

Role of Ultrasonography in the Detection of Uterine Abnormalities in Infertile Female

Abdullahi Abubakar, Zakariya Bello, Syed Amir Gilani, Raham Bacha, Zareen Fatima, Syed Yousaf Gilani, Syeeda Khadija, Mehreen Fatima, Sarah Maryam, Maryam Zulfiqar Maoz Ahmad, Saadia Fatima, Ghulam Jillani, Rukhsar Majid.

University Institute of Radiological Science and Medical Imaging Technology (UIRSMIT).

Faculty of Allied Health Science (FAHS), the University of Lahore, Lahore, Pakistan

Mr.abdullahiabubakar1010@gmail.com

Abstract: Background: The ultrasound examination of uterine anomalies has become an important aspect of the infertility evaluation. For the diagnosis of uterine anomalies, a range of methods might be used. The reader will learn about the arcuate uterus, septate uterus, bicornuate uterus, didelphic uterus, uterus duplex, and unicornuate uterus through these case scenarios. The sequence of infertility that leads to congenital uterine abnormalities is also presented in this article. **Objective:** The goal of this study was to see how well ultrasonography could diagnose uterine diseases in infertile women using ultrasound as the gold standard. **Methodology:** From 2010 to 2021, a systematic literature search was undertaken for names or acronyms of Role of Ultrasonography on the detection of uterine anomalies in infertile women using the following search engines: Google scholar, Radiopaedia, PubMed, and NCBI databases. Only studies that illustrate the role of ultrasonography in the evaluation of uterine anomalies in infertile women were included in this review. A total of 105 studies were chosen, however only 30 were included following examination. All of the information gleaned from them was subjected to a meta-analysis. **Results:** provides the whole data from 30 evaluated studies, as well as the defined variables. The presence of uterine anomalies. A select few were chosen for additional investigation based on their significance. As calculated and shown in the descriptive statistics table below, how does the complete data of 18 screened studies based on the mean age among the study groups, where 21 years is the minimum age and 49 years is the maximum age, the range is 28, the mean is 29.6633, and the standard Deviation is 7.60667. **Conclusion:** Ultrasound is the preferred investigation for screening and detecting uterine defects since it is readily available, inexpensive, and non-radiation. Ultrasound may be used as an alternative method of detecting uterine abnormalities.

Keyword; ultrasound, pelvic uterine, infertility.

INTRODUCTION

Ultrasound is a gold standard in the evaluation of female uterine organ, using ultrasound also helps for the detection of uterine pathology in infertile female, also one of the most extensively utilized imaging technologies in medicine. The purpose of this study is to identify the similarities and differences among Role of Ultrasonography on the detection of uterine abnormalities in infertile female. Ultrasound is a type of imaging that creates tomographic images and collects data on biological organs¹. It has a number of features that make it the primary choice for soft tissue diagnostics². Infertility is inability of a couple to obtain clinically recognizable pregnancy after 12 months of unprotected intercourse³. Infertility affects 10–15 percent of couples, and the age of the female partner is the single most critical factor in determining prognosis⁴. Primary infertility those who have never conceived in the past and who have regular unprotected intercourse for 12 months⁵. Secondary infertility is inability to become pregnant, or to carry a pregnancy to term, following the birth of one or more biological children the birth of the first child does not involve any assisted reproductive technologies or infertility medication⁶. Ultrasound has the following advantages: it is portable, painless, and does not require needles or injections are less expensive, and there is no ionizing radiation, making it one of the safest methods for scanning female pelvic organ⁷. The abdominal pelvic cavity is continuous space containing the major organs of the abdomen⁸. Pelvic cavity is caudal portion of the abdomen- pelvic cavity extending from the iliac crests superiorly to the pelvic diaphragm inferiorly⁹. The uterus is anatomically divided into three parts - fundus, body, and cervix¹⁰. The bladder is located in the lesser pelvis anterior to the vagina and cervix and caudal to the antverted uterus and small bowel, the bladder is the most anterior organ in the lesser pelvis; although an expandable organ¹¹.



The body is the uterus above the cervix. Which consists of the bulk of the uterus? In an adult uterus the body is wider and longer than the cervix. About two third of uterine fundal to cervical length is attributable to the body¹⁶ The Cervix is the lower one-third of the uterus is referred to as the cervix. Rather than smooth muscle, it is mostly made up of fibroblastic components. The place where the corpus and the lexicon meet¹⁷. The internal os of the cervix is known as the internal os, and the opposite end of the cervix is known as the external os. The external os. Isthmus is the cervix's upper few millimetres. below the internal os, a section dedicated to the development of a certain function It has been described into the "lower portion" of the gravid uterus¹⁸. The endocervical canal is an aperture in the cervix. At one end, it is contiguous with and freely communicates with the uterine cavity, while at the other, it is contiguous with and freely communicates with the vaginal cavity. When the bladder expands and drapes over the urethra¹⁹,

