European Journal of Obstetrics and Gynecology 320 (2026) 115014

Contents lists available at ScienceDirect

European Journal of Obstetrics & Gynecology and Reproductive Biology

journal homepage: www.journals.elsevier.com/european-journal-of-obstetrics-and-gynecology-and-reproductive-biology

Review article

Reproductive outcomes after surgical correction of congenital obstructive genital tract anomalies: A systematic review and quantitative pooled analysis of published data

Natalie Drever [a,b,*], Chloe Gane [a], Madison Bailey [a]

[a] College of Medicine and Dentistry, James Cook University, Cairns, Australia
[b] Department of Obstetrics and Gynaecology, Cairns Hospital, Australia

ARTICLE INFO

Keywords:
Müllerian anomalies
Imperforate hymen
OHVIRA
Cervical agenesis
Fertility
Pregnancy
Outcomes
Review

ABSTRACT

Background: Congenital obstructive genital tract anomalies are rare but clinically significant causes of menstrual outflow obstruction, endometriosis, and subfertility. Surgical correction aims to restore reproductive potential, yet evidence to guide counselling on fertility and pregnancy outcomes remains fragmented.
Objective: To synthesise and pool published data on fertility, obstetric, and neonatal outcomes following surgical correction of congenital obstructive anomalies, comparing outcomes across anomaly types to inform individualised counselling.
Study design: A systematic review was conducted. PubMed, Emcare, CINAHL, and Scopus were searched from inception to May 2025. Studies reporting reproductive outcomes after surgical correction of imperforate hymen, transverse vaginal septum, OHVIRA-spectrum, functional non-communicating uterine horns, or cervicovaginal atresia were included. Data were extracted independently and pooled by anomaly type. Study quality was assessed using Joanna Briggs Institute tools.
Results: Ninety-six studies (41 case reports, 41 case series, and 14 retrospective cohorts) were contributed 634 fertility-related events. Infertility rates were low following imperforate hymen (8.0%) and OHVIRA-spectrum anomalies (18.2%), intermediate in functional rudimentary horns (21.2%), and high following transverse vaginal septum (52.6%) and cervicovaginal atresia (55.4%). Among achieved pregnancies, livebirth rates exceeded 80%. Preterm birth occurred in 23.7% of pregnancies and did not differ significantly by anomaly type. Caesarean delivery was frequent (55.9%), particularly after cervicovaginal reconstruction (97.6%). Birthweight was lower following cervicovaginal atresia repair, with higher rates of small-for-gestational-age infants. Gestational hypertensive disorders were associated with co-existing renal agenesis.
Conclusion: Reproductive outcomes after surgical correction are generally favourable but vary substantially by anomaly type. These findings support individualised counselling and targeted antenatal surveillance.

Introduction

Obstructive reproductive tract anomalies are congenital malformations that block menstrual outflow, leading to hematometra or hematocolpos and often retrograde menstruation with endometriosis [1,2]. They typically present at puberty with primary amenorrhea, cyclical pain, or dysmenorrhea depending on the level of obstruction [3]. Surgical correction aims to restore patency and preserve fertility, with postoperative complications such as restenosis or adhesions being uncommon but occasionally requiring revision, particularly after cervical or upper-vaginal reconstruction [4].

The spectrum of obstruction ranges from distal anomalies such as imperforate hymen and transverse vaginal septum, where the uterus and cervix are normal, to complex forms involving uterine duplication or fusion defects, including Obstructed Hemivagina with Ipsilateral Renal Agenesis (OHVIRA) and non-communicating functional uterine horns[3]. Other variants, such as cervicovaginal atresia, require complex reconstructive surgery with risks of stenosis, cervical insufficiency, and potential obstetric complications related to breaching the myometrium during repair [5,6]. Although their embryologic origins differ—some arising from the urogenital sinus and others from Müllerian duct anomalies— they converge clinically as causes of menstrual outflow

* Corresponding author at: James Cook University, Level 2, A Block, Cairns Hospital, 165 The Esplanade, Cairns, Queensland 4878, Australia.
E-mail address: Natalie.Drever@jcu.edu.au (N. Drever).

https://doi.org/10.1016/j.ejogrb.2026.115014
Received 17 December 2025; Received in revised form 1 February 2026; Accepted 15 February 2026
Available online 16 February 2026

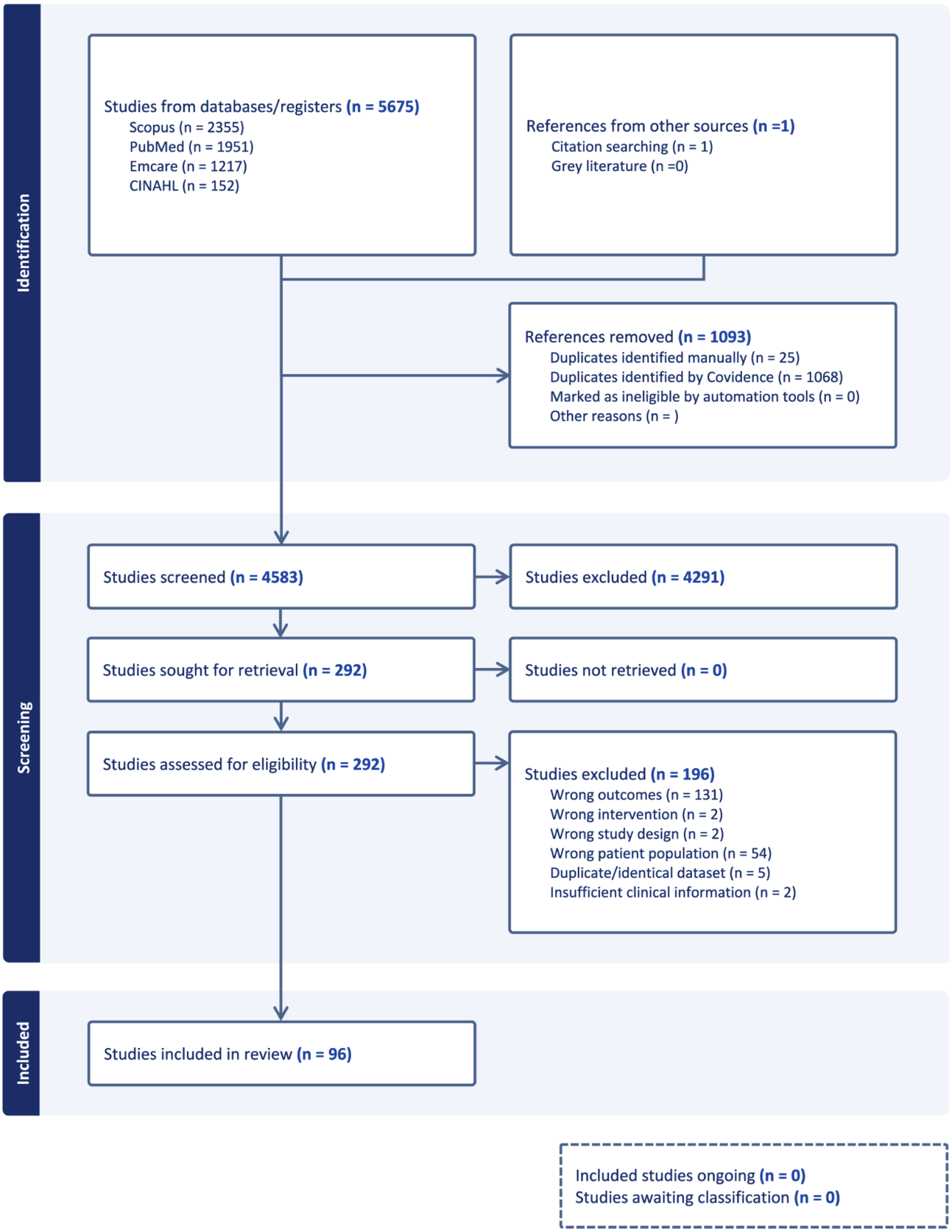

Fig. 1. PRISMA flow diagram of study selection.

obstruction, sharing the surgical goal of restoring drainage and preserving fertility [7].

Because these anomalies are rare and heterogeneous, most evidence comes from small case series with variable outcome reporting, limiting evidence-based counselling on fertility and pregnancy outcomes [4]. Examining them collectively offers a framework to understand how the level and nature of obstruction influence reproductive prognosis. Our goal was not to merge distinct entities, but to enable comparison between them, highlighting the unique reproductive implications of each anomaly. Accordingly, outcomes are presented stratified by anomaly subtype rather than as a single unified prognosis. This approach provides clinicians a single, accessible reference for counselling and follow-up, while outlining where prognoses diverge by anomaly type.

Existing reviews have largely focused on diagnostic and operative aspects, with limited reporting of reproductive outcomes. Fertility data are typically presented narratively or limited to overall pregnancy or livebirth rates, providing little insight into conception method, obstetric complications, or neonatal outcomes [8]. The scope of reproductive outcome reporting has varied: reviews of imperforate hymen and transverse vaginal septum [9,10] omitted reproductive outcomes entirely, one OHVIRA review [11] described these outcomes narratively, and another pooled limited data across 67 pregnancies [12]. Other work has examined non-obstructive but related variants, such as complete uterine septum with double cervix and vaginal septum [13], which fall outside the scope of this review.

The most comprehensive synthesis of congenital cervical malformations to date, by Mikos et al. [8], pooled data from 27 viable pregnancies, reporting aggregated pregnancy and livebirth rates but no further obstetric detail. While their *meta*-analysis offered valuable evidence of fertility potential, outcomes such as use of assisted conception, miscarriage, preterm birth, mode of delivery, and neonatal parameters remain undefined.

The present review builds on this foundation by systematically collating and quantitatively analysing reproductive outcomes across obstructive genital tract anomalies. By integrating detailed fertility and obstetric data, it aims to clarify reproductive prognosis after surgical correction and to inform both patient counselling and long-term management strategies.

Materials and methods

Protocol and registration

This systematic review was conducted in accordance with the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) 2020 guidelines. The review protocol was prospectively registered with PROSPERO (registration number: CRD420251179088 and is available online (https://www.crd.york.ac.uk/PROSPERO/view/CRD420251179088).

Eligibility criteria

Eligible studies included women of any age with a surgically corrected obstructive reproductive tract anomaly, defined as any congenital malformation causing partial or complete menstrual outflow obstruction. Anomalies considered included imperforate hymen, transverse vaginal septum, OHVIRA spectrum, distal vaginal or cervicovaginal atresia, obstructed uterine septum, and functional non-communicating uterine horn.

