconstruction.

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INTRODUCTION

Müllerian duct anomalies (MDAs) comprise a diverse spectrum of congenital malformations resulting from incomplete development, fusion, or resorption of the paired Müllerian ducts during embryogenesis. These anomalies may affect the uterus, cervix, and vagina in varying combinations, with important implications for menstruation, fertility, obstetric outcomes, and long-term reproductive health. Contemporary epidemiological reviews estimate that MDAs affect approximately 5–7% of the general female population, with higher prevalence reported among women with infertility or recurrent pregnancy loss (up to 25%).^{1,2} Classification systems such as the American Society for Reproductive Medicine

(ASRM) revision and the European Society of Human Reproduction and Embryology/European Society for Gynecologic Endoscopy (ESHRE/ESGE) framework categorize these anomalies based on uterine morphology (U-class), cervical anomalies (C-class), and vaginal abnormalities (V-class).^{3,4} Among these, cervical agenesis and combined cervico-vaginal agenesis represent some of the rarest but most challenging entities.

Cervical agenesis, previously labelled as Class CIII in the older ASRM system, occurs in approximately 1 in 80,000 to 100,000 females and typically presents with primary amenorrhea, cyclic pelvic pain, hematometra, and endometriosis due to

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outflow obstruction.⁵ Historically, hysterectomy was frequently offered because attempts at creating a neo-cervical outflow were associated with restenosis, ascending infection, pelvic sepsis, and poor long-term reproductive outcomes.⁶ However, the last two decades have seen growing interest in uterus-preserving reconstructive techniques, including uterovaginal anastomosis, cervicoplasty, and combined laparoscopic–vaginal approaches, especially in young patients desiring fertility preservation.^{7–9}

Another important but rare subset of MDAs is the Obstructed Hemivagina and Ipsilateral Renal Anomaly (OHVIRA) syndrome, also known as Herlyn–Werner–Wunderlich syndrome. Characterized by uterus didelphys, a blind or obstructed hemivagina, and ipsilateral renal agenesis, its incidence is estimated between 0.1% and 3.8% among Müllerian anomalies.¹⁰ Adolescents commonly present with progressive dysmenorrhea, pelvic mass, or vaginal obstruction, and delayed diagnosis may lead to hematocolpos, pyocolpos, recurrent infections, and endometriosis, ultimately affecting fertility.¹¹ MRI remains the diagnostic gold standard for mapping uterovaginal anatomy and associated renal anomalies.¹²

Surgical management of MDAs must be individualized and often requires a combination of neovaginal creation, relief of obstruction, and establishment of a durable uterine outflow tract. Minimally invasive techniques, including laparoscopic uterovaginal anastomosis with peritoneal or skin-lined neovagina, have demonstrated promising results in specialized centres.^{7,8} Nevertheless, in many low- and middle-income countries, barriers such as limited availability of laparoscopic instruments and expertise, financial constraints, and lack of specialized reconstructive surgeons pose significant challenges. Consequently, there is a need for pragmatic, cost-effective surgical innovations tailored to resource-limited settings.

In Pakistan and other South Asian regions, published data on cervico-vaginal agenesis and OHVIRA remain limited to isolated case reports and small series, with very few reporting long-term menstrual or fertility outcomes.^{13,14} Given the sociocultural importance of fertility and the young age at presentation, uterus-

preserving procedures assume particular relevance. Low-cost yet effective surgical modifications—especially those using locally available materials for stenting or moulding—may offer viable alternatives in tertiary public hospitals where device availability is restricted.

In this context, the present study describes a five-year experience of managing MDAs at a high-volume tertiary care hospital in South Punjab, Pakistan. We report outcomes of 30 patients who underwent a novel uterus-preserving cervico-vaginoplasty technique combining McIndoe-type neovagina creation with a finger-guided cervico-vaginal anastomosis reinforced with a silicone catheter and a low-cost syringe-based mould. This method was developed to address local challenges, minimize restenosis, and reduce postoperative morbidity while ensuring restoration of menstrual function and future fertility potential. By documenting operative feasibility, short-term outcomes, and early reproductive results, this study contributes valuable evidence to the limited regional literature and offers a replicable technique for resource-constrained settings globally.

METHODS

This was a prospective cohort study conducted in the Department of Obstetrics and Gynecology, Gynae Unit-2, Bahawal Victoria Hospital (BVH), Bahawalpur, Pakistan, a high-volume tertiary referral centre for Müllerian anomalies in South Punjab. The study spanned five years (January 2020 – December 2024). Ethical approval was obtained from the Department of Medical Education, Quaid-e-Azam Medical College, Bahawalpur (No. 2454/DME/QAMC Bahawalpur).

