

Frequency of Congenital Uterine Anomalies in Women with Infertility

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Abstract: Congenital uterine anomalies are developmental malformations of the Müllerian ducts that may impair implantation, fertility, and subsequent obstetric outcomes. Their burden among infertile women remains underreported in local clinical settings, making routine uterine assessment an important component of infertility evaluation. **Objective:** To determine the frequency and types of congenital uterine anomalies among women presenting with infertility at a tertiary care hospital. **Methods:** This descriptive cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Lady Willingdon Hospital, Lahore, from June 2025 to August 2025. A total of 104 women of reproductive age presenting with primary or secondary infertility were enrolled through non-probability consecutive sampling. Women with other identifiable causes of infertility, including uterine fibroids, ovarian cysts, tubal blockage, male-factor infertility, previous uterine surgery, and significant systemic comorbidities, were excluded. Demographic and clinical data were collected using a structured proforma. All participants underwent two-dimensional transvaginal ultrasonography followed by hysterosalpingography for assessment of uterine morphology. Congenital uterine anomalies were classified according to the American Fertility Society classification system. Data were analyzed using SPSS version 25.0, and post-stratification analysis was performed using chi-square or Fisher's exact test, with $p \leq 0.05$ considered statistically significant. **Results:** The mean age of participants was 31.4 ± 6.2 years, and the mean BMI was 27.3 ± 5.1 kg/m². Primary infertility was observed in 62 women (59.6%), while 42 women (40.4%) had secondary infertility. The mean duration of infertility was 4.7 ± 3.1 years. Congenital uterine anomalies were identified in 7 women, giving an overall frequency of 6.73% (95% CI: 2.73%–13.31%). Septate uterus was the most common anomaly, observed in 3 affected women (42.9%), followed by bicornuate uterus in 2 (28.6%), arcuate uterus in 1 (14.3%), and unicornuate uterus in 1 (14.3%). Among women with congenital uterine anomalies, primary infertility was more common than secondary infertility (71.4% vs. 28.6%), although this association was not statistically significant ($p=0.699$). Family history showed a significant association with congenital uterine anomalies, with a higher frequency among women with positive family history than those without it (21.1% vs. 3.5%; $p=0.020$). **Conclusion:** Congenital uterine anomalies were present in a clinically meaningful proportion of infertile women, with septate uterus being the most frequent anomaly. A positive family history was significantly associated with congenital uterine anomalies. These findings support the integration of routine uterine structural assessment into infertility workup to facilitate early diagnosis, counseling, and timely management of potentially correctable anomalies.

Keywords: Infertility, Uterine Abnormalities, Müllerian Ducts, Septate Uterus, Hysterosalpingography, Ultrasonography

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Introduction

Congenital uterine anomalies (CUAs), also referred to as Müllerian duct anomalies, comprise a heterogeneous group of structural malformations of the female reproductive tract that occur due to abnormal development, fusion, canalization, or resorption of the Müllerian ducts during embryogenesis (1). Under normal developmental conditions, the paired Müllerian ducts fuse to form the uterus, cervix, and upper two-thirds of the vagina; disruption at any stage of this process may result in a wide spectrum of uterine abnormalities, ranging from minor fundal contour variations to complex uterine malformations (2,3).

CUAs are clinically important because they may adversely affect reproductive performance and obstetric outcomes. Women with these anomalies have been reported to experience higher rates of infertility, recurrent pregnancy loss, preterm labor, fetal malpresentation, intrauterine growth restriction, premature rupture of membranes, fetal loss, and cesarean delivery (4,5,6). The reproductive impact varies according to the type and severity of the anomaly. Septate uterus is commonly associated with impaired implantation and early pregnancy loss, while unicornuate uterus has been linked with ectopic pregnancy, intrauterine growth restriction, and preterm birth (8,9). Other recognized anomalies include arcuate, bicornuate, didelphys, and unicornuate uterus, as described in established classification systems (7).

The reported frequency of CUAs varies considerably across populations because of differences in study design, clinical setting, diagnostic criteria, and imaging modality (10). In the general female population, the prevalence has been reported between 1% and 10%, whereas among infertile women it ranges from approximately 2% to 8%. A higher prevalence, ranging from 5% to 30%, has been described among women with recurrent miscarriage (11–13). This wide variation highlights the diagnostic challenges associated with CUAs and emphasizes the need for standardized assessment using reliable imaging techniques such as transvaginal ultrasonography, hysterosalpingography, hysteroscopy, laparoscopy, magnetic resonance imaging, and three-dimensional ultrasonography.

In routine infertility evaluation, uterine structural abnormalities may remain underdiagnosed, particularly in resource-limited settings where advanced imaging facilities are not always available. Many women with CUAs are asymptomatic and may present only after delayed conception, recurrent pregnancy loss, or adverse obstetric outcomes. Early detection is clinically relevant because selected anomalies, particularly septate uterus, may be amenable to corrective intervention and improved reproductive outcomes following appropriate management (11).

