European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 08, Issue 03, 2021

Role of MRI in detecting female infertility

Dr. A Antony Jean[1],Dr. K. Karthikeyan[2],Dr.Ajit Kumar Reddy[3], Dr.AnnithaElavarasi J[4]

[1]MBBS, MDRD, Associate Professor, Department of Radiology, Dhanlakshmi, Srinivasan Medical College & Hospital, Perambalur, Tamil Nadu, India, 621212.drjeanrd@gmail.com;
[2]Assistant Professor, Department of Radiodiagnosis, DhanlakshmiSrinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India, 621212.karthikkannan05@gmail.com;
[3]HOD Department of Medical Imaging, Hosmat Hospitals Private Limited, drajitreddy@gmail.com;
[4]Consultant Radiologist, Department of Medical Imaging Hosmat Hospitals Private Limited, anithaela@gmail.com

Corresponding Author:
Dr K. Karthikeyan, Assistant Professor, Department of Radiodiagnosis, DhanlakshmiSrinivasan Medical College and Hospital, Siruvachur, Perambalur, Tamil Nadu, India, 621212.karthikkannan05@gmail.com

Aim:To assess role of MRI in detecting female infertility.
Materials & Methods:Eighty- six women age ranged 20- 40 years were included in the study. All underwent MRI using 1.5 Tesla unit equipped with a 32 phased-array surface coil. Causes of female infertility was recorded.
Results: Age group 20-30 years comprised of 50 and 31-40 years had 36 patients. Various causes of female infertility was PCOS in 12, tubal disease in 18, pelvic inflammatory disease in 10, endometriosis in 8, leiomyoma in 6, adenomyosis in 12 and endometrial polyps in 20 cases. A significant difference was observed (P< 0.05).
Conclusion: MRI is an excellent non-invasive, radiation-free modality for the evaluation of female infertility; its superior soft-tissue contrast resolution and multiplanar evaluation generate exquisite anatomical details.
Key words:Adenomyosis, Infertility, MRI, Leiomyoma

Introduction

World Health Organization defined infertility as the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual inter-course. Assisted-reproduction techniques progress continuously. As a result, the evaluation of infertile women has to be as accurate as possible. Diagnostic work-up of female infertility is a multi-modality approach that is required to identify organic causes of infertility and to guide clinical management.[1]
Approximately 10% of married couples are infertile. Males and females are equally affected.[2]The causes of female infertility can be broadly categorized into the following as Uterine causes such as congenital anomalies, infections, uterine synechiae, focal lesions, intrauterine scar, cervical stenosis, reduced uterine perfusion, and alterations in endometrial thickness and vascularity. Ovarian causes such as follicular and ovulation abnormalities, stromal vascularity, and endometriosis. Tubal causes such as infections and obstruction.[3]
Imaging modalities available in the Radiologist's armamentarium include hysterosalpingography (HSG), transabdominal and transvaginal ultrasound, MRI and less commonly sono-hysterography. Magnetic resonance imaging (MRI) is best for delineating the morphology and orientation of pelvic structures.[4] Though it is non-invasive and radiation free, it has limited availability and high cost, and hence cannot be repeated easily. Longer

examination time, failure to delineate sub-centimeter uterine lesions, and inability to characterize endometriomas at some stages are other limitations. MRI is contraindicated in patients with cardiac pacemakers and cochlear implants. MRI also detects pathological lesions, including tubal lesions and pituitary adenoma. It helps in predicting the prognosis in conservatively treated cases of leiomyoma, adenomyosis, and endometriosis.[5]The present study was selected with the aim to assess role of MRI in detecting female infertility.

Methodology

Eighty- six women age ranged 20- 40 years reported to Radiology department with the complaint of infertility were enrolled. Patients were made ware of the purpose of the study and with their written consent they were selected. The study protocol was approved from institutional ethical committee.