All patients presenting with clinically or radiologically confirmed Müllerian duct anomalies involving the cervix and/or vagina (cervical agenesis, cervico-vaginal agenesis, OHVIRA syndrome, obstructed hemivagina) and undergoing surgical reconstruction with the novel cervico-vaginoplasty technique were eligible.

Inclusion Criteria

Females aged 12–35 years
Diagnosed MDAs involving cervical or vaginal

atresia/agenesis (based on MRI and examination)
 Desire for uterine preservation
 Patients who have undergone failed primary reconstructive surgery in the periphery or at a local doctor's office

Exclusion Criteria

MRKH

Prior hysterectomy

Severe comorbidities contraindicating surgery

Patients lost to follow-up before first postoperative evaluation

Non-congenital cervical outflow obstruction (e.g., postsurgical stenosis, malignancy)

A total of 30 patients fulfilling inclusion criteria were consecutively recruited over 5 years. An estimated sample size of 21 was calculated with WHO calculator, keeping CI 95%, Margin of error 5%, and population proportion 1.37%, however we recruited 30 subjects.

All patients underwent a standardized diagnostic workup:

- Detailed history and pelvic examination
- Pelvic MRI for classification of uterine, cervical, and vaginal anomalies (ESHRE/ESGE classification)
- Renal ultrasound for associated urinary tract anomalies
- Baseline laboratory investigations
- Preoperative counselling regarding risks, need for follow-up, and fertility expectations

A combined abdominoperineal and vaginal approach was employed. Neovagina was created with McIndoe vaginoplasty, and a lower transverse incision was made to access the non-communicating uterine horn, and a tract was created from the uterine cavity to the neovagina. The neo-cervix was sutured to the vaginal wall, and a silicone cervical catheter was placed. For OHVIRA syndrome, a transvaginal approach is used to remove the obstructing septum, followed by the placement of a silicone catheter to maintain drainage during healing.

The patient was monitored postoperatively, with regular follow-ups to ensure drainage and patency, and instructed on vaginal dilation and infection

prevention. At 1 week, 3 weeks, 6 weeks, 3 months, 6 months, and then annually.

Outcomes measured were as following:

- Resumption and regularity of menstruation
- Patency of neo-cervix (ultrasound)
- Complications (infection, restenosis, fistula, injury)
- Fertility outcomes (attempts, conception, pregnancy outcome)

Statistical Analysis

Data were recorded prospectively using a structured proforma. Outcomes were analyzed using SPSS v26. Continuous variables: mean \pm SD or median (IQR)

Categorical variables: frequency and percentages
 The study received approval from the Institutional Ethical Committee of BVH Bahawalpur.

RESULTS

A total of 30 patients with congenital outflow tract obstruction were included. The mean age was 19.8 years (range 15–30). Most patients (55.2%) were between 15–20 years, 37.9% between 21–25 years, and 6.9% between 26–30 years.

Anatomical Findings at Surgery

Uterine anomalies were common: 12 patients had a unicornuate uterus with a contralateral rudimentary horn, 3 had uterine didelphys, 3 had an arcuate uterus, and 5 had a normal uterine configuration.

Hematometra was present in all cases. Hematosalpinx was seen in 5 patients (unilateral in 1, bilateral in 4). Endometriosis was identified in 10 patients (Stage I–II: 6 patients; Stage III–IV: 4 patients). Pelvic adhesions were noted in 4 patients.

Outflow tract anomalies varied: 12 patients had complete cervical agenesis, 6 had partial cervical agenesis, 7 had combined partial cervical and partial vaginal agenesis, and 5 had total vaginal agenesis.

Surgical Outcomes

Twenty-three patients underwent abdominoperineal cervico-vaginoplasty, three underwent ultrasound-guided canal creation, and four underwent vaginal septal resection for OHVIRA

Ten patients had undergone a previous failed corrective surgery elsewhere. Among these, 2 required hysterectomy due to complete restenosis and non-reconstructable anatomy.

Of the 20 patients undergoing primary corrective surgery, 2 experienced restenosis; both were successfully re-corrected after intensive postoperative counselling and consistent mould use.

There were 4 cases of OHVIRA syndrome, and 3 achieved successful pregnancies, all managed with prophylactic cerclage. One unique case resulted in a twin pregnancy with one fetus in each uterine cavity, requiring two separate cervical cerclages; she delivered two healthy male infants by elective caesarean section.