Studies were required to report at least one reproductive outcome following definitive surgical correction, including conception or infertility, miscarriage, ectopic pregnancy, preterm birth, livebirth, stillbirth, mode of birth, malpresentation, postpartum haemorrhage, or pregnancy-related hypertensive disorder. Detailed inclusion and exclusion criteria are outline in Appendix 1.

Exclusion criteria were:

- Studies limited to non-obstructive anomalies (e.g. septate or bicornuate uterus without obstruction)
- Reports describing pregnancies occurring *prior to* surgical correction
- Studies reporting only surgical or anatomical outcomes without reproductive data

No date or language restrictions were applied. Artificial intelligence translation (ChatGPT 5.1) was used to translate articles published in languages other than English.

Information sources and search strategy

A comprehensive search was performed in PubMed, Emcare, CINAHL, and Scopus from inception to May 2025. Each database was searched independently by two reviewers (CG and MB) using terms related to obstructive reproductive tract anomalies, surgical correction, and reproductive outcomes. Full search strategies are provided in Appendix 2.

Reference lists of included articles were screened manually using a backward citation snowballing approach to identify additional eligible studies. All identified records were imported into Covidence, and duplicates were removed before screening.

Study selection

Titles and abstracts were independently screened by two reviewers (CG and MB) using Covidence. Full-text articles were retrieved for all potentially eligible studies and assessed against predefined inclusion and exclusion criteria. Disagreements were resolved by consensus and discussion with a senior reviewer (ND). The study selection process is summarised in the PRISMA flow diagram (Fig. 1).

Data extraction

Two reviewers (ND and CG) independently extracted data using a standardised form developed a priori. Extracted variables included: study characteristics (author, year, country, design, sample size), type of obstructive anomaly, associated anomalies, surgical approach, maternal age, use of assisted reproductive technology (ART), fertility outcomes (number attempting conception, number conceived, number infertile), and pregnancy outcomes (livebirth, miscarriage, preterm birth, birthweight, malpresentation, mode of delivery, hypertensive disorders). Reported terminations of pregnancy were excluded. For papers that combine pre- and post-repair outcomes[14], only post-repair conceptions were included.

Where multiple papers appeared to describe overlapping cohorts, only the most complete or recent dataset was retained. Earlier or partial reports were excluded as duplicate datasets[15-19]. Authors were contacted when clarification or additional data were required.

Risk-of-bias assessment

Risk of bias and reporting quality were assessed by a single reviewer (ND) using the Joanna Briggs Institute (JBI) critical appraisal tools for case reports, case series, and cohort studies, according to study design[20]. The tools were applied to evaluate the appropriateness and completeness of reporting within each study rather than experimental rigor.

Data synthesis and analysis

Individual study results were tabulated by anomaly type and synthesised descriptively using summary tables. Fertility outcomes were analysed per woman attempting conception, and pregnancy outcomes per pregnancy. Infertility was defined as failure to conceive within ≥ 12

Table 1
Characteristics of included studies.

Characteristic	Values	n (%) of studies
Publication period	≤1980	3 (3.1%)
	1981–1990	6 (6.3%)
	1991–2000	12 (12.5%)
	2001–2010	18 (18.8%)
	2011–2020	34 (35.4%)
	2021–2025	23 (24.0%)
Continent/region of origin	Africa	1 (1.0%)
	Asia	34 (35.4%)
	Europe	32 (33.3%)
	Middle East	16 (16.7%)
	North America	10 (10.4%)
	Oceania	1 (1.0%)
	South America	2 (2.1%)
Study design	Case report	41 (42.7%)
	Case series	41 (42.7%)
	Retrospective cohort	14 (14.6%)
Sample size	Median 5 (range 1–170)	
Mean follow-up duration (years)	5.7 ± 5.9 (range 0.25–36 years)	
Risk-of-bias summary	**Study type**	**Median JBI score (IQR)**[a]
	Case reports	8 (8–8)
	Case series	9 (9–9)
	Retrospective cohorts	9 (8–9)

JBI, Joanna Briggs Institute; IQR, interquartile range.
[a] Methodological quality was assessed using the Joanna Briggs Institute (JBI) critical appraisal tools appropriate to study design; higher scores indicate lower methodological quality. JBI checklists comprised 8 items for case reports, 10 items for case series, and 11 items for retrospective cohort studies.

months after surgical correction, excluding those who did not attempt or desire conception, or who had pre-existing subfertility but conceived within 12 months post-repair.

Descriptive pooled proportions were calculated for each outcome using aggregated counts from the included studies.

Statistical analyses were performed using IBM SPSS Statistics version 29. Continuous variables were assessed for normality using visual inspection of histograms and the Shapiro–Wilk test. Normally distributed data are presented as mean ± standard deviation, whereas non-normally distributed data are reported as median with interquartile range (IQR). Categorical outcomes were compared using the Chi-square test, and continuous non-normally distributed variables (e.g. birth weight) were compared using the Mann–Whitney *U* test. Logistic regression was used to explore predictors of hypertensive disorders of pregnancy, adjusting for maternal age, ART use, and anomaly subtype. Missing data were treated as "not reported" rather than assumed absence.

To assess the robustness of pooled pregnancy outcomes, a sensitivity analysis was planned excluding studies that included fewer than four participants. Single case reports and very small case series (≤3 women) were excluded from quantitative analyses of fertility outcomes, including denominators for women attempting conception and those infertile after surgical correction. These reports were retained only for the descriptive synthesis of pregnancy outcomes, as they are strongly subject to publication bias toward successful conceptions and rarely include information on attempts to conceive or duration of follow-up.

Ethical considerations

Ethics approval was not required as all data were obtained from previously published studies without individual patient identifiers.

Results

Study selection and characteristics

A total of 292 full-text articles were assessed for eligibility, of which 96 met inclusion criteria for quantitative synthesis (Fig. 1) [6,13–109]. Backward citation searching was undertaken for all included full-text articles. Manual screening of these titles identified one additional case report that met inclusion criteria and was retrieved via library request [110]. No further eligible studies were found.

Included studies comprised 41 single-case reports, 41 case series, and 14 retrospective cohort studies published between 1953–2025. The dataset encompassed a broad geographic distribution, with most studies from Asia, Europe, and the Middle East, and smaller cohorts reported from other regions. Most were single-centre case series or case reports, reflecting the rarity of obstructive Müllerian anomalies and the lack of

Table 2
Fertility outcomes after surgical correction of obstructive genital tract anomalies.

Anatomical variant/ obstruction	No. of studies (fertility outcomes)[a]	Total women (n)	Women attempting conception (n)[b]	Infertile n (%)	Any ART use among fertility events n (%)[c]	Endometriosis n (%)[d]	Notes/fertility context
Imperforate hymen	3	89	26	2 (8.0%)	0 (0.0%)	0 (0.0%)	Normal reproductive anatomy once corrected; fertility essentially normal.
Transverse vaginal septum	2	49	19	10 (52.6%)	2 (3.8%)	11 (37.9%)	Lower fertility; high or thick septa prone to restenosis or malalignment. Limited data available only.
OHVIRA spectrum[e]	13	475	176	32 (18.2%)	8 (4.0%)	34 (17.6%)	Fertility generally restored after septal excision.
Rudimentary horn (functional)[f]	5	271	66	14 (21.2%)	14 (11.8%)	10 (58.8%)	Fertility arises from the contralateral functioning uterus once the obstructed horn is removed; good postoperative reproductive potential.
Cervicovaginal atresia[g]	12	240	56	31 (55.4%)	15 (23.4%)	17 (51.5%)	Fertility remained low even after reconstruction or ART; true infertility may be underestimated as women who underwent hysterectomy were not counted among those attempting conception.

[a] Study counts apply to fertility outcomes; ART and endometriosis were summarised using available event-level data.
[b] Totals reflect pooled counts across all studies contributing fertility data within each anomaly type.
[c] ART = Assisted Reproductive Technology (IVF, ICSI, or similar). ART use was analysed at the fertility-event level (pregnancy or infertility events), rather than per individual woman. Percentages represent the proportion of fertility events involving ART. ART data were available for 504 of 634 fertility events (79.5%).
[d] Endometriosis data were available for 359 of 634 events (56.6%).
[e] "OHVIRA spectrum" (Obstructed Hemivagina and Ipsilateral Renal Agenesis) includes uterus didelphys or bicorporeal variants with an obstructed hemivagina and ipsilateral renal anomaly.
[f] "Rudimentary horn (functional)" refers to a unicornuate uterus with a functioning, non-communicating horn.
[g] "Cervicovaginal atresia" includes any atresia involving the cervix and/or vagina. Some studies included a majority of participants with cervical atresia but included women with vaginal atresia and normal cervix, these data could not be extracted separately.

Table 3
Pregnancy and reproductive outcomes after surgical correction of obstructive reproductive tract anomalies.