Local data regarding the burden and pattern of congenital uterine anomalies among infertile women in Pakistan remain limited. International estimates may not be directly generalizable to the Pakistani population because reproductive health outcomes are influenced by

genetic, demographic, sociocultural, environmental, and healthcare-related factors. Determining the local frequency and distribution of CUAs is therefore essential for improving infertility workup protocols, guiding timely referral, and supporting evidence-based counseling. This study was conducted to determine the frequency and types of congenital uterine anomalies among women presenting with infertility at a tertiary care hospital.

Methodology

This descriptive cross-sectional study was conducted in the Department of Obstetrics and Gynaecology, Lady Willingdon Hospital, Lahore, from June 2025 to August 2025. A total of 104 women presenting with infertility were enrolled using a non-probability consecutive sampling technique after fulfillment of the eligibility criteria. Women of reproductive age with primary or secondary infertility were included. Participants with other identifiable causes of infertility, including uterine fibroids, ovarian cysts, tubal blockage, male-factor infertility, previous uterine surgery, or significant medical comorbidities such as diabetes mellitus, hypertension, chronic liver disease, or renal disease, were excluded from the study.

The sample size of 104 participants was calculated using a 95% confidence level and 5% margin of error, taking the expected frequency of congenital uterine anomalies among infertile women as 7.3%. The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants before enrollment, and confidentiality of participant information was maintained throughout the study.

After recruitment, detailed demographic and clinical information was recorded on a structured proforma, including age, body mass index, type of infertility, duration of infertility, residence, and family history of congenital anomalies. A complete general physical, abdominal, and pelvic examination was performed for each participant. Semen analysis of the husband was reviewed as a prerequisite to exclude male-factor infertility.

All enrolled women underwent two-dimensional transvaginal ultrasonography, followed by hysterosalpingography for the assessment of uterine morphology. Transvaginal ultrasonography was performed using a conventional B-mode ultrasound machine with a 7.5 MHz transvaginal probe. The longitudinal axis of the uterus from the isthmus to the fundus was assessed first, followed by serial transverse sections from the internal cervical os to the uterine fundus to evaluate endometrial

echoes and structural uterine abnormalities. Hysterosalpingography was performed during the follicular phase of the menstrual cycle under fluoroscopic guidance using an iodinated water-soluble contrast medium. Initial and serial radiographs were obtained after the injection of approximately 3–4 mL of contrast material. The final diagnosis of congenital uterine anomaly was made using combined ultrasonographic and hysterosalpingographic findings.

Congenital uterine anomalies were classified according to the American Fertility Society classification system. Septate uterus was diagnosed on the basis of an intercornual distance of less than 4 cm, intercornual angle of less than 60°, and absence of fundal indentation between the horns on ultrasonography. Bicornuate uterus was defined by an intercornual distance greater than 4 cm, intercornual angle greater than 60°, and the presence of fundal indentation between the horns. Didelphys uterus was identified by widely separated uterine horns with two uterine cavities and two cervices. Arcuate uterus was diagnosed when a concave fundal indentation was present with an obtuse central indentation angle and a uniformly convex external fundal contour or external indentation of less than 10 mm.

Data were entered and analyzed using SPSS version 25.0. Quantitative variables, including age, BMI, and duration of infertility, were presented as mean ± standard deviation. Categorical variables, including type of infertility, BMI category, family history, and presence and type of congenital uterine anomaly, were expressed as frequencies and percentages. Data were stratified by age group, BMI category, type of infertility, residence, and family history. Post-stratification chi-square test or Fisher’s exact test was applied where appropriate. A p-value of ≤0.05 was considered statistically significant.

Results

A total of 104 women with infertility were included in the final analysis. The mean age of participants was 31.4 ± 6.2 years, with a median age of 30 years and an age range of 20–49 years. Most women were aged 25–34 years (n=60, 57.7%). The mean body mass index (BMI) was 27.3 ± 5.1 kg/m². Overall, 38 participants (36.5%) were overweight and 32 (30.8%) were obese. Primary infertility was more frequent than secondary infertility, observed in 62 women (59.6%) and 42 women (40.4%), respectively. The mean duration of infertility was 4.7 ± 3.1 years, and the largest proportion of participants had infertility for 3–4 years (n=32, 30.8%) (Table 1).