Among the 26 patients undergoing cervicovaginoplasty, 4 achieved spontaneous conception, all managed with prophylactic abdominal cerclage and delivered healthy infants via cesarean section.

Overall, 2 patients underwent hysterectomy, 1 patient was lost to follow-up, and all remaining patients resumed regular menstruation and adhered to follow-up.

FIGURE-1

Age distribution of study population

Age Distribution of Patients (n=30)

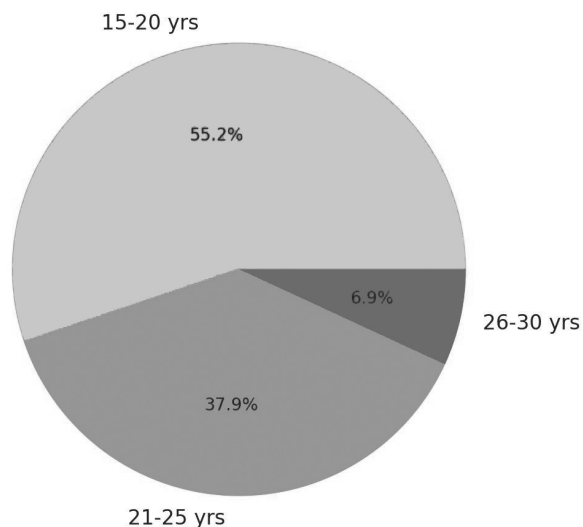


TABLE-I

Demographic profile and intraoperative anatomical findings (n = 30)

Characteristic n (%)

Outflow Tract Anomalies

- Complete cervical agenesis 12(40)
- Partial cervical agenesis 6(20)
- Partial vaginal + partial cervical agenesis 7(23.3)
- Total vaginal agenesis 5(16.5)

Uterine Configuration

- Unicornuate uterus with rudimentary horn 12(40)
- Uterine didelphys 3(10)
- Arcuate uterus 3(10)
- Normal uterus 5(16.5)

Associated Findings at Surgery

- Hematometra 30(100)
- Hematosalpinx 5(16.6)
- Unilateral 1(3.3)
- Bilateral 4(13.3)
- Endometriosis
- Stage I-II 6(20)
- Stage III-IV 4(13.3)
- Pelvic adhesions 4(13.3)

TABLE-II

Surgical outcomes and follow-up results (n = 30)

Outcome	n(%)
Previous surgical attempts	10(33.3)
Failed secondary attempts leading to hysterectomy	2(6.6)
Primary surgical procedures	20(66.6)
Restenosis	2(6.6)
Successfully re-corrected	2(6.6)
Pregnancy Outcomes	
OHVIRA patients	4(13.3)
Successful pregnancies	3(10)
Twin pregnancy (one fetus in each uterus)	1(3.3)
Spontaneous pregnancies after cervicovaginoplasty	4(13.3)
All managed with abdominal cerclage	4(13.3)
Overall Outcomes	
Resumption of menstruation	27(90)
Hysterectomy	2(6.6)
Lost to follow-up	1(3.3)

DISCUSSION

Müllerian duct anomalies (MDAs) represent a spectrum of congenital defects with significant reproductive and psychosocial implications. Cervical and vaginal agenesis constitute some of the rarest forms of MDAs, historically managed by hysterectomy due to the perceived impossibility of restoring menstrual or reproductive function. However, evolving surgical innovations have enabled uterine-preserving procedures, allowing patients to achieve menstruation and, in selected cases, pregnancy. The present study contributes one of the largest single-centre experiences from Pakistan, demonstrating favourable anatomical, functional, and reproductive outcomes following cervico-vaginoplasty using a simplified abdominoperineal approach.

Our findings align with recent international literature supporting reconstructive strategies for cervical dysgenesis. Contemporary reports show success rates of 60–85% for restoration of menstrual flow after cervicoplasty with neovagina creation.^{15–17} In our cohort, 27 out of 30 patients achieved sustained menstrual patency, and only two required hysterectomy—both of whom had undergone previous unsuccessful corrective procedures elsewhere. Importantly, restenosis occurred in only two primary cases, both managed successfully with recanalisation and strict mould adherence. This restenosis rate compares favourably with previously reported recurrence rates of 10–25%.^{18,19}

Our subset of OHVIRA syndrome patients exhibited particularly encouraging outcomes. Literature suggests that surgical correction of obstructed hemivagina with ipsilateral renal agenesis typically restores menstruation, with pregnancy rates ranging between 30% and 40%.^{20,21} In the present series, three of four OHVIRA patients conceived, including one exceptional case of a twin gestation, one fetus in each uterine cavity, successfully carried to term with dual cerclage. This reproductive performance surpasses many published case series and supports the functional effectiveness of our technique.