Symptoms such as pelvic pain, dysmenorrhoea etc. was noted. A serum hCG test was done before the examinations. MRI was performed on a 1.5 Tesla unit equipped with a 32 phased-array surface coil, with the patient in the supine position. The following sequences were acquired: – T2-weighted (T2W) turbo spin-echo (TSE) sequences in axial and sagittal planes with: echo time (TE), 90 ms; repetition time (TR), 4,500 ms; field of view (FOV), 250 x 230; slice thickness, 3.0 mm/1.0 mm. – T1-weighted (T1W) TSE sequence in sagittal plane with: TE, 7 ms; TR, 627 ms; FOV, 250x207; slice thickness, 3.0 mm/1.0 mm. – T1W TSE sequence in axial plane with fat suppression (SPIR sequence). On MRI various anomalies were recorded. Results thus obtained were subjected to statistical analysis using students' t test where significance level was set below 0.05.

Results

Table1 Age wise distribution of cases

Age group (Years)	Number	P value
20-30	50	0.051
31-40	36	

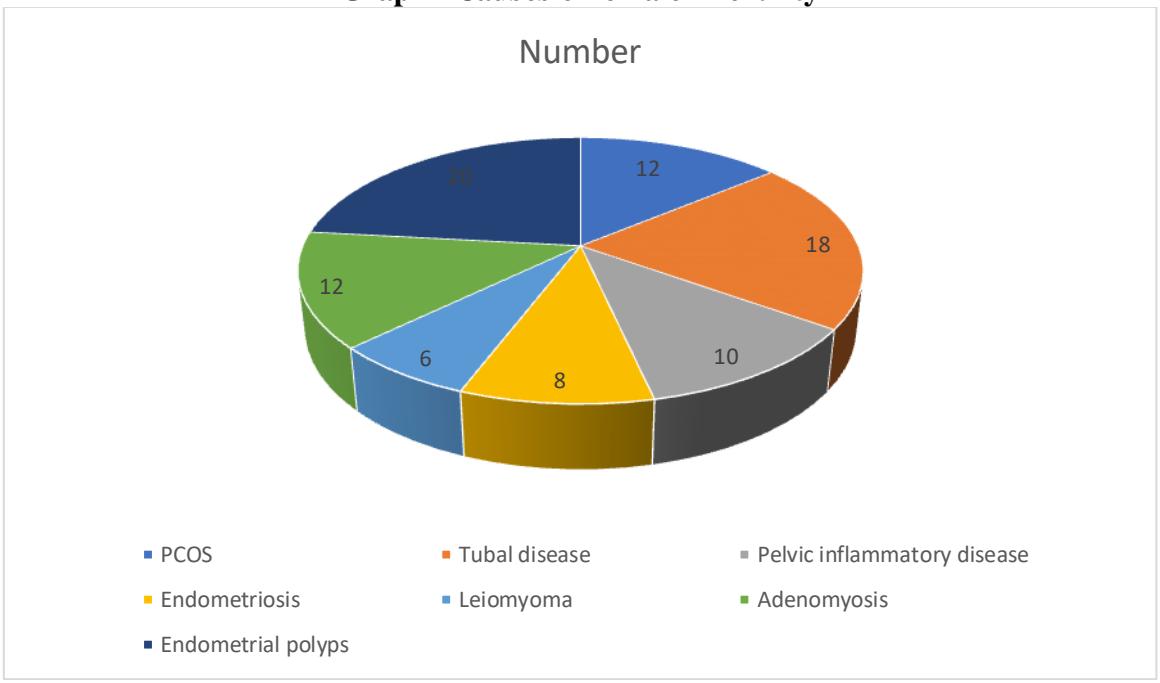
Age group 20-30 years comprised of 50 and 31-40 years had 36 patients. A significant difference was observed (P< 0.05) (Table 1).

Table 2 Causes of female infertility

Causes	Number	P value
PCOS	12	0.05
Tubal disease	18	
Pelvic inflammatory disease	10	
Endometriosis	8	
Leiomyoma	6	
Adenomyosis	12	
Endometrial polyps	20	

Various causes of female infertility was PCOS in 12, tubal disease in18, pelvic inflammatory disease in 10, endometriosis in 8, leiomyoma in 6, adenomyosis in 12 and endometrial polyps in 20 cases. A significant difference was observed (P< 0.05) (Table 2, graph 1).