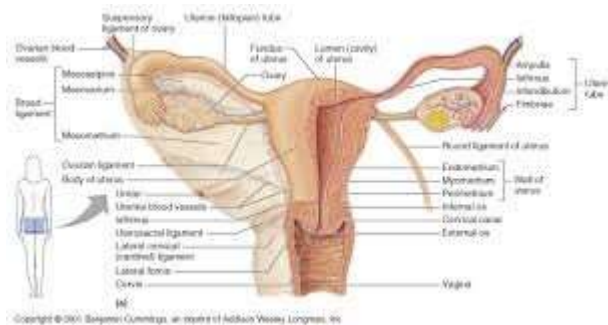
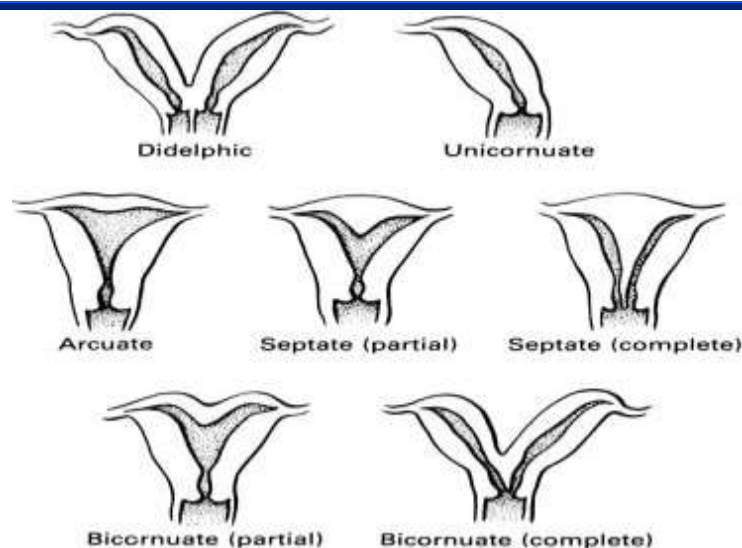


Figure 2-4 anatomy of the uterus

www.ijeais.org/ijamsr



Under development of the uterine tubes or any other portion of the uterus, as well as the uterus itself the vagina's cranial portion the uterus with only one fallopian tube and an asymmetric, smaller-than-normal fundus is known as a unicornuate uterus²⁵. The uterus arcuatus is a synonym. **Didelphys** Uterus didelphys describes complete duplication of the uterus including the cervix; frequently associated (75%) with a longitudinal septum of the vagina²⁶ **Bicornuate Uterus** A uterus with symmetric division of the fundus (bifid or forked fundus), with or without duplication of the cervical canal, is known as a bicornuate uterus²⁷. A bicornis bicollis uterus is a uterus that is bicornuate and has two cervicals. a system of canals (medial wall is common)²⁸. A bicornis uncollis uterus is a type of uterus. With a bicornuate shape and a regular cervix²⁹. **Septate uterus** is an abnormal uterus that has a muscle septum that divides the uterine cavity partially or completely without any serosal indentation of the fundus. Septate uteruses are three times as prevalent as bicornuate uteruses. The uterus is the female reproductive organ **Uterus Septus** A muscular septum divides the uterine cavity up to the internal os; the serosal surface of the fundus, the cervix, and the vagina are all normal. **Uterus Subseptus**³⁰ Uterus subseptus is a uterus with only partial separation of the uterine cavity by a partitioning septum; the cranial portion of the uterine cavity is separated by a muscular septum; the serosal surface of the fundus is normal; the lower portion of the body of the uterus, cervix and vagina are all normal³¹.

MATERIAL AND METHOD

Search Strategy

Systematic literature search was conducted by the help of following search engines: Google scholar, PubMed, NCBI, Medline and Medscape databases from 2010 up to 2021 for names Role of Ultrasonography on the detection of uterine abnormalities in infertile. Only those studies were included in this review study which show the Role of Ultrasonography on the detection of uterine abnormalities in infertile or the studies in which motion independent sequence was selected, that truly work on the physics of abnormalities.

Selection criteria

After independently screening the abstract and titles relevant articles, studies were included if they contain any related information of Role of Ultrasonography on the detection of uterine abnormalities in infertile use of propeller sequence in different anatomical regions and motion sensitive regions of body. Studies investigating both adults and children together were included. The minimum data set required was sample size, anatomical region of the body, technique, imaging indication, imaging time, presence of , image quality and pathology Detection. Data were extracted from the full journal article and studies were assessed for applicability and quality. Summary statistics were calculated from the raw data given in the study if they were not reported. Numbers were read from graphs if not reported in the text of the articles

Study Characteristics

A total of 82 original studies were found in the search, and twenty-two more were found by hand-searching reference lists and utilising the Web of Science cited reference tool. There are fourteen studies in total. Ultrasonography's role in the diagnosis of uterine anomalies in infertile women: a review of 10 studies Table 1 lists the studies that were considered. The majority of the participants in the experiments were youngsters, but some adults were also included. Observers interpreted three-dimensional ultrasound and magnetic resonance imaging side by side in certain small investigations. Observers were entirely blinded to the scanning sequence in all experiments except review articles. In the PRISMA flow chart, all omitted studies are listed. The data analysis in this review study was done using Microsoft Excel 2017 and the Statistical Package for the Social Sciences version 24 (SPSS 24, IBM, Armonk, NY, United States of America).