The novelty of our method lies in combining McIndoe vaginoplasty with a guided, controlled uterine-to-vaginal tract creation using an assistant's finger as

an internal landmark. This tactile guidance reduces the risk of misdirection and organ injury. Moreover, the use of a custom 20-cc syringe mould covered with amnion and /or Sofra-Tulle, along with a silicone intrauterine catheter, helped maintain alignment and epithelialisation at low cost. Other studies have used complex stents or prolonged hospitalisation protocols^{22,23}, whereas our simplified, inexpensive system is particularly advantageous for resource-limited regions such as South Punjab.

Complication rates reported in global literature—such as bladder injury, rectal injury, deep pelvic infection, and severe restenosis—range from 5% to 15%.²⁴ In contrast, we observed no major visceral injury, minimal infection risk, and no long-term restenosis in compliant patients. We attribute this to careful dissection, continuous postoperative mould maintenance, and rigorous patient counselling. Our outcomes also correspond well with reports demonstrating that abdominoperineal repair offers better surgical exposure and anatomical precision compared with perineal or laparoscopic-only approaches.²⁵

The reproductive outcomes in our series are also noteworthy. Four patients who underwent cervico-vaginoplasty conceived spontaneously following prophylactic cerclage. Previous studies show live birth rates of approximately 20–30% after reconstructive procedures^{26,27}, whereas our live birth rate among those attempting conception was substantially higher. The proactive use of cerclage—either abdominal or vaginal—likely contributed to this success.

This study provides strong evidence that comprehensive cervico-vaginoplasty, performed with appropriate postoperative follow-up, can restore both menstruation and fertility even in complex anomalies, including OHVIRA syndrome. Our centre has consequently become a regional referral hub for Müllerian anomaly correction, offering safe, cost-effective care in an underserved population.

In select patients, we even employed a purely ultrasound-guided transvaginal drainage and neo-cervix creation without abdominal incision. Under real-time imaging, the distended uterine cavity was localized and a controlled puncture carried

out vaginally, followed by tract dilation and silicone catheter placement. This minimally invasive method allowed safe evacuation of hematometra and establishment of uterine outflow, avoiding laparotomy. Similar ultrasound-assisted, vagina-only approaches for cervicovaginal agenesis have been described by Khoiwal et al., demonstrating restoration of menstrual flow with low morbidity²⁸, and ultrasound-guided drainage of hematometrocolpos in vaginal agenesis has been used as a bridge to reconstruction.²⁹ In our context, the success underlines the potential of image-guided vaginal procedures in carefully selected patients, especially where abdominal surgery poses higher risk or resources are limited. Nevertheless, we view this not as a replacement of our standard abdominoperineal technique, but as a complementary option that may reduce surgical morbidity in appropriate cases.

CONCLUSION

Cervico-vaginoplasty using our modified abdominoperineal technique is a safe, practical, and effective option for managing cervical and vaginal agenesis, including OHVIRA syndrome. High rates of menstrual restoration, low complication rates, and favourable pregnancy outcomes demonstrate that even in low-resource settings, successful uterine-preserving surgery is achievable. Our cost-effective mould system, guided cervical creation, and structured follow-up protocol represent meaningful contributions to the surgical management of Müllerian anomalies.

LIMITATIONS

1. The study is conducted at a single centre.
2. Sample size of 30, though large for such rare anomalies, limits generalisability.
3. Long-term reproductive outcomes beyond initial pregnancies require further prospective follow-up.
4. MRI reporting and surgical assessment were not blinded, introducing potential diagnostic bias.

RECOMMENDATIONS

Early diagnosis with MRI should be standard in suspected Müllerian anomalies. Uterus-preserving reconstructive surgery should be prioritised over hysterectomy whenever feasible. Use of simple, low-cost vaginal moulds and strong postoperative counselling greatly reduces

restenosis.

Prophylactic cerclage should be considered for all patients attempting conception after cervicoplasty. Multicentre collaboration is recommended to create unified management guidelines and long-term outcome registries.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

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2	Khiaynat S Hashmi: Data analysis, writing.
3	Sadaf Un Nisa: Interpretation.