Graph 1 Causes of female infertility



DISCUSSION

In the era of evidence-based medicine, MRI has an indispensable role in the diagnosis and management of female infertility.[6] MRI increases the diagnostic performance of transvaginal sonography in the accurate detection of extensive pelvic inflammation, complex tubo ovarian pathologies, leiomyomas, exact delineation of endometriosis and adenomyosis. MRI provides a pre-surgical mapping of location and vascularity of leiomyomas and guides final management.[7] Definitive diagnosis by MRI, obviates the necessity of invasive diagnostic laparoscopy and hysteroscopy in patients with endometriosis and intrauterine adhesions. Owing to its high spatial resolution, MRI provides accurate anatomical information about Mullerian duct anomalies anomalies and is considered to be the standard of care, in such patients.[8]The present study was selected with the aim to assess role of MRI in detecting female infertility.

We enrolled 84 patients age ranged 20-40 years. In present study age group 20-30 years comprised of 50 and 31-40 years had 36 patients.Volondotet al[9] compared diagnostic accuracy of MR-hysterosalpingography (MR-HSG) and conventional hysterosalpingography (X-HSG) in the evaluation of female infertility. Forty women received prospectively both X-HSG, the gold standard technique, and MR-HSG on the same day but the order in which they were conducted was randomised. A 1.5 Tesla MRI was performed with classical sequences for pelvic analysis and an additional 3D T1-weighted sequence with intra-uterine injection of gadolinium. Twenty-six patients were included. Diagnostic performance of MR-HSG was: Se: 91.7% (95% CI 61.5–99.8); Sp: 92.9% (95% CI 66.1–99.8) ; PPV: 91.7% (95% CI 61.5–99.8); NPV: 92.9% (95% CI 66.1–99.8). Pain analysis showed a significant statistical difference between the two procedures: average VAS for X-HSG was 4.43 (95% CI 3.50–5.36) versus 3.46 (95% CI 2.62–4.31) for MR-HSG, p=0,01. Intra- and inter-rater agreements for detection of tubal or intracavity abnormalities were 0.92 (95% CI 0.78–1.00) and 0.76 (95% CI 0.52–1.00).

In this study it was seen that various causes of female infertility was PCOS in 12, tubal disease in 18, pelvic inflammatory disease in 10, endometriosis in 8, leiomyoma in 6, adenomyosis in 12 and endometrial polyps in 20 cases.Polycystic ovarian syndrome (PCOD)

is characterized by a combination of multiple clinical manifestations (i.e., hirsutism, menstrual disturbances, anovulatory cycles, and infertility) and hormonal imbalance (an abnormal luteinizing hormone / follicular stimulating hormone (LH/FSH) ratio and excessive androgen secretion. Tubal diseases mainly include destruction or obstruction and peritubal adhesions.[10]PID is a common cause of infertility and can manifest as pelvic collections, tubo-ovarian collections, uterine or broad ligament infection. MRI is superior to USG for revealing an infected uterus and broad ligament which appear hyperintense on T2W images. Other signs of PID include probe tenderness, thickening of the tubes (mural thickness more than 5 mm) and tubo-ovarian masses.[11]

Endometriosis mostly involves the ovaries but can secondarily involve other pelvic structures. USG is the preferred technique and shows a typical endometrioma located in the ovary as a well-defined cystic lesion with homogeneous low-level internal echoes. MRI is more sensitive in detecting an endometrioma which appears hyperintense on T1W images and hypo- to hyperintense on T2W images. Fat-suppressed T1W images are very useful for detecting peritoneal implants.[12]

Leiomyoma infrequently causes infertility by interfering with transportation of sperms or implantation due to distortions of the uterine contour and cavity. MRI however is superior in the preoperative evaluation of the site, number, and size of leiomyomas. MRI can monitor post-treatment changes and recurrences in patients treated with uterus-conserving methods of treatment.[13]

MRI is excellent in not just arriving at a definitive diagnosis in sonographically undiagnosed tubo-ovarian masses, but also in delineating stage, severity, and extent of spread of pelvic inflammatory disease.[14] Characteristic MRI appearances in tubo-ovarian abscesses include, complex cystic solid masses in adnexal region, with ovaries not separately delineated. These lesions appear heterogeneously hypointense on T1W sequences, hyperintense on T2W sequences, and show heterogeneous contrast enhancement of the tubal walls and septae on gadolinium administration. These masses have irregular wall thickening, debris, and internal septations. MRI is superior to US in determining both tubal and peri-tubal components of PID.[15] Contrast-enhanced MRI provides a unique assessment of the spread of infection along the broad ligament in patients with PID.

