Prevalence of Uterine Anomalies in Relation with Radiological Anatomy among Patients Attending Tertiary Care Centre

Azhagiri R.[1], M. Anitha[2], Hemapriya J.[3]

Abstract

Introduction: Uterine anomalies arise due to malformation in the Mullerian duct development. These anomalies were often asymptomatic and unrecognized, also increases the risk of adverse pregnancy outcome like infertility, recurrent pregnancy loss, preterm delivery, amenorrhea, pain and fetal malpresentation. Many of these malformations were detected by radiologic or sonographic studies. *Materials and Methods:* Observational study includes 150 women between 18-35 yrs with gynecological problem in a tertiary care hospital in Kancheepuram district over a period of 1 year from January 2017 to January 2018. Pelvic imaging of study subjects with transabdominal and transvaginal ultrasound was performed as per the standard procedure. *Results:* Among 150 patients 75 had the complaint of primary infertility, 71 had primary amenorrhea and 4 came with frequent miscarriage. Out of 150 study subjects who underwent 2D ultrasonography, 69 showed uterine anomalies. Overall prevalence of anomalies was 46%, of which frequency of septate form of anomalies was maximum (45%), followed by Bicornuate uterus (17%), arcuate uterus (16%), didelphic uterus (13%), unicornuate uterus (4.3%), and subseptate uterus (4.3%). *Conclusion:* Actual prevalence with correct assessment of anomalies using radiological anatomy will help to differentiate uterine anomalies and thereby suggest a right therapeutic option.

Keywords: Reproductive Problems; Prevalence; Uterine Anomalies; Radiological Anatomy.

Introduction

Anatomical abnormalities of female genital tract can be classified as congenital (disorders of mullerian tract) and acquired (adhesions, cervical incompetence, polyps, and uterine myomas). Although some anomalies may have little to no effect on pregnancy outcome, others may cause recurrent pregnancy loss**.** Hence, prevalence of anatomical abnormalities in patients with repeated miscarriages is high, ranging from 6.3% to 67%, depending on the type of the study and the study population [1].

Of all mullerian anomalies, those involving the uterus are most commonly implicated in causing poor obstetric outcomes. Uterine anomalies are a defect from normal anatomy of the uterus with estimated prevalence of 4–7% among general population and even higher in selected populations such as recurrent aborters. Presentation of uterine anomaly is reported as one of the main reason for recurrent abortion [2,3].

Uterine anomalies are associated with diminished cavity size, insufficient musculature, impaired ability to distend, abnormal myometrial and cervical function, inadequate vascularity, and abnormal endometrial development. These abnormalities of uterine space, vascular supply, and associated local defects contribute to increased rates of recurrent pregnancy loss, preterm delivery, and malpresentation associated with uterine anomalies [4].

A classification of the Müllerian anomalies was introduced in 1980 and, with few modifications, was adopted by the American Fertility Society (currently, ASRM). The Society identified seven basic groups according to Müllerian development and their relationship to fertility: agenesis and hypoplasia, unicornuate uteri (unilateral hypoplasia), didelphys uteri (complete nonfusion), bicornuate uteri (incomplete fusion), septate uteri (nonreabsorption of septum), arcuate uteri (almost complete reabsorption of septum), and anomalies related to DES syndrome[5].

Author's Affiliation: [1]Assistant Professor [3]Tutor, Department of Anatomy, ESIC Medical College & PGIMSR, KK Nagar, Chennai, Tamil Nadu 600078 Dr. MGR Medical University, Chennai, India. [2]Lecturer, Department of Microbiology, Shri Sathya Sai Medical College & Research Institute, Ammapettai, Tamil Nadu 603108, India.

Corresponding Author: Azhagiri R., Assistant Professor, Department of Anatomy, ESIC Medical college & PGIMSR, KK Nagar, Chennai, Tamil Nadu 600078, India.
E-mail: drazhagirir@gmail.com

These anomalies were often asymptomatic and unrecognized, but reported in 2–4% among normal reproductive age women [2,3,4,6] and up to 5–25% in women with adverse reproductive outcomes [6,7]. Presence of anomalies increases the risk of adverse pregnancy outcome like infertility [2] recurrent pregnancy loss [8] preterm delivery [9] amenorrhea, pain and fetal malpresentation [10].

