Specificity and Sensitivity of Ultrasound and Magnetic Resonance Imaging in Uterine Anomalies

Dr. Prabu D[1*], Dr. Ramachandra Prasad T[2], Dr. Prabakaran M[3]

[1]Final year Postgraduate, Department of RadioDiagnosis , Sree Balaji Medical College and Hospital, Chromepet, Chennai, India
[2]Professor, Department of RadioDiagnosis, Sree Balaji Medical College and Hospital, Chromepet, Chennai, India
[3]Professor & Head of the Department of RadioDiagnosis, Sree Balaji Medical College and Hospital, Chromepet, Chennai, India

Abstract		Original Research Article

Congenital Uterine malformations may be due to arrested development or failure of fusion of the Mullerian ducts or failure of resorption of the median septum. The prevalence of uterine malformations is difficult to establish. There are two techniques which is indeed relevant for the diagnosis: Magnetic Resonance Imaging (MRI) and Ultrasound. There is a lack of studies comparing these two techniques for the diagnosis and categorisation of Uterine malformations. Hence the present study was done to determine the specificity and sensitivity of Ultrasound and Magnetic Resonance Imaging in diagnosing Uterine anomalies. The study was performed with 40 women who were referred to the Radiology department with clinical complaints of infertility, miscarriage, primary amenorrhea. Each patient underwent ultrasound examination, followed by MRI. The results were statistically analysed. MRI has greater sensitivity in detecting uterine anomalies when compared to Ultrasound.
Keywords: Uterine anomalies, Mullerian ducts, Ultrasound, Magnetic Resonance Imaging.

INTRODUCTION

Congenital Uterine malformations may be due to arrested development or failure of fusion of the Mullerian ducts or failure of resorption of the median septum. The prevalence of uterine malformations is 0.4% in the general population, 4% in women with infertility complaints, and 5 – 30% in women with habitual abortion[1]. The classification of uterine malformation, by the American Fertility Society (AFS) [2], has been adopted widely.

There are two techniques which is indeed relevant for the diagnosis of Uterine anomalies, they are Ultrasound and Magnetic Resonance Imaging (MRI) There is a lack of studies comparing these 2 techniques for the diagnosis and categorisation of Uterine malformations. Hence the present study was done to determine the specificity and sensitivity of Ultrasound and Magnetic Resonance Imaging in diagnosing Uterine anomalies.

MATERIALS AND METHODS

A prospective study was performed with 40 women between August 2016 and September 2018 (period of 2 years) who were referred to our hospital with clinical complaints of Infertility, Miscarriage, and Primary amenorrhea. Informed consent was taken from each patient and they were instructed to be on fasting for atleast 4-6 hrs before the scan time. Each patient underwent ultrasound examination, followed by MRI within a period of 1 week.

Inclusion criteria
Patients with clinically suspected Mullerian duct anomalies.
Age group between 14 to 44 years
Patients with Infertility, Miscarriage, Primary amenorrhoea
Patients willing to undergo this study

Exclusion criteria
Any absolute contraindication for MRI like metal implants/ ferromagnetic substance in the body. Patients who refused MRI examination.

Detailed clinical history and consent were taken from the patients. Ultrasound was performed on Siemens Acuson 2000 trans-abdominal transducer. The US images were evaluated.

Magnetic resonance imaging of pelvis was performed with HITACHI APERTO machine. A pelvic phased array coil was used in most cases; in cases where

lesions were large, a body coil was used for better coverage. The following sequences were obtained:

- Axial Tl-weighted spin echo images from the renal hilum to the symphysis pubis (TR/TE 400-640 ms/10-14 s, slice thickness 5-8 mm, gap 1-2 mm, field of view 24-38 cm, NEX 1-2, matrix 256x192-256.
- Axial T2-weighted fast spin echo images of the pelvis (TR/TE 4000-6000 ms/90-110 ms effective, echo train length 8, slice thickness 5-7 mm, gap 1-2 mm, field of view 24-38 cm, NEX 2, 512x256 matrix).
- Sagittal T2-weighted fast spin echo images from

one femoral head to the other (TR/TE 400O- 6000 ms/90-110 ms, echo train length 8, slice thickness 5-7 mm, gap 1-2 mm, field of view 24- 32 cm, NEX 2, 512x256 matrix

RESULTS

Table shows the distribution of age group amongst the patients taken for the study. It is observed that maximum cases fall under age group 21-30 years (47.5%), followed by age group 11-20 years (35%). Maximum patients were under younger age group.