Table 1. Baseline demographic and clinical characteristics of study participants (n=104)

Variable	Category	Frequency (n)	Percentage (%)
Age group, years	20–24	12	11.5
	25–29	31	29.8
	30–34	29	27.9
	35–39	18	17.3
	40–44	10	9.6
	45–49	4	3.8
BMI category, kg/m²	Underweight (<18.5)	6	5.8
	Normal weight (18.5–24.9)	28	26.9
	Overweight (25.0–29.9)	38	36.5
	Obese class I (30.0–34.9)	22	21.2
	Obese class II (≥35.0)	10	9.6
Type of infertility	Primary infertility	62	59.6
	Secondary infertility	42	40.4
Duration of infertility, years	1–2	18	17.3
	3–4	32	30.8
	5–6	24	23.1
	7–8	16	15.4
	9–10	9	8.7
	>10	5	4.8

Congenital uterine anomalies were detected in 7 of 104 women, giving an overall frequency of 6.73% (95% CI: 2.73%–13.31%). Septate uterus was the most frequently identified anomaly, present in 3 of 7

affected women (42.9%), followed by bicornuate uterus in 2 women (28.6%). Arcuate uterus and unicornuate uterus were observed in 1 woman each (14.3%) (Table 2).

Table 2a. Frequency and types of congenital uterine anomalies

Parameter	Frequency (n)	Percentage (%)
Total study participants	104	100.0
Congenital uterine anomaly present	7	6.73
Congenital uterine anomaly absent	97	93.27

Table 2 b: Type of anomaly among affected women

Type of anomaly	Frequency (n=7)	Percentage (%)	AFS classification
Septate uterus	3	42.9	Class V
Bicornuate uterus	2	28.6	Class IV
Arcuate uterus	1	14.3	Class VI
Unicornuate uterus	1	14.3	Class II

Among women with congenital uterine anomalies, primary infertility was more common than secondary infertility. Of the 7 affected women, 5 (71.4%) had primary infertility and 2 (28.6%) had

secondary infertility. However, the association between infertility type and the presence of congenital uterine anomalies was not statistically significant (p=0.699) (Table 3).

Table 3. Distribution of congenital uterine anomalies according to type of infertility

Type of infertility	Total participants, n (%)	CUA present, n (%)	CUA absent, n (%)	p-value
Primary infertility	62 (59.6)	5 (8.1)	57 (91.9)	0.699
Secondary infertility	42 (40.4)	2 (4.8)	40 (95.2)	
Total	104 (100.0)	7 (6.7)	97 (93.3)	

CUA = congenital uterine anomaly.

The duration of infertility ranged from 1 to 18 years. Women with congenital uterine anomalies had a longer mean duration of infertility than the overall cohort (6.1 ± 3.4 years vs. 4.7 ± 3.1 years), but this

difference was not statistically significant (p=0.180). Most CUA cases were observed among women with infertility duration of 5–6 years (n=3, 42.9%) and 7–8 years (n=2, 28.6%) (Table 4).

Table 4. Duration of infertility and congenital uterine anomaly status

Duration of infertility, years	Total participants, n (%)	CUA present, n (%)
1–2	18 (17.3)	0 (0.0)
3–4	32 (30.8)	1 (14.3)
5–6	24 (23.1)	3 (42.9)
7–8	16 (15.4)	2 (28.6)
9–10	9 (8.7)	1 (14.3)
>10	5 (4.8)	0 (0.0)
Total	104 (100.0)	7 (100.0)

On post-stratification analysis, family history was significantly associated with the presence of congenital uterine anomalies. Women with a positive family history had a higher frequency of CUA than

those without a family history (21.1% vs. 3.5%; p=0.020). No statistically significant association was observed between CUA and BMI category (p=0.857) or type of infertility (p=0.699) (Table 5).

Table 5. Post-stratification analysis of factors associated with congenital uterine anomalies

Stratification variable	Category	Total n (%)	CUA present n (%)	CUA absent n (%)	p-value
BMI category	Underweight	6 (5.8)	0 (0.0)	6 (100.0)	0.857
	Normal weight	28 (26.9)	1 (3.6)	27 (96.4)	
	Overweight	38 (36.5)	3 (7.9)	35 (92.1)	
	Obese class I	22 (21.2)	2 (9.1)	20 (90.9)	
	Obese class II	10 (9.6)	1 (10.0)	9 (90.0)	
Type of infertility	Primary infertility	62 (59.6)	5 (8.1)	57 (91.9)	0.699
	Secondary infertility	42 (40.4)	2 (4.8)	40 (95.2)	
Family history	Positive	19 (18.3)	4 (21.1)	15 (78.9)	0.020
	Negative	85 (81.7)	3 (3.5)	82 (96.5)	

CUA = congenital uterine anomaly.

Discussion

The present study identified congenital uterine anomalies in 6.73% of women presenting with infertility at a tertiary care hospital. This finding falls within the range reported in previous studies involving infertile

populations and supports the clinical relevance of structural uterine assessment during infertility evaluation. Bhatt et al. reported a prevalence of 7.5% among infertile women in a prospective evaluation, which is comparable to the present findings (17). Similarly, Chan et al., in a large systematic review and meta-analysis, reported a prevalence of 5.5%

among infertile women, with a higher prevalence among women with recurrent pregnancy loss (18). The similarity between the present results and previously published data suggests that CUAs represent a consistent but often under-recognized contributor to female infertility.

