Ultrasound And Mri Correlation In Diagnosis Of Pelvic Pathologies In Female Patients

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Abstract:

Background:For female pelvic pathologies, ultrasonography remains as primary investigational imaging modality. But, sometime the findings can be inaccurate. Magnetic resonance imaging (MRI) can offer detailed and more accurate pelvic findings, which can avoid unseemly and unsuitable surgeries. Hence we focused to differentiate various pelvic pathologies by ultrasonography and MRI.

Materials and Methods: In this prospective study, 94 referred female cases to department of Radiodiagnosisof more than 18 years with clinical suspicion of pelvic pathology were included. All the recruited cases underwent ultrasonography. Furthermore, cases with positive pelvic pathology or suspicion on clinical examination and ultrasonography underwent MRI examination. The comparison was made between two modalities for detection and characterization of each of pathologies.

Results: Among 94 cases, majority pertained to more than 50 years of age group (34%) and exhibited malignant pelvic masses (42%) with per vaginal bleeding (36%). Maximum cases had uterine pathologies (26%), and endometrial pathologies (25%). MRI could diagnose 3 cases of endometrial carcinoma which were missed by ultrasonography.Cervical pathologies were identified on both the modalities except in 3 cases where ultrasonography showed bulky cervix which was diagnosed as carcinoma on MRI. Also, MRI could diagnose hemorrhagic and dermoidcyst accurately with precise characterization of blood products. MRI diagnosed 1 case as dermoid cyst which was misdiagnosed on ultrasonography as carcinoma of ovary. Hydrosalpinx, peritoneal enhancement and lymphadenopathy was easily diagnosed on MRI.

Conclusion:MRI was found to be more precise to evaluate both benign and malignant female pelvic lesions in comparison to ultrasonography most of the times.

Keyword:Pelvic masses, Ultrasonography, Magnetic resonance imaging

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I. Introduction

Pelvic masses in females can originate from gynaecologic organs such as uterus, cervix and uterine adnexa or non-gynaecologic organs like bladder, intestines, ureters and renal organs[1,2]. Radiological investigations particularly ultrasonography and magnetic resonance imaging (MRI)have become an indispensable modality for screening pelvic pathologies[3]. Sonography of the pelvis is the first resort and primary evaluation technique for any suspected pelvic pathology after clinical examination[4].Sonographic assessment of pelvic masses is a mere extension of physical examination and has now become an innate part of evaluation before the commencement of treatment of any pelvic pathology[5,6].MRI with its high resolution and multi planar imaging has the capability to characterize multiple lesions and is becoming the modality of choice to assess the pelvic pathologies[7]. The advent of minimally invasive therapies in the management of pelvic masses has created a need for increased accuracy in the preoperative evaluation of pelvic pathologies[8]. The current study aimed to correlate the differentiation and characterization of pelvic pathologiesin females by ultrasound and MRI.

II. Material And Methods

This prospective study was carried out in female patients referred to department of Radiodiagnosis at tertiary care teaching centre in central India from November 2022 to November 2023. A total 94 adult subjects (females) of aged ≥ 18, years were included in this study.

Study Design: Prospective study

Study Location: This was a tertiary care teaching hospital based study done in department of Radiodiagnosis, Maharashtra, Central India.

Study Duration: November 2022 to November 2023.

Sample size: 94 patients.

Sample size calculation: The sample size actually obtained for this study was 94 patients.Sampling was done through convenience sampling technique

Subjects & selection method: The study population was drawn from referred female patients from from gynaecology and surgicalservicesto department of Radiodiagnosiswith clinical suspicion of pelvic pathology

Inclusion criteria:
1. Aged ≥ 18 years,
2. Clinical suspected cases of pelvic masses,
3. Patients with incidental detection of pelvic masses on ultrasound

Exclusion criteria:
1. Pregnant women,
2. Unmarried females were refrained from transvaginal ultrasonography
3. Patients with claustrophobia,
4. Patients who underwent implant surgeries in past with metallic fixations, or cardiac pacemakers
5. Patients who underwent treatment of pelvic masses in past.