Usually diagnosis of Mullerian duct abnormality is diagnosed when the female fails to attain menarche and fails to conceive after marriage. Due to their high prevalence, diagnosis of MDAs and their sub type identification is important for management and therapeutic decision-making of these structural anomalies [11].

Imaging plays an essential role in diagnosis of these conditions. Many of these malformations were detected by radiologic or sonographic studies. 2D ultrasonography remains a baseline procedure in detecting malformations. MRI was considered the preferred modality due to its multiplanar capabilities as well as its ability to evaluate the uterine contour, junctional zone, and other pelvic anatomy [12,13]. Compared to *MRI* 2D US method has the additional advantage of offering a better imaging of the uterine cavity, thus enhancing the accuracy in identifying the anatomy of the female genital tract and especially that of the uterus [14].

Hence, careful understanding of uterine anatomy using sonographic imaging will improve the detection of these anomalies, which could play an important role in recognizing and managing the obstetric and gynecological impediments. Hence our study was undertaken to assess the morphology of uterus using 2D Ultrasonography and evaluate the anomalies.

Materials and Methods

Inclusion Criteria

- Age Group: 18- 35 years Females
- Females with gynecological problem (primary infertility, primary amenorrhea and frequent miscarriage)
- No previous history of Hysterectomy

Exclusion Criteria

- Patients known to have sexually transmitted diseases,
- Pelvic inflammatory diseases
- Genetic anomalies

This observational study involved the prospective recruitment of women referred to a tertiary care center for the assessment and treatment of gynaecological problems. The study was carried out in a Tertiary care hospital in Kancheepuram district over a period of 1 year from January 2017 to January 2018. A total of 150 women were included in the study. The study was conducted after getting approval from Institutional ethics committee and the patients were informed about complete details of imaging procedure and their safety measures. A written informed consent was obtained from each subject before performing the technique.

All the study subjects underwent a radiologic and operative diagnostic workup using 2D trans abdominal and transvaginal ultrasonography. Pelvic imaging with transabdominal and transvaginal ultrasound was performed as per the standard procedure [3].

As our study population include both married and unmarried women, 2D trans abdominal as well as transvaginal ultrasonography procedure was carried out only for married women whereas unmarried women underwent only transabdominal ultrasonography.

Sampling technique adapted for the study was Complete Enumeration Method, Ultrasonography images were collected from Radiology Department, these images evaluated anatomically and as per American Fertility Society (AFS) established in 1988 [5]. Data were analysed and compiled statistically.

Results

A total of 150 patients with the complaint of primary infertility (75), primary amenorrhea (69) and frequent miscarriage (6) were included in this study. Out of 150 study subjects who underwent 2D ultrasonography, 69 showed uterine anomalies including septate uterus, Bicornuate, arcuate, didelphic, unicornuate, and subseptate uterus.

Out of 69 cases of Mullerian duct anomalies examined by ultrasonography, 50 (72.4%) patients presented with primary infertility, 15 (21.7%) with primary amenorrhea and 4 (5.7%) had the history of recurrent miscarriage.

Overall prevalence of anomalies was 46%, of which frequency of septate (Figure 2) anomalies was maximum (45%), followed by Bicornuate (17%) (Figure 3), arcuate (16%), didelphic (13%), unicornuate (4.3%), and subseptate (4.3%) (Table 1).

Number of patients with different gynecological problems and the corresponding uterine anomaly types were as follows. Among 50 primary infertility cases with uterine anomalies 26 was examined with septate uterus, 10 with bicornuate uterus, 5 with arcuate uterus, 6 with didelphic uterus and 3 with unicornuate uterus. Of 15 primary amenorrhea patients, 5 showed septate uterus on examination followed by 6 arcuate uterus, 1 didelphic uterus and 3 subseptate uterus. (Table 2, 3 & 4).