Anatomical variant/obstruction	No. studies (n)	Livebirths n (%)[a]	Miscarriages n (%)[b]	Preterm birth n (%)[c]	Median gestation (weeks)	Caesarean n (%)[d]	Hypertensive disorder n (%)[e]	Renal anomaly n (%)[f]	Reported median (IQR) birthweight (g)[h]
Imperforate hymen	5	101 (97.1%)	3 (2.9%)	12 (11.9%)	38	21 (23.1%)	3 (4.3%)	0 (0.0%)	2867 (2867–2867)
Transverse vaginal septum	11	31 (72.1%)	11 (25.6%)	8 (25.8%)	32	10 (41.7%)	1 (3.8%)	13 (30.2%)	3382 (2779–3765)
OHVIRA spectrum	30	217 (69.8%)	54 (19.4%)	57 (26.9%)	37	137 (63.7%)	10 (6.4%)	307 (98.7%)	3010 (2645–3050)
Functional rudimentary horn	16	91 (83.5%)	17 (15.6%)	26 (28.3%)	37	48 (52.7%)	19 (21.8%)	35 (34.7%)	3145 (–)
Obstructed uterine hemicavity	4	4 (80.0%)	0 (0.0%)	1 (25.0%)	36	4 (100.0%)	0 (0.0%)	0 (0.0%)	3175 (–)
Vaginal atresia	7	5 (83.3%)	0 (0.0%)	2 (40.0%)	36	3 (60.0%)	0 (0.0%)	1 (20.0%)	3062 (–)
Cervicovaginal atresia	27	42 (75.0%)	10 (17.9%)	8 (21.6%)	37	41 (97.6%)	1 (3.2%)	2 (3.8%)	2400 (2350–3000)
Overall	100[i]	491/596 (82.4%)	95/602 (15.8%)	114/482 (23.7%)	37	264/472 (55.9%)	34/379 (9.0%)	358/622 (57.6%)	2867 (2710–3145)

IQR, interquartile range; OHVIRA, obstructed hemivagina and ipsilateral renal agenesis.
*Cerclage data available for 411 of 528 applicable pregnancies. Women with cervicovaginal atresia significantly more likely to undergo cervical cerclage than other obstructive anomalies.
[g]Endometriosis data were available for 359 of 634 pregnancies (56.6%).
[a] Livebirth outcomes reported for 596 of 634 pregnancies (94%); missing data comprised 32 pregnancies from Tong et al. 2013 and seven ongoing pregnancies.
[b] Miscarriage outcomes reported for 602 of 634 pregnancies (95%); missing data comprised 32 pregnancies from Tong et al. 2013.
[c] Preterm-birth outcomes were applicable to 528 pregnancies (excluding miscarriages, ectopics, and ongoing pregnancies, but including livebirths and stillbirths). Gestational-age data were reported for 482/528 pregnancies (91.2%), with missing data limited to Tong et al. (2013; n = 32) and three smaller studies (n = 6, 2, and 6). Percentages for preterm birth were therefore calculated from the 482 pregnancies with reported gestational age.
[d] Mode of birth outcomes were applicable to 528 pregnancies (excluding miscarriages, ectopics, and ongoing pregnancies, but including livebirths and stillbirths). Gestational-age data were reported for 472/528 pregnancies (89.4%), with missing data limited to Tong et al. (2013; n = 32) and five smaller studies (n = 17, 1, 1, 3 and 2). Percentages for preterm birth were therefore calculated from the 472 pregnancies with reported gestational age.
[e] Hypertensive disorders of pregnancy (including gestational hypertension and pre-eclampsia) were reported in only a subset of studies and were not a primary outcome in most. As such, data completeness was limited (reported for 379 of 528 pregnancies to which this outcome was applicable, 71.8%). Missing data were treated as 'not reported' rather than assumed absence of disease.
[f] Renal anomaly data were available for 622 of 634 pregnancies (98%); 12 cases were not specified in the source publications.
[h] Birthweight was non-normally distributed for several anomaly types; therefore, median (IQR) values are presented for all groups. Birthweight data were inconsistently reported (available for ≈ 220/635 pregnancies). When reported, data were often aggregated per study and rounded. In some anomaly groups, the 75th percentile could not be calculated owing to ≤2 cases, resulting in apparent IQR = median values. in these instances, medians are presented without an IQR (shown as '–'). Values therefore represent reported medians or single study means where available and should be interpreted with caution.
[i] Because some studies reported multiple anomaly types, totals exceed 96.

prospective cohort data. Risk-of-bias assessment using the JBI critical appraisal tools indicated generally good quality of reporting across included studies, particularly for descriptive clarity and case detail. However, as most evidence comprised case reports and small series, the findings remain vulnerable to publication bias toward positive or successful outcomes. A summary of study characteristics is provided in Table 1, and detailed characteristics of individual studies are provided in Supplementary Table 1.

Fertility outcomes

Fertility outcomes varied substantially according to anomaly type (Table 2). Across studies reporting fertility outcomes [3,6,14,29,31–33,43,45,48,50,51,53,55,58,59,62,63,66,68,70,73,74,76–78,81,83,85–89,93,95,97,99,103–106,109,111], the proportion of women attempting conception ranged from 26 in imperforate hymen to 176 in OHRIVA-spectrum anomalies. Infertility was uncommon after correction of imperforate hymen (2/26, 8.0%) and remained relatively low for OHVIRA-spectrum anomalies (32/176, 18.2%) and functional rudimentary horns (14/66, 21.2%). In contrast, infertility was common among women with transverse vaginal septum (10/19, 52.6%) and cervicovaginal atresia (31/56, 55.4%), despite surgical reconstruction.

Use of assisted reproductive technology (ART) was uncommon in anomalies with preserved uterine anatomy but increased with anomaly complexity ART use was summarised at the fertility-event level (pregnancy or infertility events), rather than per individual woman. Percentages therefore represent the proportion of fertility events involving ART, not the proportion of women attempting conception. ART use was rare following imperforate hymen repair and transverse vaginal septum but occurred more frequently in functional rudimentary horns and cervicovaginal atresia, reflecting greater baseline infertility and reliance on assisted conception in these groups.

Endometriosis was variably reported across studies and was more prevalent in complex obstructive anomalies. Endometriosis data were available for 359 of 634 events (56.6%), primarily from aggregate study-level reporting, limiting precise prevalence estimates. Reported proportions therefore reflect available event-level data rather than true prevalence among all women. Higher proportions of endometriosis were observed in functional rudimentary horns and cervicovaginal atresia, consistent with prolonged obstruction and retrograde menstruation.

Pregnancy and obstetric outcomes

Pregnancy outcomes for all reported post-surgical pregnancies (n = 634) are summarised in Table 3. Once pregnancy was achieved, outcomes were generally favourable across anomaly groups. Overall livebirth rates exceeded 80%, with the highest proportions following repair of lower-tract anomalies such as imperforate hymen, and somewhat lower, but still favourable, rates among duplication and atresia groups.

Preterm birth occurred in 23.7%, and did not differ significantly between anomaly types among pregnancies with reported gestational age ($\chi^2 = 10.97$, df = 6, p = 0.09), although the proportion was lower in imperforate hymen than in other categories. Cervical cerclage was performed in 3.9% of ongoing pregnancies and was significantly more frequent (15.8%) among women with cervicovaginal atresia (p = 0.002), consistent with the need for structural support after cervical

reconstruction.

Median birthweight was significantly lower in pregnancies with cervicovaginal atresia (2400 g, IQR 2350–3000) than in other anomaly groups (3040 g, IQR 2794–3145; Mann–Whitney U = 1252, Z = –3.91, $p < 0.001$). Because rates of preterm birth were comparable across groups, these lower weights are unlikely to be explained by gestational age alone. Using the Hadlock fetal growth chart[115], small-for-gestational-age (SGA, <10th percentile) infants were identified in 22.2% of cervicovaginal atresia births, compared with 14.3% in OHVIRA, 11.7% in functional rudimentary horn, and fewer than 5% in anomalies confined to the lower genital tract such as transverse septum or imperforate hymen. Hadlock centiles were used as a pragmatic and widely applied reference, as ethnicity- or country-specific growth standards were not consistently reported across included studies.

Malpresentation occurred in 20% of reported pregnancies (73/359), most frequently among duplication anomalies, with rates of 27% in OHVIRA and 28.9% in functional rudimentary horn, compared with fewer than 10% in lower-tract anomalies.

Caesarean was performed in 55.9% (264/472) of pregnancies for which mode of birth data were available, again varying by anomaly type: 63.7% in OHVIRA, 52.7% in functional rudimentary horn, and 97.6% in cervicovaginal atresia, where prior reconstructive surgery generally necessitated elective caesarean birth. Caesarean delivery was also frequent among women with transverse vaginal septum (41.7%). In contrast, rates were lower in imperforate hymen (23.1%). Among pregnancies with available data, the distribution of caesarean delivery closely paralleled the pattern of malpresentation ($p < 0.001$), but was also influenced by surgical considerations, including previous horn excision and cervicovaginal anastomosis, which often preclude a trial of labour.

Maternal morbidity

Hypertensive disorders of pregnancy (gestational hypertension or pre-eclampsia) were reported in 9% of ongoing pregnancies for which this outcome was documented (34/379). In a secondary multivariable logistic model restricted to these cases, the presence of a renal anomaly remained independently associated with hypertensive disorder (adjusted OR 7.11, 95% CI 1.9–26.6, $p = 0.003$), after controlling for maternal age, use of ART, and anomaly subtype. The corresponding unadjusted association was more modest (OR 2.62, 95% CI 1.19–5.78, $p = 0.02$). Results of the full model are provided in Supplementary Table S2.

Sensitivity analyses

Sensitivity analyses were conducted to assess the influence of very small case series on pooled outcomes. After excluding studies that included fewer than four participants, the overall live-birth rate remained stable at 81.9%, compared with 82.4% in the primary analysis. Rates of preterm birth (23.1%) and caesarean delivery (52.2%) were likewise unchanged. These findings indicate that exclusion of small studies did not materially alter the pooled reproductive or obstetric outcomes, supporting the robustness of the overall results.

Discussion

This review provides the largest quantitative synthesis of reproductive outcomes after surgical correction of obstructive genital tract anomalies. By pooling previously fragmented data, it defines the reproductive prognosis across anomaly types—ranging from excellent outcomes after distal outflow obstruction of urogenital-sinus origin to markedly reduced fertility in complex upper-tract anomalies. These findings provide a consolidated evidence base to guide counselling and clinical planning.

Distal outflow obstruction is associated with the most favourable reproductive potential. For imperforate hymen, outcomes are excellent following membranotomy. One large retrospective cohort, however, reported higher rates of caesarean section and infertility compared with more than 70,000 controls without hymenal anomalies [22]. This isolated finding should be interpreted cautiously, as most series report normal conception and term delivery rates [17,66,76,87].

Published data on transverse vaginal septum are sparse and heterogeneous, with variable success after septal resection or Z-plasty despite an anatomically intact uterus and cervix. Contributing factors may include restenosis, fibrosis, altered cervical alignment, or tubal damage. Wierrani et al. reported eight pregnancies following modified Z-plasty, all resulting in term vaginal births [101], but such outcomes are rarely replicated. These observations highlight the need for prospective, multicentre studies with standardised reporting to identify modifiable predictors of reproductive success. It is also important to recognise that reduced fertility following correction of certain anomalies—particularly transverse vaginal septum—may reflect acquired or postoperative factors rather than the congenital pathology alone. Recurrent stenosis, the need for prolonged or repeated vaginal dilatation, dyspareunia, or other sexual dysfunction following reconstruction may reduce the frequency or feasibility of penetrative intercourse and thereby contribute to delayed conception or infertility. In this context, reported fertility outcomes may capture the downstream impact of surgical consequences and functional vaginal anatomy, rather than intrinsic reproductive potential. This distinction is clinically important when counselling patients and interpreting fertility outcomes across anomaly types.