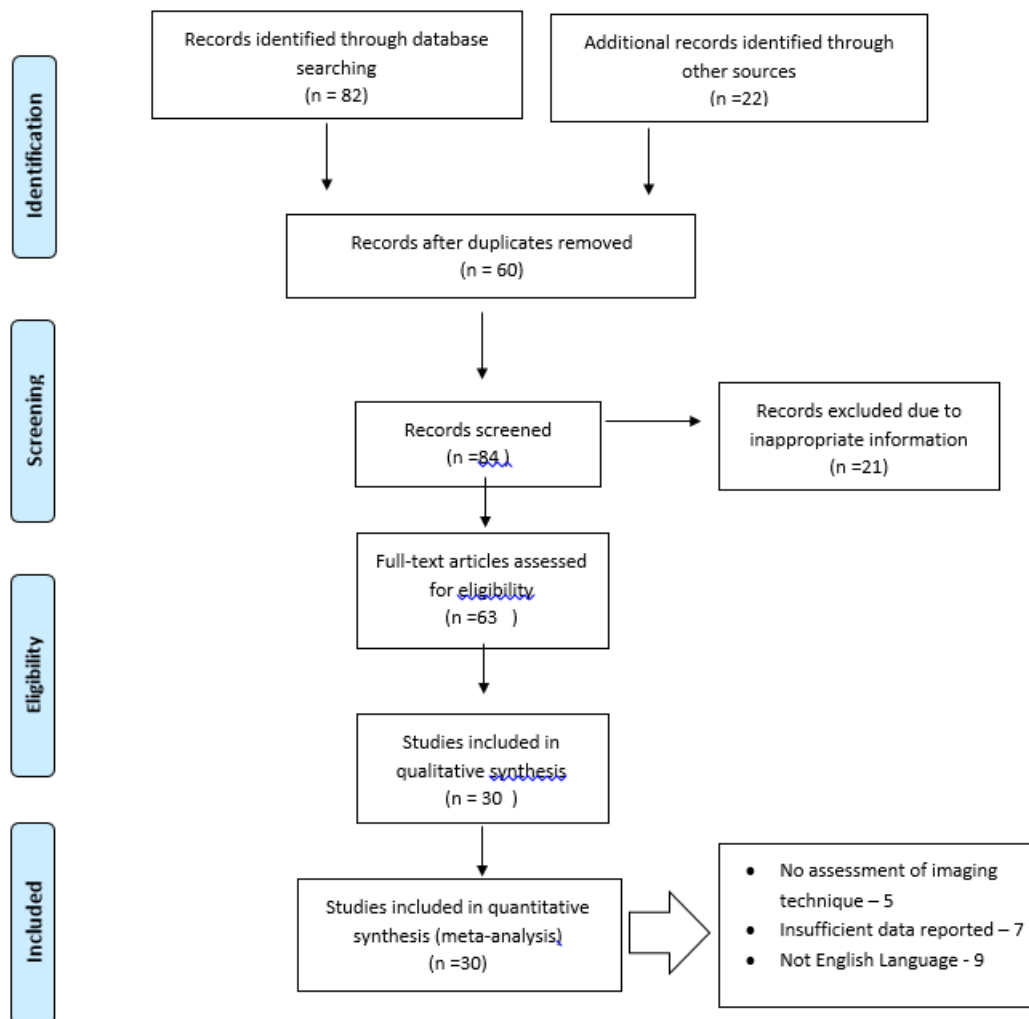
Data synthesis and analysis Procedure

The eligible studies were first categorized on the basis of descriptive statistics among 20 studies descriptive statistics was included in 18 studies only. The second important variable was imaging time which was included in 22 studies. The analysis of the data was performed according to the target conditions. After retrieving the sensitivity and specificity from each individual study a forest plot was formed as a graphical representation which was also shown in tabulated form in table 2. Descriptive analysis was performed.

ETHICAL CONSIDERATIONS

No ethical consideration is required for this type of study design

PRISMA Flow Diagram of literature searched



| STUDY | Y E A R | RESEARCHER | JOURNAL | TYP E O F ART IC L E | S A M P L E S I Z E | M E A N A G E | G E N D E R | ANAT OMIC AL REGIO N | No.OF UTERI NE ANOM ALIES [%] |
|---|------------------|----------------------------|---|---|--|---------------------------------|----------------------------|----------------------------------|---|
| Prevalence of Congenital Anomalies of Uterus in Sohag Government: A Descriptive Study by Trans-Vaginal Three-dimensional Ultrasound | 2019 | SALWA MO et al | Medical Journal of Cairo University | Original research | 977 | N/A | 977 F | Uterus | 17.3 |
| Ultrasound Role in Management of Female Infertility | 2020 | MAYSA S. ELKERDAWY, et al. | Medical Journal of Cairo University | Original research | 100 | 30.5 | N/A | Uterus | 60 |
| Mullerian anomalies and value of diagnosis with 2D ultrasonography | 2018 | Sahin C, Hortu I, Cirpan T | Journal of Clinical and Analytical Medicine | Original research | 82 | 14 - 53 | 82 F | Uterus | 67.9 |
| Pregnancy in uterus didelphys delivered by caesarean section: a case report | 2017 | Sawai D, Sharma SK, et al. | International Journal of Reproduction, Contraception, Obstetrics and Gynecology | Case study | 1 | 23 | 1 F | Uterus | 0.1 -10 |
| study of Female Infertility in Sudanese using Ultrasonography | 2019 | Abdallah HE. | (Doctoral dissertation Sudan University of Science and Technology,). | Original Research | 125 | 49 | 15 F | Uterus | 68.8/31.2 |
| Study of female secondary infertility causes using ultrasound | 2015 | Mahmud MA. | | Original research | 60 | 34 - 39 | 1 F | Uterus | 65 |
| Diagnosis and treatment of müllerian malformations | 2020 | e Passos ID, Britto RL | Taiwanese Journal of Obstetrics and Gynecology. | Case study | 67 | N/A | N/A | Uterus | 6.7 |
| Evaluation of the Uterine Causes of Female Infertility by Ultrasound: | 2017 | Irani S, Ahmadi F, Javam M | Journal of Midwifery and Reproductive Health | Review Article | 180 | N/A | N/A | Uterus | 44 |