Bicornuate uterus and septate uterus type of anomalies were seen among 4 frequent miscarriage cases. Two cases with bicornuate uterus and two cases with septate uterus was found to have recurrent miscarriage during first trimester of pregnancy. Uterine anomalies with respect to period of miscarriage was depicted in (Fig 3 & Table 5).

Table 1: Distribution of uterine anomalies by 2D ultrasonography

Uterine anomalies	Number of cases	Percentage%
Septate uterus	31	45
Bicornuate uterus	12	17
Arcuate uterus	11	16
Didelphic uterus	9	13
Unicornuate uterus	3	4.3
Subseptate uterus	3	4.3
Total	69	100

Table 2: Number of patients with primary infertility and type of uterine anomalies present

Uterine anomalies	Primary Infertility
Septate uterus	26
Bicornuate uterus	10
Arcuate uterus	5
Didelphic uterus	6
Unicornuate uterus	3
Subseptate uterus	-
Total - 69 (100%)	50(72.4%)

Table 3: Number of patients with primary amenorrhea and type of uterine anomalies present

Uterine anomalies	Primary amenorrhea
Septate uterus	5
Bicornuate uterus	6
Arcuate uterus	-
Didelphic uterus	1
Unicornuate uterus	-
Subseptate uterus	3
Total - 69 (100%)	15(21.7%)

Table 4: Number of patients with recurrent miscarriage and type of uterine anomalies present

Uterine anomalies	Recurrent miscarriage
Septate uterus	2
Bicornuate uterus	2
Arcuate uterus	-
Didelphic uterus	-
Unicornuate uterus	-
Subseptate uterus	-
Total - 69 (100%)	4 (5.7%)

Table 5: Uterine anomalies in relation to recurrent miscarriage

Type of Uterine anomalies	No of recurrent miscarriages	10-13 weeks	15 -20 weeks
Septate uterus	2	1	1
Bicornuate uterus	2	0	2

Fig. 1: Arrow depicts the Septate uterus

Fig. 2: Picture shows Bicornuate uterus
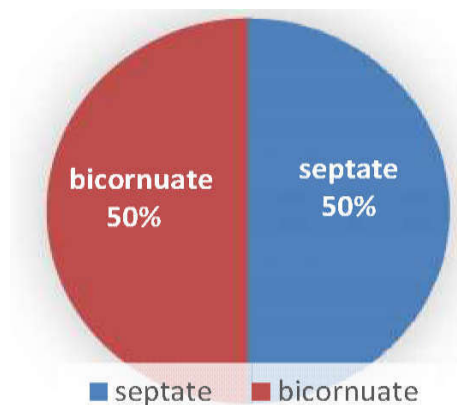
Fig. 3: Prevalence of Uterine Anamolies vs Miscarriage

Discussion

Normal Anatomy of Uterus

The uterus is a hollow, pear shaped, thick-walled and muscular organ, normally situated in the lesser pelvis between the urinary bladder and the rectum. The uterus is divided into two main regions – the body – corpus uteri – forms the upper two thirds, and the cervix – cervix uteri - forms the lower third. The uterine tubes are attached to the upper part of the body of uterus with their ostia opening into the lumen [15].

Embryology: Uterine Development

Embryologically, the uterus, fallopian tubes and upper one third of vagina develops from the paramesonephric (Mullerian) ducts. The cranial part of the paramesonephric ducts forms the uterine tubes, and the coelomic invagination remains as the pelvic opening of the fallopian tube. The caudal part of two mullerian ducts fuses to form the uterovaginal primordium, from which uterus and upper one third of vagina develops [16].

The uterus is formed at around 8–16 weeks of fetal life from the development of the two paired paramesonephric ducts, called Mullerian ducts. The process involves three main stages [3,17].

- Organogenesis of mullerian ducts, fusion and septal resorption are the three phases which aid in the normal development of the female reproductive tract from the paramesonephric ducts.

- *Fusion*: the lower Mullerian ducts fuse to form the upper vagina, cervix and uterus; this is termed lateral fusion. The upper cranial part of the Mullerian ducts will remain unfused and form the Fallopian tubes.