Among duplication anomalies, conception rates appear relatively preserved but obstetric vulnerability is evident. The pooled preterm birth rate of 28%— three times higher than the population average [112,113]—together with increased malpresentation and caesarean delivery rates, supports intensified antenatal surveillance. Joki-Erikkilä et al.[66] further noted lower birthweights among women with OHVIRA compared with those with transverse vaginal septum suggesting that anatomical configuration may influence pregnancy physiology.

The coexistence of unilateral renal agenesis adds further obstetric risk. Renal anomalies were most prevalent in OHVIRA spectrum but were also observed in other phenotypes, including functional rudimentary horns and transverse vaginal septum; renal anomaly and anomaly subtype were therefore included concurrently in the multivariable model (Supplementary Table S2) to distinguish their independent associations with hypertensive disorders of pregnancy. In the present review, women with an associated renal anomaly showed significantly higher rates of hypertensive disorders of pregnancy, consistent with data from both congenital and acquired single-kidney populations, where gestational hypertensive disorders are more frequent than in matched controls [114–116]. These findings support early monitoring of blood pressure and renal function, and consideration of prophylactic low-dose aspirin [117].

The recent 2025 in-depth analysis of OHVIRA concluded that fertility in affected women is “normal compared with the general population” [118]. However, this interpretation was based on descriptive rather than pooled quantitative data. The present synthesis suggests a more nuanced picture: conception rates are broadly maintained, yet obstetric complications occur more frequently. Further research should determine whether preventive strategies for preterm birth—such as progesterone therapy or cervical-length surveillance—are effective in this context.

Data for cervicovaginal or cervical atresia remain sparse but expanding, and the present synthesis prior systematic reviews [8], providing a clearer estimate of reproductive potential after reconstruction. These anomalies carry the poorest fertility prognosis within the obstructive spectrum. Even after successful canalization, conception rates seldom exceed 40–50% and preterm birth is common. Emerging surgical series further suggest that reproductive prognosis following cervical reconstruction varies by anatomic subtype, with less severe forms retaining residual cervical tissue achieving better functional and reproductive outcomes than complete cervical agenesis, contributing to

the wide range of reported outcomes [16]. Importantly, this review is the first to synthesise birthweight data across anomaly types and demonstrates a strong association between cervicovaginal atresia and small-for-gestational-age infants. The risk of cervical insufficiency and uterine rupture following extensive reconstruction highlights the importance of tertiary-centre management and individualised counselling.

Endometriosis prevalence varied by anomaly type, consistent with evidence that risk rises with more proximal obstruction [2]. It was rarely reported in imperforate hymen but more frequent among women with upper-vaginal, cervical, or uterine-horn anomalies. This pattern supports retrograde menstruation as a key mechanism, although ascertainment bias is possible, as distal anomalies seldom require laparoscopy for diagnosis or management. Most reports describe resolution of even advanced endometriosis following surgical relief of obstruction [27,119,120], yet long-term gynecological outcomes remain uncertain. Because anomalies most prone to endometriosis also distort uterine anatomy and cervical alignment, the present data cannot determine whether endometriosis independently contributes to subfertility. Larger pooled analyses adjusting for anomaly type and surgical approach may clarify this relationship.

Ectopic pregnancy in residual functional horns remains a recognised but preventable complication. Although such cases were excluded from the pooled analysis, uncorrected or residual horns carry a substantial risk of rupture and maternal morbidity [121,122]. Complete excision of a functional non-communicating horn eliminates this risk and should be incorporated into pre-operative counselling and surgical planning.

This study's principal strength lies in its scope and methodological rigor. It is the first to quantitatively pool reproductive and obstetric outcomes across the full range of obstructive genital tract anomalies, drawing from a global evidence base. Detailed extraction of conception mode, miscarriage, preterm birth, and neonatal outcomes provides granularity not previously available. Quality appraisal using JBI criteria showed that most studies were methodologically sound.

However, several constraints must be acknowledged. The predominance of small, descriptive case series introduces substantial risk of publication bias. Outcome definitions were inconsistent and follow-up was variable. Some outcomes—particularly endometriosis and infertility—were likely under-ascertained. The pooled analyses cannot fully adjust for confounding by anomaly type, surgical technique, or severity. The use of a single fetal growth reference may misclassify small-for-gestational-age status in some populations, as ethnicity- or country-specific growth standards were not consistently available across included studies. Finally, data on postoperative endometriosis resolution and long-term obstetric complications remain sparse, highlighting the need for coordinated multicentre registries and standardised reporting.

The pooled data presented here provide a practical resource for clinicians counselling women after surgical correction of obstructive genital tract anomalies. They underscore the heterogeneity of reproductive prognosis and the need for tailored surveillance strategies:

- **Imperforate hymen:** fertility outcomes are excellent and routine obstetric care is generally sufficient once normal anatomy is restored.
- **Transverse vaginal septum:** requires longer-term follow-up to detect restenosis or secondary tubal damage; postoperative functional factors such as the need for ongoing dilatation or dyspareunia may also influence fertility, and early fertility assessment is recommended if conception is delayed.
- **Anomalies associated with renal agenesis (e.g., OHVIRA):** monitor closely for hypertensive disorders and fetal growth restriction; consider low-dose aspirin where appropriate.
- **Functional non-communicating horns:** ensure complete excision to eliminate the risk of ectopic pregnancy and rupture.
- **Cervical and cervicovaginal reconstructions:** consider serial cervical-length assessment, and in selected cases prophylactic or interval cerclage, including abdominal approaches described in the literature. Caesarean section required in most reported cases.
- **All women with repaired upper-tract obstruction:** consider antenatal surveillance for preterm birth and intrauterine growth restriction, which were more frequently observed in these anomalies in the present review.

Future research should aim to standardise outcome reporting, incorporate prospective fertility and obstetric follow-up, and explore targeted preventive interventions. Whether progesterone supplementation or cervical-length screening can reduce preterm birth in these patients warrants formal evaluation. The potential contribution of postoperative endometriosis to ongoing subfertility should also be clarified through longitudinal imaging and laparoscopic studies.

Although the anomalies included here vary in anatomy and embryologic origin, they share the unifying mechanism of menstrual outflow obstruction prior to repair and the overarching goal of restoring reproductive function. Their reproductive trajectories do not align neatly along a simple distal–proximal gradient; rather, outcomes reflect the interplay between anatomic complexity, surgical restoration, and residual functional capacity of the cervix and uterus.

Conclusion

This systematic review provides the most comprehensive quantitative evaluation of fertility and obstetric outcomes following surgical correction of obstructive genital tract anomalies to date. It highlights encouraging overall reproductive potential but substantial variation between anomaly types. The data support tailored counselling, antenatal surveillance, and the development of evidence-based preventive strategies for adverse pregnancy outcomes. Continued collaboration through multicentre registries will be essential to refine prognostication and optimise reproductive care for affected women.

Submission declaration

This manuscript has not been published previously and is not under consideration for publication elsewhere, except in the form of an abstract, academic thesis, preprint, published lecture, or registered report. Its publication has been approved by all authors and by the responsible authorities where the work was carried out. If accepted, this manuscript will not be published elsewhere in the same form, in English or in any other language, including electronically, without the written consent of the copyright-holder.

The authors confirm that this submission complies with Elsevier's policies on multiple, redundant, or concurrent publication. The manuscript may be screened using plagiarism detection and other editorial screening tools to verify originality and compliance with journal policies.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the authors used ChatGPT to improve readability and language. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

CRediT authorship contribution statement

Natalie Drever: Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Formal analysis, Conceptualization. **Chloe Gane:** Writing – review & editing, Methodology, Investigation, Data curation. **Madison Bailey:** Writing – review & editing, Investigation, Data curation.

Funding

No external funding was received for this study.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. . Eligibility criteria

	Inclusion Criteria	Exclusion Criteria
Population	Human studies that include women with an obstructive reproductive anomaly: - Imperforate hymen - Transverse vaginal septum - Obstructed longitudinal septum - OHVIRA - Cervical agenesis - Distal vaginal agenesis - Obstructed uterine septum - Obstructed uterine horn	- Animal studies. - Studies that do not include women with an obstructive reproductive anomaly. - Studies that only include women with non-obstructive reproductive tract anomalies.
Exposure	Studies with surgical correction of obstructive reproductive tract anomaly.	
Outcome	Studies reporting at least one of the following reproductive outcomes: - Fertility - Miscarriage - Preterm birth - Mode of delivery - Stillbirth - Malpresentation - Postpartum haemorrhage - Shoulder dystocia - Ectopic pregnancy	- Studies not reporting reproductive outcomes. - Studies focusing only on surgical outcomes without reproductive outcome data.
Timeframe	All reported timeframes will be included.	
Methodology	Primary observational studies including: - Descriptive observational studies: case series, cross-sectional studies. - Analytical observational study designs (prospective or retrospective case-control, cohort, cross-sectional).	- Case reports - Secondary sources of evidence including systematic reviews and *meta*-analyses. - Opinions, letters to the editor, book chapters, news articles. - Protocols and guidelines - Experimental studies
Publication status	Studies will be included regardless of publication status.	
Time period	No date limits will apply.	
Language	Studies published in any language	

Appendix B. . Search strategy

PubMed

#1 (((((“uterus/abnormali0es”[MeSH Terms]) OR (“vagina/abnormali0es”[MeSH Terms])) OR (“vaginal diseases/congenital”[MeSH Terms])) OR (“uterine cervical diseases/congenital”[MeSH Terms])) OR (“cervix uteri/abnormali0es”[MeSH Terms]))

#2 “imperforate hymen” OR “transverse vaginal septum” OR “longitudinal vaginal septum*” OR “longitudinal vaginal septa” OR ohvira OR“obstructed hemivagina and ipsilateral renal anomaly” OR “cervical agenesis” OR “distal vaginal agenesis” OR “obstructed uterine horn” OR cryptomenorrhea OR “mullerian duct anomal*” OR ”mullerian malforma0ons“ OR “obstructed mullerian duct” OR “obstructed mullerian duct anomalies” OR “obstructed uterovaginal anomalies” OR “obstructed vaginal septum” OR “obstruc0ng vaginal septum” OR “obstructed vagina” OR “uterus abnormali0es” OR “vaginaabnormali0es” OR “cervix uteri abnormali0es”