| | | | | | | | | | |
|--|------|--|--|-------------------|-----|---------|-------|--------|-------|
| the three-dimensional ultrasound in uterine evaluation in patients with reproductive failure | 2020 | Elkashef, et al. | Journal of Gynecological Research and Obstetrics | Original research | 463 | 28.44.3 | N/A | Uterus | 3-4 |
| Comparison of two dimensional and live three dimensional ultrasounds for the diagnosis of septated uterus | 2014 | Niknejadi M, et al. | Iranian journal of reproductive medicine. | Original research | 215 | N/A | 215 F | Uterus | 50 |
| Role of 3D Ultrasound in the Evaluation of Uterine Anomalies | 2018 | Graupera B, et al. | Springer, Cham. | Original research | 24 | N/A | N/A | Uterus | NA |
| Comparison of three-dimensional ultrasound and magnetic resonance imaging diagnosis in surgically proven Mu"llerian duct anomaly cases | 2016 | Ergenoglu AM, et al. | Journal of Gynecology & Obstetrics and Reproductive Biology. | Original research | 29 | 28-4.9 | 29 F | Uterus | 20 |
| Term Pregnancy in a Bicornuate Uterus: Complications, Diagnostic and Therapeutic Challenges in a Low Resource Setting (Douala, Cameroon) | 2018 | Tazinya AA, Fetei VF, Ngu RC, Bechem NN, Halle-Ekane GE | International Journal of Medical and Pharmaceutical Case Reports | Case Study | 1 | 24 | 1 F | Uterus | .0-10 |
| Female's Infertility Rules of Ultrasound And Colour Duplex in Assessment of Pelvic Causes | 2019 | Ali M, Yousef A, Khater H | Benha Medical Journal | Original Research | 119 | 15-45 | 750 F | Uterus | 73.95 |
| Didelphys Uterus: A Case Report and Review of the Literature | 2015 | Rezai S, Bisram P, Lora Alcantara I, Upadhyay R, Lara C, Elmadjian M | Case reports in obstetrics and gynecology. | Case study | 1 | 29 | 1 F | Uterus | 0.5-5 |
| Unicornuate Uterus with Hematometra | 2017 | Aragaw YA | Androl Gynecol: Curr | Case Study | 1 | 45 | 1 F | Uterus | 1-10 |
| DOUBLE UTERUS WITH SINGLE CERVIX. | 2020 | Mohsin N. | The Professional Medical Journal | Case Study | 1 | 5 | 2 F | Uterus | 0.5-5 |
| Study to evaluate the prevalence, importance, and treatment of women with congenital uterine anomalies | 2019 | Chan YY. | Doctoral dissertation, University of Nottingham | Review research | 211 | N/A | N/A | Uterus | 1-10 |
| The incidence of ultrasound diagnosed uterine abnormalities related to miscarriage rates-a local audit. | 2019 | RAHEEM AM, Al-SHIMMARI HA, Abdul KAREEM SK | Romanian Journal of Medical Practice. | Original research | 174 | 26-35 | 71 F | Uterus | 46.6 |

| | | | | | | | | | |
|--|------|---------------------------|---|-------------------|-----|--------|--------|--------|-------|
| Role of Ultrasonography for the Evaluation of Uterine Fibromyomas and Infertility- | 2020 | Abdullah i Abubakar et al | European Journal of Radiology | Review research | 480 | N/A | N/A | Uterus | N/A |
| DOUBLE UTERUS | 2010 | Gul F, Jabeen M et al. | Khyber Medical. 2010;2(1):27-9. University Journal | Case study | 1 | 35 | 1F | terus | 3.5 |
| The pregnancy outcome in women with incidental diagnosis of septate uterus at first trimester | 2021 | Ghi T, De Musso et al | Human Reproduction, Vol.27, No.9 pp. 2671–2675, | Original research | 24 | N/A | 24F | terus | 33 |
| Uterus Didelphys with Pregnancy | 2021 | Shahi RR et al | Medical Journal of Shree Birendra Hospital | Case study | 1 | 21 | 1F | terus | 0-1 |
| Uterus didelphyswith cervical incompetence | 2021 | Nayak S,et al. | Int. J. Pharm. Sci. Rev. Res. | Case study | 1 | 33 | 1F | terus | 5-10 |
| The role of 3-dimensional ultrasound for the diagnosis of congenital uterine anomalies | 2021 | Zohav E | Open J Obstet Gynecol. | Original research | 51 | 32+6.9 | 51F | terus | 0.1-3 |
| The role of three-dimensional ultrasound in the assessment of congenital uterine anomalies. Congenital uterine abnormalities | 2021 | Tabi S et al | . Donald School Journal Ultrasound in Obstetrics and Gynecology | Original research | 141 | 22-33 | 6F | terus | 20 |
| Diagnostic accuracy of transvaginal sonography in the detection of uterine abnormalities in infertile women | 2021 | Niknejad i M et al. | Iranian journal of radiology | Original Article | 719 | N/A | 719F | terus | 79 |
| | | | | | | | | | |
| The prevalence of congenital uterine anomalies in unselected and high-risk populations | 2021 | Chan YY,et al. | Human reproduction update. | Review Article | 94 | N/A | 89861F | terus | 5.5 |
| Double uterus | 2020 | Gul F, Jabeen | Khyber Medical University Journal. | Case study | | N/A | N/A | terus | 13 |
| Obstetric outcomes in women with mullerian duct malformations | 2021 | Ramalin gappa P e al. | Int J Reprod Contracept Obstet Gynecol. | Research article | 24 | N/A | 2595F | terus | 68 |