- *Septal absorption*: after the lower Mullerian ducts fuse, a central septum is left which starts to resorb at 9 weeks eventually leaving a single uterine cavity and cervix.

The various Mullerian anomalies are the consequence of 4 major disturbances in the development of the female genital system during the fetal life [11].

- Failure of one or more mullerian duct to develop (agenesis, unicornuate uterus without rudimentary horn).

- Failure of the ducts to canalize (Unicornuate uterus with rudimentary horn without proper cavities).

- Failure to fuse or abnormal fusion of the ducts (Uterus didelphys, bicornuate uterus)

- Failure of resorption of the midline uterine septum (Septate uterus, arcuate uterus).

In our study population, prevalence of *primary infertility* with MDAs was 72.4%, this is high when compared to other studies where 25% of infertility among MDAs was reported by Krishna Pratap Singh Sengeret al., [18] and human reproduction update 2011 by Chan et al., [3] reported only 8% of infertility cases. This could be due to small sample size where human reproduction updates 2011[3] analysed about 89,861 cases.

Our study revealed 21.7% of MDAs patients with *primary amenorrhea* which is less when compared to study done by Rao and Pillai [19] who performed a study with a sample size of 40 to evaluate causes of primary amenorrhea and found a prevalence of MDAs of 50%. Another study done by Kumar and Mittal[20] on a study sample of 48 patients to evaluate etiological factors for primary amenorrhea has revealed prevalence of MDAs as 54.2% in their study population.

Recurrent miscarriage with MDAs in our study was 5.7%. In contrast to our study 37.5% of recurrent abortions/miscarriages were reported by Krishna Pratap Singh Senger et al., [18] and prevalence of 13.3% was mentioned in Human Reproduction Update 2011 [3].

The data in this study suggested a high prevalence of uterine anomalies (46%), which is found to be quite higher than the other reports [3,18].

Among our study subjects 46% had *Septate uterus*, whereas Francisco Raga et al., in 1997 [21] showed an incidence of 33.6% of septate uterus, and 35% was observed by Grigoris F. Grimbizis et al., in 2001 [22] and Braun P. et al., in 2005 [17] reported 24.3%, while Saravelos S.H. [23] in his review in 2008 found the dominance of septate uterus in infertile women.

Second most common anomaly was *Bicornuate uterus* 17% in the current study. Grigoris F. Grimbizis et al. [22] reported a mean incidence of 25% of bicornuate uterus and Braun P. et al., [17] in retrospective study stated incidence of 13.6% of bicornuate uterus.

In the current study arcuate uteruswas third most common anomaly accounting for 16%. Similarly to our study a mean incidence of 20% was reported by Grigoris F. Grimbizis et al., in 2001 [22] , whereas Francisco Raga et al., in 1997 [21] reported higher incidence of 32.8%.

Present study revealed equal prevalence of unicornuate and substrate uterus (4.3%). Similar incidence of 4.5% of unicornuate uterus was reportedby Braun P et al., [17], whereas 6.7% of prevalence was reported by Krishna Pratap Singh Senger et al.,[19].

Our study also reported 13% of didelphic uterus, didelphis (double uterus) Both Müllerian ducts develop but fail to fuse, and thus the patient has a "double uterus". Apart from high miscarriage rates and preterm deliveries, cases of didelphic uterus run the risk of Cesarean section for dystocia, and malpresentation [24].

Our study revealed 5.7% of recurrent miscarriage cases during first trimester of pregnancy with 2 septate uterus and 2 bicornuate uterus form of anomaly.

Dabirashrafi et al., Kupesic et al., [25,26] have found significantly more blood vessels in biopsy samples of the uterine septum, and Kupesic et al.,[26] found that patients with vascularized septum had significantly higher prevalence of early pregnancy failure and late pregnancy complications than those with avascularized septa. Our finding had similar report to that of Human Reproduction Update 2011 where their study showed common cause of recurrent abortions was septate uterus. Also, surgical correction of uterine septum was less morbid and easy. High prevalence of early pregnancy loss and late complications were more seen in vascularised septum. [3] Thus, embryos that do implant on the septum are more likely to miscarry as a result of this, possibly because the septum has a disorderly and decreased blood supply, which is insufficient to support subsequent placentation and embryo growth [27,28,29].