#3 #1 OR #2

#4 ((((((((((((((((((((((((((((((“fer0lity”[MeSH Terms]) OR (“infer0lity”[MeSH Terms])) OR (pregnancy rate[MeSH Terms])) OR (“abor0on, spontaneous”[MeSH Terms])) OR (premature birth[MeSH Terms])) OR (caesarean sec0on[MeSH Terms])) OR (“parturi0on”[MeSH Terms])) OR (“live birth”[MeSH Terms])) OR (“term birth”[MeSH Terms])) OR (“fetal death”[MeSH Terms])) OR(s0llbirth[MeSH Terms])) OR (“abor0on, habitual”[MeSH Terms]))OR (“fer0liza0on in vitro”[MeSH Terms])) OR (reproduc0ve techniques, assisted[MeSH Terms])) OR (“embryo transfer”[MeSH Terms])) OR(“labor presenta0on”[MeSH Terms])) OR (“breech presenta0on”[MeSH Terms])) OR (“placenta, retained”[MeSH Terms])) OR (“cerclage,cervical“[MeSH Terms])) OR (”obstetrical forceps“[MeSH Terms])) OR (”vacuum extrac0on, obstetrical“[MeSH Terms])) OR (”pregnancy, ectopic“[MeSH Terms])) OR (pregnancy, tubal[MeSH Terms])) OR (”fetal membranes, premature rupture“[MeSH Terms])) OR (”fetal growth retarda0on“[MeSH Terms])) OR (”obstetric labor, premature“[MeSH Terms])) OR (”placentaprevia“[MeSH Terms])) OR (”abrup0o placentae“[MeSH Terms])) OR (”birth weight“[MeSH Terms])) OR (”polyhydramnios“[MeSH Terms])) OR (”postpartum hemorrhage“[MeSH Terms])) OR (”pregnancyoutcome“[MeSH Terms])

#5 fer0lity OR infer0lity OR “pregnancy rate” OR miscarriage OR “spontaneous miscarriage” OR “preterm birth” OR “preterm delivery” OR “premature birth” OR “premature delivery” OR “caesarean sec0on” OR c-sec0on OR “vaginal delivery” OR “natural delivery” OR “term delivery” OR s0llbirth OR “foetal death” OR “live birth” OR “foetal survival rates” OR abor0on OR “spontaneous abor0on” OR “recurrent abor0on” OR conceive OR concep0on OR IVF OR “in vitro fer0lisa0on” OR “assisted reproduc0ve technologies” OR “embryo transfer” OR “breech delivery” OR “breech presenta0on” OR “transverse lie” OR “transverse presenta0on” OR malpresenta0on OR “retained placenta” OR “cervical cerclage”OR “shortened cervix” OR “instrumental delivery” OR ventouse OR vacuum OR forceps OR “natural concep0on” OR “ectopic pregnancy” OR “tubal pregnancy” OR “premature rupture of membranes” OR PROM OR “intrauterine growth restric0on” OR IUGR OR “preterm labour” OR “premature labour” OR “placenta previa” OR “placental abrup0on” OR “mean birth weight” OR “polyhydramnios” OR “postpartum haemorrhage” OR “reproduc0ve outcome” OR “pregnancy outcome”

#6 #4 OR #5

#7 #3 AND #6

CINAHL

S1 "imperforate hymen" OR "transverse vaginal septum*" OR "longitudinal vaginal septum*" OR "longitudinal vaginal septa" OR "obstructed vaginal septum*" OR ohvira OR "obstructed hemivagina and ipsilateral renal anomaly" OR "cervical agenesis" OR "distal vaginal agenesis" OR "obstructed uterine horn*" OR cryptomenorrhea OR "mullerian duct anomal*" OR "mullerian duct malformation*" OR "mullerian malformation*" OR "obstructed mullerian duct"OR "obstructed mullerian duct anomal*" OR "obstructeduterovaginal anomaly" OR "obstructed vagina" OR "uterus abnormal*" OR "uterine abnormal*" OR "vagina abnormal*" OR "vaginal abnormal*"

S2 (MH "Fertility") OR (MH "Infertility") OR (MH "Abortion, Spontaneous") OR (MH "Childbirth, Premature") OR (MH "Cesarean Section") OR (MH"Vaginal Birth") OR (MH "Delivery, Obstetric") OR (MH "Term Birth") OR (MH "Perinatal Death") OR (MH "Abortion, Habitual") OR (MH "Fertilizationin Vitro") OR (MH "Reproduction Techniques") OR (MH "Breech Delivery") OR (MH "Breech Presentation") OR (MH "Labor Presentation") OR (MH "Placenta, Retained") OR (MH "Cerclage, Cervical") OR (MH "Obstetrical Forceps") OR (MH"Pregnancy, Ectopic") OR (MH "Fetal Membranes, Premature Rupture") OR (MH "Fetal Growth Retardation") OR (MH "Labor, Premature") OR (MH"Placenta Praevia") OR (MH "Abruptio Placentae") OR (MH "Birth Weight") OR (MH "Polyhydramnios") OR (MH Postpartum Hemorrhage") OR (MH "Pregnancy Outcomes")

S3 fer0lity OR infer0lity OR "pregnancy rate" OR miscarriage OR "spontaneous miscarriage" OR "preterm birth" OR "preterm delivery" OR "premature birth" OR "premature delivery" OR "caesarean sec0on" OR c-sec0on OR "vaginal delivery" OR "natural delivery" OR "term delivery" OR s0llbirth OR "foetal death" OR "live birth" OR "foetal survival rates" OR abor0on OR "spontaneous abor0on" OR "induced abor0on" OR termina0on OR "recurrent abor0on" OR conceive OR concep0on OR IVF OR "in vitro fer0lisa0on" OR "assisted reproduc0ve technologies" OR "embryo transfer" OR "breech delivery" OR "breech presenta0on" OR "transverse lie" OR "transverse presenta0on" OR malpresenta0on OR "retained placenta" OR "cervical cerclage" OR "shortened cervix" OR "instrumental delivery" OR ventouse OR vacuum OR forceps OR "natural concep0on" OR "ectopic pregnancy" OR "tubal pregnancy" OR "premature rupture of membranes" OR PROM OR "intrauterine growth restric0on" OR IUGR OR "preterm labour" OR "premature labour" OR
"placenta previa" OR "placental abrup0on" OR "mean birth weight" OR "polyhydramnios" OR "postpartum haemorrhage" OR "reproduc0ve outcome" OR "pregnancy outcome"

S4 S2 OR S3

S5 S1 AND S4

Emcare

#1 Exp uterine cervix disease/cn [Congenital Disorder] OR exp uterus malformation/cn [Congenital Disorder] OR exp vagina disease/cn [Congenital Disorder] OR exp muellerian duct/ OR exp female genital tract malformation/cn [Congenital Disorder] OR exp urogenital tract
malformation/cn [Congenital Disorder]

#2 imperforate hymen.mp OR transverse vaginal septum.mp OR longitudinal vaginal septum.mp OR longitudinal vaginal septa.mp OR ohvira.mp OR obstructed hemivagina and ipsilateral renal anomaly.mp OR cervical agenesis.mp OR distal vaginal agenesis.mp OR obstructed uterine horn.mp OR cryptomenorrhea.mp OR mullerian duct anomal*.mp OR mullerian malformations.mp OR obstructed mullerian duct anomal*.mp OR obstructed uterovaginal anomal*.mp OR obstructed vaginal septum.mp OR obstructing vaginal septum.mp OR obstructed vagina.mp OR uterus malformation.mp OR uterine cervix diseases.mp OR vagina disease.mp OR female genital tractmalformation.mp

#3 #1 or #2

#4 exp fertility/ OR exp infertility/ OR exp pregnancy rate/ OR exp spontaneous abortion/ OR exp prematurity/ OR exp premature labor/ OR exp cesarean section/ OR exp vaginal delivery/ OR exp stillbirth/ OR exp fetus death/ OR exp live birth/ OR exp recurrent abortion/OR exp conception/OR exp fertilization in vitro/ OR exp infertility therapy/ OR exp instrumental delivery/ OR exp breech extraction/ OR exp vacuum extraction/ OR exp forceps delivery/ OR exp malpresentation/ OR exp breech presentation/ OR exp retained placenta/ OR exp uterine cervix cerclage/ OR exp ectopic pregnancy/ OR exp "premature rupture of membranes"/ OR exp intrauterine growth retardation/ OR exp placenta previa/ OR exp birth weight/ OR exp
polyhydramnios/ OR exp postpartum hemorrhage/ OR exp pregnancy outcome

#5 fertility.mp OR infertility.mp OR pregnancy rate.mp OR miscarriage.mp OR spontaneous miscarriage.mp OR preterm birth.mp OR preterm delivery.mp OR premature birth.mp OR premature delivery.mp OR caesarean section.mp OR c-section.mp OR vaginal delivery.mp OR natural delivery.mp OR term delivery.mp OR stillbirth.mp OR foetal death.mp OR live birth.mpOR foetal survival rates.mp OR abortion.mp OR spontaneous abortion.mp OR recurrent abortion.mp OR conceive.mp OR conception.mp OR IVF.mp OR in vitro fertilisation.mp OR assisted reproductive technologies.mp OR embryo transfer.mp OR breech delivery.mp OR breech presentation.mp ORtransverse lie.mp OR transverse presen tation.mp OR malpresentation.mp OR
retained placenta.mp OR cervical cerclage.mp OR shortened cervix.mp OR instrumental delivery.mp OR ventouse.mp OR vacuum.mp OR forceps.mp OR natural conception.mp OR ectopic pregnancy.mp OR tubal pregnancy.mp OR premature rupture of membranes.mp OR PROM.mp OR intrauterine growth restriction.mp OR IUGR.mp OR preterm labour.mp OR premature labour.mp OR placenta previa.mp OR placental abruption.mp OR mean birth weight.mp OR polyhydramnios.mp OR postpartum haemorrhage.mp OR reproductive outcome.mp OR pregnancy outcome.mp