The prevalence of CUAs varies substantially across studies because of differences in population selection, diagnostic modality, and classification criteria. Studies based on hysteroscopy, hysterosalpingography, transvaginal ultrasonography, or three-dimensional ultrasonography may report different detection rates because each modality has specific strengths and limitations (19). In the present study, congenital anomalies were diagnosed using combined findings of two-dimensional transvaginal ultrasonography and hysterosalpingography. Although this approach is practical in many tertiary care settings, more advanced modalities such as three-dimensional ultrasonography or magnetic resonance imaging may provide greater anatomical precision, particularly for differentiating septate and bicornuate uterus.

In the current study, septate uterus was the most frequently detected anomaly, accounting for 42.9% of all CUAs, followed by bicornuate uterus in 28.6% of affected women. Arcuate and unicornuate uterus were less frequent. These findings are consistent with the broader literature indicating that septate uterus is one of the most common congenital uterine anomalies associated with reproductive impairment. Pervaiz et al. reported uterine structural abnormalities among women with persistent miscarriages and highlighted the clinical importance of identifying both congenital and acquired uterine causes of reproductive failure (20). Similarly, Sutan et al. documented different patterns of congenital uterine anomalies and demonstrated their association with adverse obstetric outcomes, including preterm birth, cesarean delivery, and low birth weight (21). The absence of more complex anomalies such as uterus didelphys in the present study may be related to the modest sample size and single-center design.

Primary infertility was more common than secondary infertility in the overall cohort and among women with CUAs. In the present study, 71.4% of women with congenital uterine anomalies had primary infertility, while 28.6% had secondary infertility. This finding is comparable with previous evidence suggesting a higher proportion of uterine anomalies among women presenting with primary infertility (22). The predominance of primary infertility may reflect the adverse effect of uterine structural abnormalities on implantation and early reproductive success. However, the association between infertility type and CUA presence was not statistically significant in this study, which may be due to the small number of women diagnosed with CUAs.

The mean age of the study participants was 31.4 ± 6.2 years, which reflects the usual reproductive age group seeking infertility evaluation in tertiary care settings. BMI analysis showed that a considerable proportion of participants were overweight or obese. Excess body weight has been associated with menstrual irregularity, ovulatory dysfunction, metabolic disturbance, and reduced fertility potential (23). However, no statistically significant association was observed between BMI category and congenital uterine anomalies in the present study. This finding is biologically plausible because CUAs originate from embryological disturbances in Müllerian duct development rather than acquired metabolic or anthropometric factors (24,25). Therefore, while BMI remains an important determinant of overall reproductive health, it does not appear to be an independent predictor of congenital uterine structural anomalies in this cohort.

Family history was the only variable significantly associated with the presence of congenital uterine anomalies. Women with a positive family history had a higher frequency of CUAs compared with those without such history. This observation supports the possible familial or genetic contribution to Müllerian duct developmental abnormalities and emphasizes the importance of detailed family history during infertility assessment (26). Although this association was statistically significant, it should be interpreted cautiously because only seven women in the study were diagnosed with CUAs. Larger multicenter studies are needed to

validate this association and to explore whether familial clustering, consanguinity, or genetic predisposition contributes to the burden of CUAs in the local population.

Overall, this study highlights that congenital uterine anomalies are present in a clinically meaningful proportion of infertile women. Septate uterus was the predominant anomaly, primary infertility was the most common infertility pattern among affected women, and family history showed a significant association with CUA presence. These findings reinforce the need for systematic uterine structural evaluation as part of infertility workup, particularly in tertiary care settings where early diagnosis may guide timely counseling and appropriate intervention. However, the interpretation of these findings should consider the limitations of a single-center design, relatively small sample size, and reliance on two-dimensional ultrasonography with hysterosalpingography rather than universal confirmation by three-dimensional imaging, hysteroscopy, or magnetic resonance imaging.

Conclusion

This study demonstrated that congenital uterine anomalies were present in a clinically meaningful proportion of women presenting with infertility, with septate uterus being the most frequently identified anomaly. Primary infertility was the predominant presentation among affected women, and a positive family history showed a significant association with the presence of congenital uterine anomalies. These findings highlight the need for routine structural assessment of the uterus as an integral part of infertility evaluation. Early identification of correctable anomalies, particularly septate uterus, may support timely counseling, appropriate referral, and improved reproductive outcomes in infertile women.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-LDYRHADA-99-24)

Consent for publication

Approved

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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

IK (Postgraduate Resident)

Manuscript drafting, Study Design,

RW (Assistant Professor)

Review of Literature, Data entry, Data analysis, and drafting articles.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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