Similar to our study, Fedele and Bianchi et al.,[30] and Rock JA et al.,[31] confirms bicornuate uterus as a reproductive anomaly in pregnant women reported with frequent miscarriage. Excessive preterm delivery, retained placenta, malpresentation and miscarriage rates were characteristic in bicornuate uterus cases. This anomaly therefore requires extensive surgical repair. Women with bicornuate uterus have an increased risk of first trimester miscarriage, preterm birth and fetal malpresentation. Our finding was consistent with these previous studies [28,29,32].

Ultrasonography was considered as first imaging technique in evaluation of Mullerian duct anomalies among women. Ultrasonography is a simple and widely available option with no radiation risk and can be performed repeatedly.

Conclusion

Uterine anomalies being the most common anatomical variations causing numerous major gynecological and obstetrical problems such as consecutive abortions, infertility and primary amenorrhea among reproductive age group women, it becomes a great struggle for low socio economic status women to face it. 2D Ultrasonography being a noninvasive, easily feasible, cost effective procedure, most importantly has no radiation hazards and is thus suitable as first line of investigation. Hence 2D Ultrasonography has brought a revolution in diagnosing uterine anomalies for such low socioeconomic patients. The knowledge of the relationship by appropriate anatomical understanding of these anomalies using 2D imaging helps the gynecologist in early diagnosis and surgical treatment of uterine anomaly. Thereby preventing recurrent abortion in pregnancy and brings a boon in the life of many cases of infertility patients.

References

1. Stephenson M, Management of recurrent early pregnancy loss. J Reprod Med; 2006:51(4):303-310.

2. Grimbizis GF, Camus M, Tarlatzis BC, et al. Clinical implications of uterine malformations and hysteroscopic treatment results. Hum Reprod Update 2001;7:161–74.

3. Chan YY, Jayaprakasan K, Zamora J, et al. The prevalence of congenital uterine anomalies in unselected and high-risk populations: a systematic review. Hum Reprod Update 2011;17: 761–71.

4. W. Rackow and Aydin Arici, Reproductive performance of women with mullerian anomalies, Current Opinion in Obstetrics and Gynecology 2007, 19:229–37.

5. The American Fertility Society classiûcations of adnexal adhesions, distal tubal obstruction, tubal occlusion secondary to tubal ligation, tubal pregnancies, Mullerian anomalies and intrauterine adhesions. FertilSteril. 1988;49:944–55.

6. Acien P. Incidence of mullerian defects in fertile and infertile women. Hum Reprod 1997;12:1372–6.

7. Rackow BW, Arici A. Reproductive performance of women with mullerian anomalies. CurrOpin Obstet Gynecol 2007;19:229–37.

8. Tomazevic T, Ban-Frangez H, Ribic-Pucelj M, Premru-Srsen T, Verdenik I. Small uterine septum is an important risk variable for preterm birth. Eur J Obstet Gynecol Reprod Biol 2007;135:154–57.

9. Rock JA, Schlaff WD. The obstetric consequences of uterovaginal anomalies. FertilSteril 1985; 43:681–92.

10. Raga F, Bonilla MF, Blanes J. Congenital mullerian anomalies: diagnostic accuracy of three-dimensional ultrasound. FertilSteril. 1996;65:523-28.

11. Meiling Hua, Anthony Odibo O, Ryan E Longman, George A Macones, Kimberly A Roehl, Alison G Cahill. Congenital uterine anomalies and adverse pregnancy outcomes. MSCI American Journal of Obstetrics & Gynecology 2011 Dec;205(6):558.e1-558.e5.