#6 #4 OR #5

#7 #3 AND #6

Scopus

#1 "imperforate hymen" OR "transverse vaginal septum" OR "longitudinal vaginal septum*" OR "longitudinal vaginal septa" OR ohvira OR"obstructed hemivagina and ipsilateral renal anomaly" OR "cervical agenesis" OR "distal vaginal agenesis" OR "obstructed uterine horn" OR cryptomenorrhea OR "mullerian duct anomal*" OR "mullerian malforma0ons" OR "obstructed mullerian duct" OR "obstructed mullerian duct anomalies" OR "obstructed uterovaginal anomalies" OR "obstructed vaginal septum" OR "obstruc0ng vaginal septum" OR "obstructed vagina" OR "uterus abnormali0es" OR "vaginaabnormali0es" OR "cervix uteri abnormali0es"

#2 fer0lity OR infer0lity OR "pregnancy rate" OR miscarriage OR "spontaneous miscarriage" OR "preterm birth" OR "preterm delivery" OR "premature birth" OR "premature delivery" OR "caesarean sec0on" OR c-sec0on OR "vaginal delivery" OR "natural delivery" OR "term delivery" OR s0llbirth OR "foetal death" OR "live birth" OR "foetal survival rates" OR abor0on OR "spontaneous abor0on" OR termina0on OR "recurrent abor0on" OR conceive OR concep0on OR IVF OR "in vitro fer0lisa0on" OR "assisted reproduc0ve technologies" OR "embryo transfer" OR "breech delivery" OR "breech presenta0on" OR "transverse lie" OR "transverse presenta0on" OR malpresenta0on OR "retained placenta" OR "cervical cerclage" OR "shortened cervix" OR "instrumental delivery" OR ventouse OR vacuum OR forceps OR "natural concep0on" OR "ectopic pregnancy" OR "tubal pregnancy" OR "premature rupture of membranes" OR PROM OR "intrauterine growth restric0on" OR IUGR OR "preterm labour" OR "premature labour" OR "placenta previa" OR "placental abrup0on" OR "mean birth weight" OR "polyhydramnios" OR "postpartum haemorrhage" OR"reproduc0ve outcome" OR "pregnancy outcome" OR "follow up" OR "long term follow up"

#3 #1 AND #2

Appendix C. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ejogrb.2026.115014.

References

[1] Skinner B, Quint EH. Obstructive reproductive tract anomalies: a review of surgical management. J Minim Invasive Gynecol 2017;24(6):901–8.

[2] Vercellini P, Salmeri N, Somigliana E, Piccini M, Caprara F, Viganò P, et al. Müllerian anomalies and endometriosis as potential explanatory models for the retrograde menstruation/implantation and the embryonic remnants/celomic metaplasia pathogenic theories: a systematic review and meta-analysis. Hum Reprod 2024;39(7):1460–70.

[3] Dietrich JE, Millar DM, Quint EH. Obstructive reproductive tract anomalies. J Pediatr Adolesc Gynecol 2014;27(6):396–402.

[4] Ludwin A, Pfeifer SM. Reproductive surgery for müllerian anomalies: a review of progress in the last decade. Fertil Steril 2019;112(3):408–16.

[5] Keepanasseril A, Saha SC, Bagga R, Vyas S, Dhaliwal LK. Uterovaginal anastomosis for the management of congenital atresia of the uterine cervix. Gynecol Surg 2011;8(2):161–4.
[6] Rezaei Z, Omidvar A, Niroumanesh S, Omidvar A. Cervicovaginal anastomosis by Gore-Tex in Mullerian agenesis. Arch Gynecol Obstet 2015;291(2):467–72.
[7] Dixit R, Duggireddy CS, Pradhan GS. Mullerian anomalies: revisiting imaging and classification. Insights into Imaging 2025;16(1):40.
[8] Mikos T, Lantzanaki M, Anthoulakis C, Grimbizis GF. Functional and reproductive outcomes following surgical management of congenital anomalies of the cervix: a systematic review. J Minim Invasive Gynecol 2021;28(8). 1452-61.e16.
[9] Lee KH, Hong JS, Jung HJ, Jeong HK, Moon SJ, Park WH, et al. Imperforate hymen: a comprehensive systematic review. J Clin Med 2019;8(1).
[10] Brander EPA, Vincent S, McQuillan SK. Transverse vaginal septum resection: technique, timing, and the utility of dilation. A scoping review of the literature. J Pediatr Adolesc Gynecol 2022;35(1):65–72.
[11] Moufawad G, Giannini A, D'Oria O, Laganà AS, Chiantera V, Khazzaka A, et al. Obstructed hemivagina and ipsilateral renal anomaly syndrome: a systematic review about diagnosis and surgical management. Gynecol Minim Invasive Ther 2023;12(3):123–9.
[12] Liu Y, Li Z, Dou Y, Wang J, Li Y. Anatomical variations, treatment and outcomes of Herlyn-Werner-Wunderlich syndrome: a literature review of 1673 cases. Arch Gynecol Obstet 2023;308(5):1409–17.
[13] Parodi L, Hoxhaj I, Dinoi G, Mirandola M, Pozzati F, Topouzova G, et al. Complete uterine septum, double cervix and vaginal septum (U2b C2 V1): hysteroscopic management and fertility outcomes-a systematic review. J Clin Med 2022;12(1):189 [Internet]. Available from: http://europepmc.org/abstract/MED/36614990. https://doi.org/10.3390/jcm12010189. https://europepmc.org/articles/PMC9821280. https://europepmc.org/articles/PMC9821280?pdf=render.
[14] Yi S, Jiang J. Clinical characteristics and management of patients with complete septate uterus, double cervix, obstructed hemivagina, and ipsilateral renal agenesis. J Obst Gynaecol Res 2021;47(4):1497–501.
[15] Acar A, Ercan F, Balci O, Elçi Atılgan A, Alan C, Niftiyev K. Long-term results of an imperforate hymen procedure that leaves the hymen intact. J Obstet Gynecol India 2021;71(2):168–72.
[16] Xie Z, Zhang X, Liu J, Zhang N, Xiao H, Liu Y, et al. Clinical characteristics of congenital cervical atresia based on anatomy and ultrasound: a retrospective study of 32 cases. Eur J Med Res 2014;19(1):10.
[17] Acar A, Balci O, Karatayli R, Capar M, Colakoglu MC. The treatment of 65 women with imperforate hymen by a central incision and application of Foley catheter. Obstet Gynecol Surv 2008;63(2):93–4.
[18] Acién P, Acién MI, Quereda F, Santoyo T. Cervicovaginal agenesis: spontaneous gestation at term after previous reimplantation of the uterine corpus in a neovagina: Case Report. Hum Reprod 2008;23(3):548–53.
[19] Albulescu DM, Ceauşescu AE, Sas LM, Comănescu MC, Constantin C, Tudorache Ş. The Herlyn-Werner-Wunderlich triad (OHVIRA syndrome) with good pregnancy outcome - two cases and literature review. Rom J Morphol Embryol 2018;59(4):1253–62.
[20] Alobaid A, Ali R, Al-Lehibi A, AlDakhil LO, Althubaiti G. Minimally invasive technique for the reconstruction of the cervix in cervical atresia. Gynecol Surg 2016;13(4):473EP-8.
[21] Altchek A, Paciuc J. Successful pregnancy following surgery in the obstructed uterus in a uterus didelphys with unilateral distal vaginal agenesis and ipsilateral renal agenesis: case report and literature review. J Pediatr Adolesc Gynecol 2009;22(5):e159–62.
[22] Amitai E, Lior Y, Sheiner E, Saphier O, Leron E, Silberstein T. The impact of hymenectomy on future gynecological and obstetrical outcomes. J Matern Fetal Neonatal Med 2020;33(8):1400–4.
[23] Arkoulis N, Kearns C, Deeny M, Telfer JRC. The interdigitating Y-plasty procedure for the correction of transverse vaginal septa. BJOG 2017;124(2):331–5.
[24] Banu T, Hannan MJ, Aziz MA, Hoque M, Laila K. Rectovestibular fistula with vaginal malformations. Pediatr Surg Int 2006;22(3):263–6.
[25] Batioglu S, Zeyneloglu HB. Endoscopic management of a case of complete septate uterus with unilateral pyometra. Gynecol Obstet Invest 1999;47(2):144–6.
[26] Beilly JS, Wrubel NN. Menstruation, pregnancy, and childbirth after operation for aplasia of vagina. Am J Obstet Gynecol 1953;65(2):413–5.