Conclusion

MRI is an excellent non-invasive, radiation-free modality for the evaluation of female infertility; its superior soft-tissue contrast resolution and multiplanar evaluation generate exquisite anatomical details.

References

1. Kaproth-Joslin K, Dogra V. Imaging of female infertility: A pictorial guide to the hysterosalpingography, ultrasonography, and magnetic resonance imaging findings of the congenital and acquired causes of female infertility. RadiolClin North Am. 2013;51:967–81.
2. Olpin J, Kennedy A. Secondary infertility in women: Radiologic evaluation. Reports in Medical Imaging. 2011;4:1–14.
3. Steinkeler J, Woodfield C, Lazarus E, Hillstrom M. Female infertility: A systematic approach to radiologic imaging and diagnosis. Radiographics. 2009;29:1353–70.
4. Cipolla V, Guerrieri D, Pietrangeli D, Santucci D, Argirò R, de Felice C. Role of 3.0 tesla magnetic resonance hysterosalpingography in the diagnostic work-up of female infertility. ActaRadiol. 2016;57:1132–9.
5. Rastogi R. Role of imaging in female infertility [Dr KM Rai memorial oration award] Indian J Radiol Imaging. 2010;20:168–7.

6. Imaoka I, Wada A, Matsuo M, Yoshida M, Kitagaki H, Sugimura K. MR imaging of disorders associated with female infertility: Use in diagnosis, treatment, and management. Radiographics. 2003;23:1401–21.
7. Bartynski WS, Lin L. Dynamic and conventional spin-echo MR of pituitary microlesions. AJNR Am J Neuroradiol 1997;18:965-72.
8. Unterweger M, De Geyter C, Fröhlich JM, Bongartz G, Wiesner W. Three-dimensional dynamic MR-hysterosalpingography; A new, low invasive, radiation-free and less painful radiological approach to female infertility. Hum Reprod 2002;17:3138-41.
9. Volondat M, Fontas E, Delotte J, Fatfouta I, Chevallier P, Chassang M. Magnetic resonance hysterosalpingography in diagnostic work-up of female infertility–comparison with conventional hysterosalpingography: a randomised study. European radiology. 2019 Feb;29(2):501-8.
10. Outwater EK, Siegelman ES, Chiowanich P, Kilger AM, Dunton CJ, Talerman A. Dilated fallopian tubes: MR imaging characteristics. Radiology 1998;208:463-9.
11. Ha HK, Lim GY, Cha ES, Lee HG, Ro HJ, Kim HS, et al. MR imaging of tubo-ovarian abscess. ActaRadiol 1995;36:510-4.
12. Fleischer AC, Kepple DM. Normal pelvic anatomy as depicted by various sonographic techniques. In: Fleischer AC, Javitt HC, Jeffrey RB Jr, Jones HW III, Editors. Clinical gynecologic imaging. Philadelphia, Pa: Lippincott-Raven; 1997. p. 10-22.
13. Woodward PJ, Sohaey R, Mezzetti TP Jr. Endometriosis: Radiologicpathologic correlation. Radiographics 2001;21:193-216.
14. Thompson JD, Rock JA. Leiomyoma uteri and myomectomy. In: Rock JA, Thompson JD, Editors. TeLinde's operative gynecology. 8th ed. Philadelphia, Pa: Lippincott-Raven; 1997. p. 731-70.
15. Ascher SM, Arnold LL, Patt RH, Schruefer JJ, Bagley AS, Semelka RC, et al. Adenomyosis: prospective comparison of MR imaging and transvaginal sonography. Radiology 1994;190:803-6.