RESULT AND CONCLUSION

| RESEARCHER | No. of uterine anomalies | No. of arcuate uterus | No. of septate uterus | No. of Bicornuate uterus | No. of Didelphic uterus | No. of Unicornuate uterus | No. of hypoplastic Uterus |
|----------------------------|--------------------------|-----------------------|-----------------------|--------------------------|-------------------------|---------------------------|---------------------------|
| SALWA MO et al | 17.3 | 84 | 62 | 3 | 3 | 9 | 4 |
| MAYSA S. ELKERDAWY, et al. | 18 | 0 | 0 | 0 | 0 | 0 | 7 |
| Sahin C, Hortu I, Cirpan T | 67.9 | 0 | 51 | 13 | 13 | 5 | 1 |
| SawaiD, et al. | 0.1-10 | 20 | 35 | 25 | 8 | 0 | 0 |
| e Passos ID, Britto RL | 6.7 | 0 | 55 | 10 | 3-4 | 0.3-3 | 0 |
| Elkashef, et al. | 3-4 | 3 | 0 | 3 | 3 | 1 | 0 |
| Niknejadi M, et al. | 50 | 53 | 13 | 0 | 0 | 0 | 0 |
| Tazinya AA, et al. | .0-10 | 0 | 0 | 62.5 | 0 | 0 | 0 |
| Ali M,et al. | 73.95 | 0 | 2 | 2 | 0 | 0 | 0 |
| Rezai S,et al. | 0.5-5 | 0.2 | 0.35 | 0.25 | 8.3 | 9.6 | 3 |
| Aragaw YA. | 1-10 | 0 | 0 | 0 | 0 | 14 | 0 |
| RAHEEM AM,et al. | 46.6 | 9.88 | 19.75 | 24.69 | 0 | 7.41 | 0 |
| Gul F, Jabeen M et al. | 3.5 | 20 | 20 | 20 | 0 | 40 | 0 |
| Ghi T, De Musso et al | 33 | 0 | 15 | 0 | 0 | 0 | 0 |
| Shahi RR et al | 0-1 | 0 | 0 | 0 | 55 | 0 | 0 |
| Nayak S,et al. | 5-10 | 0 | 75 | 0 | 24 | 0 | 0 |
| Zohav E | 0.1-3 | 3 | 5 | 7 | 0 | 4 | N/A |
| Tabi S et al | 1.385 | 11.8 | 0.4 | 0.1 | 0 | 0.4 | 21 |
| Niknejadi,M et al. | 79 | 0 | 30 | 0 | 1 | 4 | 9 |
| Chan YY,et al. | 5.5 | 3.9 | 2.3 | 0.4 | 0.1 | 0.3 | 0.1 |
| Ramalingappa P e al. | 68 | 5 | 6 | 7 | 1 | 1 | 0 |
| | | | | | | | |
| | | | | | | | |

The Overall Role of Ultrasonography on the diagnosis of uterine anomalies in infertile women was discovered using a literature evaluation of 104 research from 2010 to 2021, of which only 30 were included in this study, with a total number of patients of

3,589.7, all of whom were female. The data was further grouped on the basis of variables after 30 studies were analysed. There was also a pooled analysis for mean values. All additional variables were subjected to descriptive analysis, which is displayed in the table below.

Table 5.1 provides the whole data from 30 evaluated studies, as well as the defined variables. The presence of uterine anomalies, as well as the names of the authors and their references. A select few were chosen for additional investigation based on their significance.

Table 5.2 As calculated and shown in the descriptive statistics table below, how does the complete data of 18 screened studies based on the mean age among the study groups, where 21 years is the minimum age and 49 years is the maximum age, the range is 28, the mean is 29.6633, and the standard Deviation is 7.60667.

Distribution of Uterine Anomalie

(In this table a data set of twentieth (N=20 studies is categorized according to required detail, it is showing that the overall septate uterus after using ultrasound technique. Further variables are analyzed individually).

Descriptive Statistics

| | N | Range | Minimum | Maximum | Mean | Std. Deviation |
|--------------------|----|-------|---------|---------|---------|----------------|
| Mean Age | 18 | 28.00 | 21.00 | 49.00 | 29.6633 | 7.60667 |
| Valid N (listwise) | 18 | | | | | |

(Table is showing descriptive statistics of eighteen studies (N=18) including mean value and std. deviation)

Discussion;

Ultrasonography is the first step in the investigation of female infertility, and it provides details for uterine disorders diagnosis. The precise diagnosis, on the other hand, is dependent on the "time of assessment." As a result, every midwife can learn about the "optimal timing" for ultrasound evaluations for each patient³⁸

SALWA MO et al. conducted a study to determine the prevalence of congenital uterine anomalies in the Sohag Government: The aim of this descriptive analysis using Trans-Vaginal Three Dimensional Ultrasound was to estimate the prevalence of congenital uterine abnormalities in women with infertility in Sohag. The study enlisted the participation of 977 women. 808 (82.7%) of the women had a normal uterus, while 169 (17.3%) had congenital uterine abnormalities. The most common uterine abnormalities were arcuate [n=84 (49.7%)] and septate [n=62 (36.8%)], followed by unicornate [n=9 (5.3%)], T-shaped, and hypo plastic uterus [n=4 each (2.3%)]. Last but not least, didelphys and bicornate [n=3 each (1.8%)]. In Sohag, 17.3 percent of women had uterine congenital abnormalities. Arcuate uterus was the most common form of uterine congenital anomaly³²

They should be seen as a possible cause of infertility and poor obstetrical outcomes. 2D ultrasonography has traditionally been used to diagnose mullerian anomalies. We looked at mullerian anomalies that had been diagnosed in our clinic and looked at how 2D ultrasonography could predict them. Material and Procedure: A total of 82 patients with mullerian duct abnormalities were included in this report The following are the results of a survey of 82 patients. Infertility affected 53 people. The uterus septum was found in 67.9% (36/53) of infertile patients³⁴