12. Canzone G. 2D-3D USG in diagnosis of Uterine malformations. Donald School J of USG in Obs and Gynae. 2007;1(3):77-9.

13. Robbins JB, Parry JP, Guite KM. MRI of Pregnancy Related Issues: Mullerian Duct Anomalies. AJR. 2012;198:302-10.

14. Fedele L, Bianchi S, Marchini M, Franchi D, Tozzi L, Dorta M. Ultrastructural aspects of endometrium in infertile women with septate uterus. Fertil Steril 1996; 65:750–52.

15. Susan Standring, PhD; Gray's Anatomy, The Anatomical Basis of Clinical Practice; 40th ed.

16. T. L. Anbumani, S. Anthony Ammal, A. Thamarai Selvi, T. L. Selvakumari. A study on anatomical basis with embryological aspects and its clinical significance in south indian population, journal of evolution of med and dent sci, 2015 Mar 30;4(26): 4457-63.

17. Braun P., Grau F.V., Pons R.M., Enguix D.P.: Role of Hysterosalpingography in diagnosis of uterine malformations. Eur J. Radiol. 2005;53(2):274-9.

18. Senger KPS et al., Detection of Mullerian duct anomalies: Diagnostic utility of two dimensional ultrasonography as compared to Magnetic resonance imaging. International Journal of Reproduction, Contraception, Obstetrics and Gynecology Int J ReprodContraceptObstet Gynecol. 2017;6(1):20-28.

19. Rao K, Pillai NV. Primary amenorrhoea: analysis of 40 cases. J Indian Med Assoc. 1991;89(2):42-3.

20. Kumar S, Mittal S. Primary amenorrhea: analysis of 48 cases. J Indian Med Assoc. 1998;96(4):119-20.

21. Francisco Raga, Celia Bauset, Jose Remohi, Fernando BonillaMusoles, Carlos Simon, Antonio Pellicer. Reproductive Impact of Congenital Mullerian Anomalies. Human Reproduction 1997;12(10):2277–81.

22. Grigoris F. Grimbizis, Michel Camus, Basil C. Tarlatzis, John N. Bontis and Paul Devroey. Clinical Implications

of Uterine Malformations and Hysteroscopic Treatment Results. Human Reproduction Update 2001;7(2):161-74.

23. Saravelos SH, Cocksedge KA, Li T-C. Prevalence and diagnosis of congenital uterine anomalies in women with reproductive failure: a critical appraisal. Hum Reprod Update 2008;14:415–19.

24. F. Gary Cunningham, John C. Hauth, Kenneth J. Leveno, Larry Gilstrap III, Steven L. Bloom, MD, Katharine D. Wenstrom, Williams Obstetrics, 22nd Ed. 2005.pp.950-952.

25. Dabirashrafi H, Bahadori M, Mohammad K, Alavi M, Moghadami-Tabrizi N, Zandinejad K, Ghafari V. Septate uterus: new idea on the histologic features of the septum in this abnormal uterus. Am J Obstet Gynecol 1995;172:105–07.

26. Kupesic S. Clinical implications of sonographic detection of uterine anomalies for reproductive outcome. Ultrasound Obstet Gynecol 2001;18:387–400.

27. Candiani GB, Fedele L, Zamberletti D, De Virgiliis D, Carinelli S. Endometrial patterns in malformed uteri. Acta Eur Fertil 1983;14:311–18.

28. Homer HA, Li TC, Cooke ID. The septate uterus: a review of management and reproductive outcome. Fertil Steril 2000;73:1–14.

29. Rock JA, Murphy AA. Anatomic abnormalities. Clin Obstet Gynecol 1986;29:886–911.

30. Fedele L, Dorta M, Brioschi D. Magnetic resonance evaluation of double uteri. Obstet Gynecol. 1989;74: 844-7.

31. Rock JA. Surgery for anomalies of the mullerian ducts. Tompson JD, Rock JA, eds. TeLind's Operative Gynecology. 9th ed. Philadelphia, Pa: JB Lippincott Williams and Wilkins. 2003:705.

32. Heinonen PK, Saarikoski S, Pystynen P. Reproductive perfor- mance of women with uterine anomalies. An evaluation of 182 cases. Acta Obstet Gynecol Scand 1982; 61:157–62.