Table-1: Age distribution

Age group (years)	No. of cases	Percentage
11-20	14	35%
21-30	19	47.5%
31-40	03	7.5%
41-50	04	10%
Total	40	100%

Table shows the clinical presentation of different incidences for the patients taken for study. Maximum incidences were found for infertility (37.5%)

followed by primary amenorrhea (20%), pelvic pain (17.5%), Menorrhagia (15%), pregnancy (5%) and miscarriage (5%).

Table-2: Clinical presentation

	No. of cases	Percentage
Infertility	15	37.5%
Menorrhagia	06	15%
Miscarriage	02	5%
Pelvic pain	07	17.5%
Pregnancy	02	5%
Primary amenorrhoea	08	20%
Total	40	100%

Table-3: USG findings

Findings	No. of cases	Percentage
Arcuate ut	05	12.5%
Bicornuate ut	13	32.5%
Septate ut	02	5%
Uterine agenesis	08	20%
Uterus Didelphys	04	10%
Unicornuate ut	01	2.5%
Subseptate Ut	00	0
Normal ut	07	17.5%
Total	40	100%

Table-4: MRI findings

Findings	No. of cases	Percentage
Arcuate ut	05	12.5%
Bicornuate ut	13	32.5%
Septate ut	01	2.5%
Uterine agenesis	08	20%
Uterus Didelphys	04	10%
Unicornuate ut	08	20%
Subseptate Ut	01	2.5%
Normal ut	00	0
Total	40	100%

Table-5: Sensitivity (%) for the findings of USG and MRI

Findings	USG	Sensitivity (%)	MRI	Sensitivity (%)	hysteroscopy / laparoscopy	Total proven findings
Arcuate ut	05	100	05	100	05	05
Bicornuate ut	13	100	13	100	13	13
Septate ut	02	97.44	01	100	01	01
Uterine agenesis	08	100	08	100	08	08
Uterus Didelphys	04	100	04	100	04	04
Unicornuate ut	01	12.50	08	100	08	08
Subseptate Ut	00	0	01	100	01	01
Total	33		40		40	40
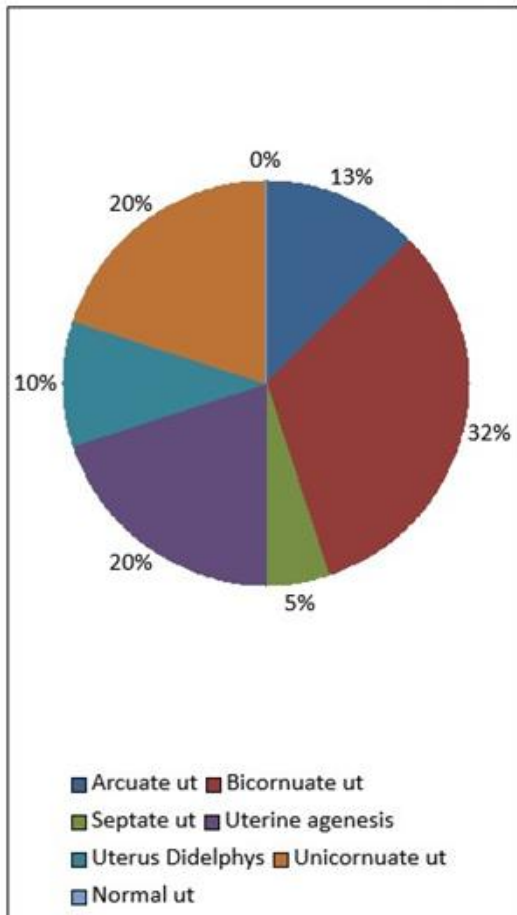
Pie Diagram for MRI findings
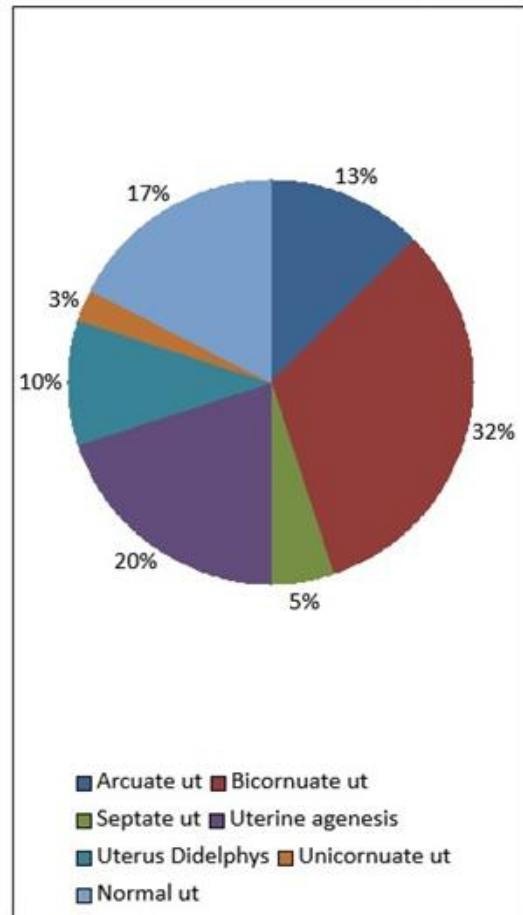
Pie Diagram for Ultrasound findings
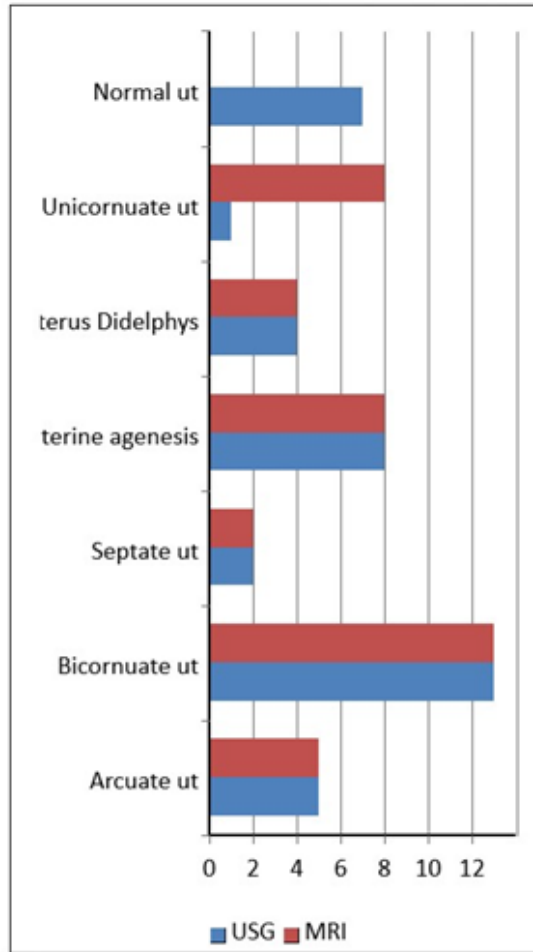
Bar Diagram for correlation between Ultrasound and MRI Findings