. We describe a pregnancy in the left sided body of a didelphys uterus that was delivered by caesarean section in our institute uterus, Patients of uterus didelphys are at a higher risk of complications, since the uterus is malformed. In such cases, diligent prenatal care is needed. It's an unusual Mullerian disorder that can cause a variety of obstetrical and gynecological issues. To avoid complications, early and effective diagnosis of uterine malformations, as well as adequate surgical intervention, is critical³⁵

The effectiveness of ultrasound in the diagnosis of female pelvic pathology is critically evaluated in this review. The diagnosis should be more precise, cost-effective, fast, and reliable, with as little invasiveness as possible. The data was obtained from approximately 750 infertile women, with a sample size of 255 cases⁴⁴

The aim of this study is to use ultrasound to determine if there is a connection between uterine abnormalities and miscarriage at various stages of pregnancy. Trans abdominal and transvaginal ultrasound is used to investigate 174 miscarriage cases. The patients ranged in age from 18 to 45 years old, and the information was gathered over the course of eight months from five separate hospitals. With 40.8 percent, the age group (26-35 years) has the highest rate of miscarriage among the other age groups studied (71cases). In addition, it was discovered that the majority of the cases involved a single miscarriage. In 46.6 percent of cases, miscarriage was discovered in women with uterine anomalies. Bicornuate, septate, arcuate, and unicornuate uterus were the most common uterine

abnormalities, with 24.69 percent, 19.75 percent, 9.88 percent, and 7.41 percent, respectively. Other ultrasound results were interpreted in the same way. Pregnancy loss is more common in women with bicornuate and septate uteri than in women with other uterine abnormalities, although it is less common in unicornuate uterus⁴⁹

We found 94 observational studies with a total of 89 861 women. In the unselected population, the prevalence of uterine anomalies diagnosed by optimal tests was 5.5 percent [95 percent confidence interval (CI), 3.5–8.5], 8.0 percent (95 percent CI, 5.3–12) in infertile women, 13.3 percent (95 percent CI, 8.9–20.0) in those with a history of miscarriage, and 24.5 percent (95 percent CI, 18.3–32.8) in those with miscarriage and infertility. Arcuate uterus is most prevalent in the general population (3.9 percent; 95 percent confidence interval, 2.1–7.1), and it is not more common in high-risk groups. In high-risk groups, however, septate uterus is the most prevalent abnormality⁵⁸.

CONCLUSION

Ultrasound is the preferred investigation for screening and detecting uterine defects since it is readily available, inexpensive, and non-radiation. Ultrasound may be used as an alternative method of detecting uterine abnormalities. Infertility is the most prevalent symptom at the time of diagnosis, followed by primary amenorrhoea, pelvic pain, menorrhagia, and miscarriage. Ultrasound is the most prevalent method of detecting uterine anomalies.

Reference

1. Braverman M, Kamisan Atan I, Turel F, Friedman T, Dietz HP. Does patient posture affect the ultrasound evaluation of pelvic organ prolapse?. *Journal of Ultrasound in Medicine*. 2019 Jan;38(1):233-8.
2. Toprak H, Kiliç E, Serter A, Kocakoç E, Ozgocmen S. Ultrasound and Doppler US in evaluation of superficial soft-tissue lesions. *Journal of clinical imaging science*. 2014;4.
3. Mahmud MA. Study of female secondary infertility causes using ultrasound.
4. Mahmud MA. Study of female secondary infertility causes using ultrasound. 2015
5. Groszmann YS, Benacerraf BR. Complete evaluation of anatomy and morphology of the infertile patient in a single visit; the modern infertility pelvic ultrasound examination. *Fertility and sterility*. 2016 Jun 1;105(6):1381-93.
6. Olpin JD, Kennedy A. Secondary infertility in women: Radiologic evaluation. *Reports in Medical Imaging*. 2011 Jan 11;4:1-4.
7. Braverman M, Kamisan Atan I, Turel F, Friedman T, Dietz HP. Does patient posture affect the ultrasound evaluation of pelvic organ prolapse?. *Journal of Ultrasound in Medicine*. 2019 Jan;38(1):233-8.
8. Groszmann YS, Benacerraf BR. Complete evaluation of anatomy and morphology of the infertile patient in a single visit; the modern infertility pelvic ultrasound examination. *Fertility and sterility*. 2016 Jun 1;105(6):1381-93.
9. Cicchiello LA, Hamper UM, Scoutt LM. Ultrasound evaluation of gynecologic causes of pelvic pain. *Obstetrics and Gynecology Clinics*. 2011 Mar 1;38(1):85-114.
10. Mihiu D, Mihiu M. Ultrasonography of the uterus and ovaries. *Medical ultrasonography*. 2011 Sep 1;13(3):249-52.
11. Gharibvand MM, Kazemi M, Motamedfar A, Sametzadeh M, Sahraeizadeh A. The role of ultrasound in diagnosis and evaluation of bladder tumors. *Journal of family medicine and primary care*. 2017 Oct;6(4):840.
12. Ghi T, Casadio P, Kuleva M, Perrone AM, Savelli L, Giunchi S, Merigg. 2020;9.
13. Cassar OA, Dalli SM. Pregnancy in a Bicornuate Uterus with Contraceptive Coil in Situ-A Case Report. *Obstetrics & Gynecology International Journal*. 2017;7(3):00247.
14. Sibal M. Ultrasound Evaluation of Congenital Uterine Anomalies. In *Ultrasound in Gynecology 2017* (pp. 435-467). Springer, Singapore.
15. Rikken JF, Leeuwis-Fedorovich NE, Letteboer S, Emanuel MH, Limpens J, van der Veen F, Goddijn M, van Wely M. The pathophysiology of the septate uterus: a systematic review. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2019 Sep;126(10):1192-9.
16. iola MC, Gubbini G, Pilu G, Pelusi C, Pelusi G. Accuracy of three-dimensional ultrasound in diagnosis and classification of congenital uterine anomalies. *Fertility and Sterility*. 2009 Aug 1;92(2):808-13.
17. La Vignera S, Condorelli RA, Di Mauro M, D'Agata R, Vicari E, Calogero AE. Seminal vesicles and diabetic neuropathy: ultrasound evaluation. *Journal of andrology*. 2011 Sep 10;32(5):478-83.
18. HU CF, Lin H. Ultrasound diagnosis of complete uterine inversion in a nulliparous woman. *Acta obstetrica et gynecologica Scandinavica*. 2012 Mar;91(3):379-81.
19. Ghi T, Casadio P, Kuleva M, Perrone AM, Savelli L, Giunchi S, Meriggiola MC, Gubbini G, Pilu G, Pelusi C, Pelusi G. Accuracy of three-dimensional ultrasound in diagnosis and classification of congenital uterine anomalies. *Fertility and Sterility*. 2009 Aug 1;92(2):808-13.