[27] Bunnell ME, Cipres DT, Laufer MR. Case series of reproductive outcomes after surgical correction of obstructed hemivagina in OHVIRA. AJP Rep 2023;14(1):E26EP-E30.
[28] Busacca M, Natale A, Candiani M, De Marinis S, Vignali M. Term pregnancy and vaginal delivery from unicornuate uterus after laparoscopic treatment of a cavitate rudimentary horn by an endoscopic stapler. J Gynecol Surg 2002;18(3):113EP-6.
[29] Candiani GB, Fedele L, Candiani M. Double uterus, blind hemivagina, and ipsilateral renal agenesis: 36 cases and long-term follow-up. Obstet Gynecol 1997;90(1):26EP-32.
[30] Candiani M, Ciappina N, Fedele F, Bergamini V, Ruffolo AF, Parazzini F. Laparoscopic removal of nonseparated cavitated horn in *Unicorn*uate uterus: surgical aspects and long-term follow-up. Int J Fert Steril 2023;17(2):145–50.
[31] Candiani M, Vercellini P, Fedele F, Parma M, Salvatore S, Fedele L. Long-term follow-up after laparoscopic uterovestibular anastomosis in patients with cervical atresia and complete absence of the vagina. J Pediatr Adolesc Gynecol 2023;36(1):72–8.
[32] Candiani M, Vercellini P, Ferrero-Caroggio C, Fedele F, Salvatore S, Fedele L. Conservative treatment of Herlyn-Werner-Wunderlich syndrome: analysis and long-term follow-up of 51 cases. Eur J Obst Gynecol Reprod Biol 2022;275:84–90.
[33] Capito C, Echaieb A, Lortat-Jacob S, Thibaud E, Sarnacki S, Nihoul-Fekete C. Pitfalls in the diagnosis and management of obstructive uterovaginal duplication: a series of 32 cases. Pediatrics 2008;122(4):e891EP-e7.
[34] Cappello S, Piccolo E, Cucinelli F, Casadei L, Piccione E, Salerno MG. Successful preterm pregnancy in a rare variation of Herlyn-Werner-Wunderlich syndrome: a case report. BMC Pregnancy Childbirth 2018;18(1):498.
[35] Castillo Lara M, De Pablo ZL, Pozuelo SE. Herlyn–Werner–Wünderlich syndrome: a case series. Clin Invest Ginecol Obstet 2024;51(1).
[36] Cetinkaya K, Kumtepe Y. Perforated transverse vaginal septum: a rare case of müllerian duct anomaly presenting only primary infertility. Fertil Steril 2008;90(5). 2005.e11-13.
[37] Chakrabarti SB, Tigga MP, Ray J, Debbarma A. An eventful journey from menarche to successful motherhood. J Hum Reprod Sci 2016;9(2):125–7.
[38] Chen F-P, Ng K-K. Term pregnancy at the site of atresia following vaginal canalization in a case of uterus didelphys with hemivaginal atresia and ipsilateral renal agenesis. Taiwan J Obstet Gynecol 2006;45(4):366–8.
[39] Cozzolino M, Corioni S, Malosso ERM, Sorbi F, Mecacci F. Two successful pregnancies in Herlyn-Werner-Wunderlich syndrome. J Obstet Gynaecol 2014;34(6):534.
[40] Creatsas G, Bakas P. A full-term pregnancy in a patient with a severe müllerian duct anomaly with obstruction. Fertil Steril 2000;74(2):410–1.
[41] Creatsas G, Cardamakis E, Hassan E, Deligeoroglou E, Salakos N, Aravantinos D. Congenital uterine anomalies with obstructed cervix, hemivagina, or both during adolescence: Report of 22 cases. J Gynecol Surg 1994;10(3):159EP-67.
[42] Crowley CM, Botros K, Hegazy IF, O'Donnell E. Uterine didelphys: diagnosis, management and pregnancy outcome. BMJ Case Reports 2021;14(3):e242233.
[43] Dabi Y, Dray G, Allanche M, Skalli D, Paniel BJ, Haddad B, et al. Fertility and pregnancy outcomes in patients with bicorporeal uterus and blind hemivagina: 20 years of experience in a tertiary referral gynaecological department. J Gynecol Obstet Hum Reprod 2020;49(3):101651.
[44] Darga SL, Chiruvella M, Bedigeri TM, Mohammed GS, Pandya S, Enganti B. Robotic management of congenital urethra-vaginal fistula with transverse vaginal septum. Brazil 2022.
[45] Deffarges JV, Haddad B, Musset R, Paniel BJ. Utero-vaginal anastomosis in women with uterine cervix atresia: long-term follow-up and reproductive performance. a study of 18 cases. Hum Reprod 2001;16(8):1722–5.
[46] Ding Y, Zhang X, Zhang Y, Shen F, Ding J, Hua K. Cervicovaginal reconstruction with small intestinal submucosa graft in congenital cervicovaginal atresia: a report of 38 cases. Eur J Obst Gynecol Reprod Biol 2021;267:49–55.
[47] Dogan E, Yavuz O, Altay C, Ozmen S. Asymptomatic microperforated transverse vaginal septum presenting with primary infertility: a rare form of mullerian anomaly. Turkish Journal of. Obstet Gynecol 2019;16(2):140EP-2.
[48] Donnez J, Nisolle M. Endoscopic laser treatment of uterine malformations. Hum Reprod 1997;12(7):1381–7.
[49] El-Agwany AS. Herlyn Werner Wunderlich syndrome: a case of obstructed hemivagina with ipsilateral renal agenesis (OHVIRA syndrome) and didelphic uterus. Afr J Urol 2014;20(2):91–4.
[50] Eleje GU, Ihekwoaba EC, Onu OA, Igbodike EP, Ilokanuno CN, Chukwuanukwu TO, et al. Conception following successful repair of two previous failed attempts at repair of partial transverse vaginal septum diagnosed after marital union: A case report. SAGE Open Medical Case Reports. 2022;10 ((Eleje, Okpala) Effective Care Research Unit, Department of Obstetrics and Gynecology, Nnamdi Azikiwe University, Nnewi, Nigeria(Eleje, Igbodike, Okoro, Okpala) Department of Obstetrics and Gynecology, Nnamdi Azikiwe University Teaching Hospital, Nnewi, N).
[51] Erkkinen E, Farahzad MM, O'Brien KE, Rosen MW. Pregnancy outcomes in patients with obstructed hemivagina ipsilateral renal agenesis. J Pediatr Adolesc Gynecol 2023;36(6):545–8.
[52] Fascilla FD, Olivieri C, Cannone R, De Palma D, Manosperta F, Costantino AS, et al. In-office hysteroscopic treatment of herlyn-werner-wunderlich syndrome: a case series. J Minim Invasive Gynecol 2020;27(7):1640EP-5.
[53] Fouad R, Zayed M. Utero-vaginal anastomosis in cases of cervical malformations: long-term follow-up and fertility challenges. Arch Gynecol Obstet 2023;307(4):1001–6.
[54] Fraser IS. Successful pregnancy in a patient with congenital partial cervical atresia. Obstet Gynecol 1989;74(3 Pt 2):443–5.
[55] Ghafarnejad M, Adabi K, Moosavi SA. Uteroneovaginal cannulation using Pezzer catheter in patients with vaginal agenesis and functional uterus. J Obstet Gynaecol Res 2013;39(1):210–6.
[56] Giatras K, Licciardi FL, Grifo JA. Laparoscopic resection of a noncommunicating rudimentary uterine horn. J Am Assoc Gynecol Laparosc 1997;4(4):491EP-3.
[57] Gündüz R, Ağaçayak E, Evsen MS. OHVIRA syndrome presenting with acute abdomen findings treated with minimally invasive method: three case reports. Acta Chir Belg 2022;122(4):275–8.
[58] Gungor Ugurlucan F, Dural O, Yasa C, Kirpinar G, Akhan SE. Diagnosis, management, and outcome of obstructed hemivagina and ipsilateral renal agenesis (OHVIRA syndrome): is there a correlation between MRI findings and outcome? Clin Imaging 2020;59(2):172–8.
[59] Haddad B, Barranger E, Paniel BJ. Blind hemivagina: long-term follow-up and reproductive performance in 42 cases. Hum Reprod 1999;14(8):1962–4.
[60] Hadisaputra W, Pramayadi CT, Bramantyo A, Berguna JSN. Successful pregnancy after hysterectomy in a case of bicorporeal uterus with hematometra. J Minim Invasive Gynecol 2016;23(6):853EP-4.
[61] Hampton HL, Meeks GR, Bates GW, Wiser WL. Pregnancy after successful vaginoplasty and cervical stenting for partial atresia of the cervix. Obstet Gynecol 1990;76(5 Pt 2):900–1.