MRI T2w image axial section demonstrating two separate uterine cavities in a bicornuate uterus

Ultrasound pelvis transverse image demonstrates two separate uterine cavities in a bicornuate uterus

MRI T2w image coronal section demonstrates a unicornuate uterus

MRI T2w image coronal section demonstrates two separate horns with two separate uterine cavities and a unilateral right sided kidney, Uterine didelphys with renal anomaly

DISCUSSION

The Diagnostic Imaging Modalities used here in our study are: Sonography Versus Magnetic Resonance Imaging. It has been shown that conventional transvaginal 2-dimensional sonography is a good screening tool for the detection of uterine anomalies and has high sensitivity (90%–92%) for uterine anomalies [3-5] in adult women. The main advantage of Ultrasound is its low cost, easy availability and doesn't use ionizing radiation but the ability of 2-dimensional sonography to distinguish between different types of uterine abnormalities requires experienced hands [6, 7].

MRI can detect all types of congenital uterine anomalies with a sensitivity and specificity of 100%. The main disadvantages of MRI are relatively high cost, unavailability in rural set-up, prolonged time required for the investigation and patient may complain of claustrophobia.

In the present study Ultrasound showed 90% sensitivity and 98% specitficity. Whereas MRI showed 100% sensitivity and 100 % specificity. Patients with uterine anomalies present with primary amenorrhoea, infertility, menorrhagia, secondary amenorrhoea, repeated miscarriage and pelvic pain.

Most common age at the presentation of symptom is 21-30 yrs followed by 11-20 yrs and 41-50 yrs and 31-40 yrs respectively. Most common symptom at the time of presentation is infertility followed by primary amenorrhoea, pelvic pain, menorrhagia and miscarriage.Most common uterine anomaly detected by ultrasound and MRI is bicornuate uterus. MRI has 100 % sensitivity in detecting uterine anomalies. Thus MRI is better in diagnosing unicornuate uterine anomaly. Ultrasound failed to detect subseptate uterus which was detected by MRI.

CONCLUSION

Ultrasound is the preferred investigation for diagnosing uterine anomalies and can be used as a screening test. MRI is highly accurate with 100% sensitivity and 100% specificity.

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