20. Bajka M, Badir S. Fundus thickness assessment by 3D transvaginal ultrasound allows metrics-based diagnosis and treatment of congenital uterine anomalies. *Ultraschall in der Medizin-European Journal of Ultrasound*. 2017 Apr;38(02):183-9.
21. Groszmann YS, Benacerraf BR. Complete evaluation of anatomy and morphology of the infertile patient in a single visit; the modern infertility pelvic ultrasound examination. *Fertility and sterility*. 2016 Jun 1;105(6):1381-93.
22. Jansen CH, Kleinrouweler CE, Kastelein AW, Ruiter L, Van Leeuwen E, Mol BW, Pajkrt E. Follow-up ultrasound in second-trimester low-positioned anterior and posterior placentae: prospective cohort study. *Ultrasound in Obstetrics & Gynecology*. 2020 Nov;56(5):725-31.
23. Guzman ER, Mellon C, Vintzileos AM, Ananth CV, Walters C, Gipson K. Longitudinal assessment of endocervical canal length between 15 and 24 weeks' gestation in women at risk for pregnancy loss or preterm birth. *Obstetrics & Gynecology*. 1998 Jul 1;92(1):31-7.
24. Lisciandro GR, Fosgate GT. Use of urinary bladder measurements from a point-of-care cysto-colic ultrasonographic view to estimate urinary bladder volume in dogs and cats. *Journal of Veterinary Emergency and Critical Care*. 2017 Nov;27(6):713-7.
25. Talukdar D, Borpujari D, Ahmed FA, Lalrintluanga K. Ultrasound as a diagnostic aid for anatomical defects of female reproductive tract: An overview. *Journal of Entomology and Zoology Studies*. 2019;7(2):533-6.
26. Dheer S, Oh JS, Rivlin M. Flexor pollicis longus (FPL) tendon hypoplasia: A case report and literature review. *Radiology case reports*. 2019 May 1;14(5):565-7.
27. Riccabona M, Ring E, Avni F. Imaging in renal agenesis, dysplasia, hypoplasia, and cystic diseases of the kidney. In *Pediatric urogenital radiology 2018* (pp. 553-577). Springer, Cham.
28. Li X, Ouyang Y, Yi Y, Lin G, Lu G, Gong F. Pregnancy outcomes of women with a congenital unicornuate uterus after IVF-embryo transfer. *Reproductive biomedicine online*. 2017 Nov 1;35(5):583-91.
29. Tesemma MG. Pregnancy in noncommunicating rudimentary horn of unicornuate uterus: a case report and review of the literature. *Case reports in obstetrics and gynecology*. 2019 Dec 14;2019.
30. Saçmı KG, Oruç G, Şeker E, Özışık MS. Prenatal diagnosis of persistent cloaca accompanied by uterus didelphys: A case report. *Turkish journal of obstetrics and gynecology*. 2021 Mar;18(1):76.
31. Yim S, Yeo I, Lee M, Kyeong KS, Cho HY, Kang JB, Kyung MS. Case Report: Spontaneous perforation of a bicornuate uterus with concomitant sarcoma. *F1000Research*
32. Congenital Anomalies of Uterus in Sohag SALWA MO, SAYED AS, ELSAYED Z. Prevalence of Vaginal Three Dimensional Ultrasound. *The Medical Journal -Government: A Descriptive Study by Trans .50-of Cairo University*. 2019 Dec 1;87(December):4645
33. oFemale Infertility. MOHAMMED A, MAYSA SE, KERIAKOS N. Ultrasound Role in Management .30-The Medical Journal of Cairo University. 2020 Sep 1;88(September):1523
34. Sahin C, Hortu I, Cirpan T. Mullerian anomalies and value of diagnosis with 2D ultrasonography. .5-72:(1)JOURNAL OF CLINICAL AND ANALYTICAL MEDICINE. 2019 Jan 1;10
35. Sawai D, Sharma wai DS, Sawai U, Sharma S, Sharma A. Pregnancy in Uterus Didelphys Delivered by Caesarean Section: A Case Report. *International Journal of Reproduction, Contraception, Obstetrics and .Gynecology*. 2017;6(11):5167
36. Female Infertility in Sudanese using Ultrasonography (Doctoral dissertation Abdallah HE. Study of .(,Sudan University of Science and Technology
37. .Mahmud MA. Study of female secondary infertility causes using ultrasound
38. malformations. *Taiwanese Journal of ePassos ID, Britto RL. Diagnosis and treatment of müllerian .8-Obstetrics and Gynecology*. 2020 Mar 1;59(2):183
39. Irani S, Ahmadi F, Javam M. Evaluation of the uterine causes of female infertility by ultrasound: A .26-Apr 1;5(2):919 literature review. *Journal of Midwifery and Reproductive Health*. 2017
40. Din -Din Shawki, Ahmed Sameer Sanad, and Ahmad Ezz El-Elkashef, Abdulrahman Yehia, Hossam El dimensional ultrasound in uterine evaluation in patients with reproductive -Mahran. "The role of the three -no. 2 (2020): 054 ,6 of *Gynecological Research and Obstetrics Journal failure: A comparative study*." .059
41. Niknejadi M, Akhbari F, Niknejad F, Khalili G, Shiva M. Comparison of two dimensional and live three dimensional ultrasounds for the diagnosis of septated uterus. *Iranian journal of reproductive medicine*. .Aug;12(8):547 2014