[62] Heinonen PK. Unicornuate uterus and rudimentary horn. Fertil Steril 1997;68(2):224–30.
[63] Heinonen PK. Pregnancies in women with uterine malformation, treated obstruction of hemivagina and ipsilateral renal agenesis. Arch Gynecol Obstet 2013;287(5):975–8.
[64] Herrera Castañeda E, Piñeros Castillo WA, Paredes Soto MP. Microsurgical technique for reconstruction of Hemi-uterus with non-communicating rudimentary uterine horns. Colomb Med (Cali) 2022;53(2):e5004855.
[65] Jasonni VM, La Marca A, Matonti G. Utero-vaginal anastomosis in the treatment of cervical atresia. Acta Obstet Gynecol Scand 2007;86(12):1517–8.
[66] Joki-Erkkilä MM, Heinonen PK. Presenting and long-term clinical implications and fecundity in females with obstructing vaginal malformations. J Pediatr Adolesc Gynecol 2003;16(5):307–12.
[67] Kang J, Chen N, Zhang Y, Ma C, Ma Y, Wang 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(6):1203EP-10.
[68] Kanno Y, Suzuki T, Nakamura E, Goya K-i, Nishijima Y, Shinoda M, et al. Successful term delivery after laparoscopic resection of a non-communicating rudimentary horn in a patient with a unicornuate uterus: a case report. Tokai J Exp Clin Med 2014;39(2):59–63.
[69] Khunda S, Abas R, Khunda A. Pregnancy after Tompkins metroplasty for Robert's uterus. BMJ Case Rep 2025;18(1):e261699.
[70] Khunda SS, Al-Omari S. A new approach in the management of lower Mullerian atresia. J Obstet Gynaecol 1998;18(6):566–8.
[71] Kita M, Shiraga H, Fukuda H, Hisamatsu Y, Mizokami T, Okada H. Successful pneumovaginoscopic surgery for recurrent abscess of OHVIRA syndrome, preventing further recurrence and subsequent pregnancy. Asian J Endosc Surg 2024;17(1):e13270.
[72] Koyama N, Hasuda K, Hayashi A, Hasuda T. Pregnancy achieved following IVF-ET after surgery for infertility with perforate transverse vaginal septum and incomplete septate uterus: case report. Clin Exp Obstet Gynecol 2007;34(4):259–62.
[73] Kriplani A, Kachhawa G, Awasthi D, Kulshrestha V. Laparoscopic-assisted uterovaginal anastomosis in congenital atresia of uterine cervix: follow-up study. J Minim Invasive Gynecol 2012;19(4):477EP-84.
[74] Lee CL, Jain S, Wang CJ, Yen CF, Soong YK. Classification for endoscopic treatment of mullerian anomalies with an obstructive cervix. J Am Assoc Gynecol Laparosc 2001;8(3):402EP-8.
[75] Li J, Yu W, Wang M. Feng L-m. Hysteroscopic treatment of Robert's uterus with laparoscopy. J Obstet Gynaecol Res 2015;41(9):1491–4.
[76] Liang CC, Chang SD, Soong YK. Long-term follow-up of women who underwent surgical correction for imperforate hymen. Arch Gynecol Obstet 2003;269(1):5–8.
[77] Liu H, Zhang H, Wang C, Dang Q. Efficacy and safety of laparoscopic vaginoplasty with peritoneal flaps and cervicoplasty in patients with congenital cervical and complete vaginal atresia: a pilot study. Quant Imaging Med Surg 2024;14(4):3121–30.
[78] Liu X, Ding J, Li Y, Hua K, Zhang X. Comparison of two different methods for cervicovaginal reconstruction: a long-term follow-up. Int Urogynecol J 2023;34(1):247–54.
[79] Liu Y, Wang Y-F. Successful vaginal delivery at term after vaginal reconstruction with labium minus flaps in a patient with vaginal atresia: a rare case report. J Obstet Gynaecol Res 2017;43(7):1217–21.
[80] Morita M, Ota K, Watanabe S, Asakawa Y, Maemura T, Kubo H. Laparoscopic management of a noncommunicating rudimentary uterine horn and ipsilateral ovarian endometrioma in a dysmenorrheic and infertile patient. J Med Soc Toho Univ 2005;52(5):325–9.
[81] Sohail R, Malik A, Ashraf A, Kanwal S. Successful pregnancy outcome after septum resection and use of amnion graft in patient with high transverse vaginal septum. BMJ Case Rep 2019;12(6).
[82] Nargund G, Parsons J. A successful in-vitro fertilization and embryo transfer treatment in a woman with previous vaginoplasty for congenital absence of vagina. Hum Reprod 1996;11(8):1654.
[83] Pados G, Tsolakidis D, Athanatos D, Almaloglou K, Nikolaidis N, Tarlatzis B. Reproductive and obstetric outcome after laparoscopic excision of functional, non-communicating broadly attached rudimentary horn: a case series. Eur J Obstet Gynecol Reprod Biol 2014;182:33–7.
[84] Prapas Y, Papanicolaou A, Prapas N, Goutzioulis M, Papanicolaou N. Term pregnancy after vaginal transplantation in a case of vaginal agenesis with a functional uterus. Acta Eur Fertil 1993;24(2):77–8.
[85] Prorocic M, Vasiljevic M, Tasic L, Brankovic S. Successful pregnancy after uterovaginal anastomosis in patients with congenital atresia of cervix uteri. Clin Exp Obstet Gynecol 2012;39(4):544–6.
[86] Rock JA, Roberts CP, Jones Jr HW. Congenital anomalies of the uterine cervix: lessons from 30 cases managed clinically by a common protocol. Fertil Steril 2010;94(5):1858–63.
[87] Rock JA, Zacur HA, Dlugi AM, Jones Jr HW, TeLinde RW. Pregnancy success following surgical correction of imperforate hymen and complete transverse vaginal septum. Obstet Gynecol 1982;59(4):448–51.
[88] Sardesai SP, Dabade R, Chitale V. Double cross plasty for management of transverse vaginal septum: a 20-year retrospective review of our experience. J Obstet Gynecol India 2015;65(3):181–5.
[89] Sawada M, Kakigano A, Matsuzaki S, Takiuchi T, Mimura K, Kumasawa K, et al. Obstetric outcome in patients with a unicornuate uterus after laparoscopic resection of a rudimentary horn. J Obstet Gynaecol Res 2018;44(6):1080–6.
[90] Shin SY, Kwon H, Kim HC, Baek MJ, Shin JE. Successful pregnancy outcome via in-vitro fertilization and laparoscopic resection of non-communicating rudimentary horn pregnancy containing early pregnancy: a case report. BMC Pregn Childbirth 2024;24(1):115.
[91] Singh J, Devi YL. Pregnancy following surgical correction of nonfused müllerian bulbs and absent vagina. Obstet Gynecol 1983;61(2):267–9.
[92] Solomons E. Conception and delivery following construction of an artificial vagina; report of a case. Obstet Gynecol 1956;7(3):329–31.
[93] Stassart JP, Nagel TC, Prem KA, Phipps WR. Uterus didelphys, obstructed hemivagina, and ipsilateral renal agenesis: the University of Minnesota experience. Fertil Steril 1992;57(4):756–61.
[94] Thijssen RF, Hollanders JM, Willemsen WN, van der Heyden PM, van Dongen PW, Rolland R. Successful pregnancy after ZIFT in a patient with congenital cervical atresia. Obstet Gynecol 1990;76(5 Pt 2):902–4.
[95] Tong J, Zhu L, Lang J. Clinical characteristics of 70 patients with Herlyn-Werner-Wunderlich syndrome. Int J Gynaecol Obstet 2013;121(2):173–5.
[96] Tuqan AR, Salahaldin RR, Abubaker ME, Zaben BA, Barabrah AM, Rayyan MH, et al. Successful pregnancy in a woman with Herlyn-Werner-Wunderlich syndrome: A case report and literature review. Case Reports in Women's Health. 2024;43((Tuqan, Salahaldin, Abubaker, Zaben, Barabrah) Faculty of medicine, Al-Quds university, Jerusalem, Palestine(Rayyan, Jaber) Department of Obstetrics and Gynecology, AL-Makassed Charitable Society Hospital, East Jerusalem, Palestine):e00647.
[97] Ueda M, Ota K, Takahashi T, Suzuki S, Suzuki D, Kyozuka H, et al. Successful pregnancy and term delivery after treatment of unicornuate uterus with non-communicating rudimentary horn pregnancy with local methotrexate injection followed by laparoscopic resection: a case report and literature review. BMC Pregn Childbirth 2021;21(1):1–8.
[98] Vural M, Yildiz S, Cece H, Camuzcuoglu H. Favourable pregnancy outcome after endometrectomy for a Robert's uterus. J Obstet Gynaecol 2011;31(7):668–9.
[99] Wang J, Zhu L, Lang J, Liu Z, Sun D, Leng J, et al. Clinical characteristics and treatment of Herlyn–Werner–Wunderlich syndrome. Arch Gynecol Obstet 2014;290(5):947–50.
[100] Welker B, Krebs D, Lang N. Pregnancy following repair of a congenital atresia of the uterine cervix and upper vagina. Arch Gynecol Obstet 1988;243(1):51–4.
[101] Wierrani F, Bodner K, Spängler B, Grünberger W. "Z"-plasty of the transverse vaginal septum using Garcia's procedure and the Grünberger modification. Fertil Steril 2003;79(3):608–12.
[102] Williams CE, Nakhal RS, Hall-Craggs MA, Wood D, Cutner A, Pattison SH, et al. Transverse vaginal septae: Management and long-term outcomes. BJOG 2014;121(13):1653EP-8.
[103] Xie Z, Zhang X, Zhang N, Xiao H, Liu Y, Liu J, 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.
[104] Xu C, Xu J, Gao H, Huang H. Triplet pregnancy and successful twin delivery in a patient with congenital cervical atresia who underwent transmyometrial embryo transfer and multifetal pregnancy reduction. Fertil Steril 2009;91(5). 1958.e1-3.
[105] Yang B, Wang N, Zhang S, Wang M. Vaginal reconstruction with sigmoid colon in patients with congenital absence of vagina and menses retention: a report of treatment experience in 22 young women. Int Urogynecol J 2013;24(1):155–60.
[106] Zhang M, Zhang M-X, Li G-L, Xu C-J. Congenital vaginal atresia: a report of 39 cases in a regional Obstetrics and Gynecology Hospital. J Huazhong Univ Sci Technolog Med Sci 2017;37(6):928–32.
[107] Zhang N-N, Zuo N, Chen S-L, Bi F-F, Yang Q. Accurate identification and surgical correction of type IIb uterine malformation using synchronized hysteroscopy and laparoscopy. United States 2022.
[108] Zhang Y, Liu Q. Diagnosis and treatment of 46 patients with oblique vaginal septum syndrome. J Obstet Gynaecol 2022;42(8):3731–6.
[109] Zhang Y, Liu S, Zhang X, Ding Y, Hua K. Laparoscopic metroplasty for unicornuate uterus with a functional noncommunicating rudimentary horn. Int J Gynaecol Obstet 2020;149(1):31–6.
[110] Zarou GS, Esposito JM, Zarou DM. Pregnancy following the surgical correction of congenital atresia of the cervix. Int J Gynecol Obstet 1973;11(4):143–6.
[111] Zhu L, Chen N, Tong J-L, Wang W, Zhang L, Lang J-H. New Classification of Herlyn-Werner-Wunderlich Syndrome. Chin Med J (Engl) 2015;128(2).
[112] Qiao C, Menon R, Ahn KH, Suzuki S, Kshetrapal P, Georgiou HM, et al. Preterm birth update in Australasia: a report of the international symposium of Preterm Birth International Collaborative-Australasia branch. Front Pediatr 2022;10–2022.
[113] Centers for Disease Control and Prevention. (2024). Births: Provisional data for 2023 (National Vital Statistics Rapid Release, Report No. 507). National Center for Health Statistics, U.S. Department of Health and Human Services. https://www.cdc.gov/nchs/data/databriefs/db507.pdf.
[114] Steele SE, Terry JE, Page LM, Girling JC. Pregnancy in women known to be living with a single kidney. Obstet Med 2019;12(1):22–6.
[115] Kendrick J, Holmen J, You Z, Smits G, Chonchol M. Association of unilateral renal agenesis with adverse outcomes in pregnancy: a matched cohort study. Am J Kidney Dis 2017;70(4):506–11.
[116] Mishra VV, Mistry KM, Nanda SS, Choudhary S, Aggarwal R, Gandhi K. Pregnancy outcome in patients with solitary kidney. J Obstet Gynaecol India 2017;67(3):168–72.
[117] American College of Obstetricians and Gynecologists/Society for Maternal-Fetal Medicine: Low-Dose Aspirin Use for the Prevention of Preeclampsia and Related Morbidity and Mortality. December 2021. Available at: https://www.acog.org/clinical/clinical-guidance/practice-advisory/articles/2021/12/low-dose-aspirin-use-for-the-prevention-of-preeclampsia-and-related-morbidity-and-mortality.

[118] Moon LM, O'Flynn O'Brien KL, Dietrich JE. OHVIRA: an in-depth review with practical applications for OBGYNs worldwide. Curr Obstet Gynecol Rep 2025;14(1).
[119] Petrini A, Pasternak M, Pfeifer SM. Obstructed Mullerian anomalies and endometriosis in the adolescent. In: Nezhat CH, editor. Endometriosis in adolescents: a comprehensive guide to diagnosis and management. Cham: Springer International Publishing; 2020. p. 273–87.
[120] Pitot MA, Bookwalter CA, Dudiak KM. Müllerian duct anomalies coincident with endometriosis: a review. Abdom Radiol (NY) 2020;45(6):1723–40.
[121] Shingala MR, Airao BB. A case report on ruptured rudimentary horn ectopic pregnancy. Int J Reprod Contracept Obstet Gynecol 2021;10(6):2504.
[122] Yadav S, Yadav I, Jyoti S, Lama P, Yadav R. Primigravida with hypovolemic shock secondary to ruptured rudimentary horn ectopic pregnancy: a case report. J Nepal Med Assoc 2024;62(274):404–6.