42. Graupera B, Pascual MÀ, Hereter L, Pedrero C. Role of 3D Ultrasound in the Evaluation of Uterine .Springer, Cham .(82-Anomalies. InHysteroscopy 2018 (pp. 69
43. -H, Sendag F. Comparison of three Ergenoglu AM, Sahin Ç, Şimşek D, Akdemir A, Yeniel AÖ, Yerli dimensional ultrasound and magnetic resonance imaging diagnosis in surgically proven Müllerian duct anomaly cases. European Journal of Obstetrics & Gynecology and Reproductive Biology. 2016 Feb .6-197:22;1
44. Ekane GE. Term Pregnancy in a Bicornuate Uterus: -VF, Ngu RC, Bechem NN, Halle Tazinya AA, Feteh Complications, Diagnostic and Therapeutic Challenges in a Low Resource Setting (Douala, Duplex in s Infertility Rules of Ultrasound And Colour'Cameroon).Ali M, Yousef A, Khater H. Female .97-Assessment of Pelvic Causes. Benha Medical Journal. 2020 Mar 1;36(3):89
45. Rezai S, Bisram P, Lora Alcantara I, Upadhyay R, Lara C, Elmadjian M. Didelphys uterus: a case report .and review of the literature. Case reports in obstetrics and gynecology. 2015 Sep 7;2015
46. .Aragaw YA. Unicornuate Uterus with Hematometra. Androl Gynecol: Curr Res 5: 1. of. 2017;3:2
47. Mohsin N. Double uterus with single cervix. The Professional Medical Journal. 2020 May .91-1089:(05)27;10
48. Specificity and Sensitivity of Ultrasound and Magnetic Resonance .Prabu D, Saikumar P, Prabakaran RP .509-imaging in Uterine Anomalies. Annals of the Romanian Society for Cell Biology. 2021 Mar 27:3497
49. Chan YY. Study to evaluate the prevalence, importance, and treatment of women with congenital uterine .anomalies (Doctoral dissertation, University of Nottingham)
50. SHIMMARI HA, Abdul KAREEM SK. The incidence of ultrasound diagnosed -RAHEEM AM, Al a local audit. Romanian Journal of Medical Practice. -uterine abnormalities related to miscarriage rates .(3)Sep 1;14 2019
51. Abdullahi Abubakar et al,Role of Ultrasonography for the Evaluation of Uterine Fibromyomas and A Systematic Review.,Indo Am. J. P. Sci, 2020; 0 -Infertility
52. Gul F, Jabeen M. Double uterus: A case report. Khyber Medical University Journal. 2010;2(1):27-9.
53. Ghi T, De Musso F, Maroni E, Youssef A, Savelli L, Farina A, Casadio P, Filicori M, Pilu G, Rizzo N. The pregnancy outcome in women with incidental diagnosis of septate uterus at first trimester scan. Human reproduction. 2012 Sep 1;27(9):2671-5.
54. Shahi RR, Shrestha MS, Thapa GB, Basnet SB, Khadka G, Joshi L. Uterus Didelphys with Pregnancy. Medical Journal of Shree Birendra Hospital. 2011;10(1):40-3.
55. Nayak S, Pati T, Panda SK, Sahu MC, Padhy RN. Uterus didelphys with cervical incompetence— A rare case report. Int. J. Pharm. Sci. Rev. Res. 2014;28(1):228-32.
56. Zohav E, Melcer Y, Tur-Kaspa I, Rabinson J, Anteby EY, Orvieto R. The role of 3-dimensional ultrasound for the diagnosis of congenital uterine anomalies. Open J Obstet Gynecol. 2011 Dec 28;1:238-41.
57. Tabi S. The role of three-dimensional ultrasound in the assessment of congenital uterine anomalies. Donald School Journal of Ultrasound in Obstetrics and Gynecology. 2012 Dec 1;6(4):415-23.
58. Niknejadi M, Haghighi H, Ahmadi F, Niknejad F, Chehrizi M, Vosough A, Moenian D. Diagnostic accuracy of transvaginal sonography in the detection of uterine abnormalities in infertile women. Iranian journal of radiology. 2012 Sep;9(3):139.
59. Chan YY, Jayaprakasan K, Zamora J, Thornton JG, Raine-Fenning N, Coomarasamy A. The prevalence of congenital uterine anomalies in unselected and high-risk populations: a systematic review. Human reproduction update. 2011 Nov 1;17(6):761-71.
60. Ramalingappa P, Bhatara U, Seeri J, Bolarigowda P. Obstetric outcomes in women with mullerian duct malformations. Int J Reprod Contracept Obstet Gynecol. 2016;3:127-33.