Procedure methodology

After written informed consent was obtained, a well-designed questionnaire was used to collect the data of the recruited patients prospectively. The questionnaire included characteristics such as age, presenting symptoms and chief complaints of the patients.All patients were subjected to ultrasonography. Those patients who had positive or suspicious findings in ultrasonography were subjected to MRI examination.

Ultrasound imaging was performed using GE voluson E6 USG Machine. Transabdominal ultrasound was done using a probe (3.5-5 Mhz) and transvaginal ultrasound was done using a probe (10 Mhz). Transabdominalultrasound was done with full bladder with optimal settings. Transvaginalultrasound was done with an empty bladder. Serial longitudinal and transverse scans of the pelvic organs were obtained. The mass was then studied in detail with angled and additional scans.The parameters noted in ultrasonography examination were size and contour of uterus, endometrial thickness, lesions in endometrial cavity and myometrium along with its characteristics and lesions in cervix with extension if present. Presence of vegetation or septation (if cystic), wall of the mass, Doppler vascularity, cystic degeneration, soft tissue nodules, fat content, compression of other organs, presence of pelvic para iliac lymph node invasion, and the presence of ascites or peritoneal nodules were also examined.The details about ovary, adenexa and fallopian tube were also studied.

MRI was performed using 1.5 Tesla Siemens MagnetomeEssenza machine. The following sequences were done including T1 WI, T2 WI, T2 WI fat sat and STIR in axial plane, T2 WI fat sat and STIR in coronal plane and T2 WI and STIR in sagittal plane. Using a pelvic phased-array Torso coil, the all patients were imaged in the supine position. To minimize bowel peristalsis, intravenous administration of an antispasmodic drug (10 mg of visceralgine) was administered immediately prior to MRI. Contrast and other special sequences like diffusion and gradient imaging were used as and when required. Apart from ultrasonography findings, maximal junctional zone thickness was measured and junctional zone to myometrial thickness was measured using MRI. Extent of lesion was noted in carcinoma cervix and level of myometrial invasion was noted in case of endometrial lesions.

Statistical analysis

Data was analyzed using SPSS software version 20.0. Results on continuous measurements were presented on Mean +/- standard deviation and results on categorical measurements were presented in number (percentage). Chi-square and Fisher exact tests were performed to test for differences in proportions of categorical variables between two or more groups. The level $P < 0.05$ was considered as the cutoff value or significance.

III. Result

- It was found that, 26% women had uterine pathology, 25% endometrial pathology, 13% cervical pathology, 29% ovarian pathology and 6% mullerian anomalies.
- Of total cases, 40% women had benign pathology, 42 % had malignant pathology and 18% had various other pathology like placental invasion, mullerian anomalies and infective etiologies.
- Nearly all endometrial pathologies correlated in conclusions on both ultrasonography and MRI. Except MRI picked up 3 cases of endometrial carcinoma which were within the thickened endometrium and could not be picked on ultrasonography.

- Placental invasion was picked up on ultrasonography and MRI almost equally except in one case where placenta was posteriorly located in which ultrasonography showed false positive result.
- Cervical pathologies were identified on both the modalities except in 3 cases where ultrasonography showed bulky cervix which turned out to be carcinoma cervix on MRI.
- Hemorrhagic cyst and dermoid were more accurately diagnosed on MRI because of precise tissue characterization and identification of blood products. One case was diagnosed as carcinoma ovary on ultrasonography but it was diagnosed as dermoid on MRI.
- Hydrosalpinx was easily seen on MRI. Peritoneal enhancement as well as thickening and lymphadenopathy were more easily seen on MRI due to its multiplanar capability.

Table no 1 Shows distribution of cases according to their age. Majority of females were more than 50 years (34%). This was followed by 28% of the females less than 30 years, 22% females pertaining to age interval of 31 to 40 years and 16% females from age interval of 41 to 50 years.

Table no 1 : Distribution of cases according to age

Age in years	Number	Percentage
Less than 30	26	28
31-40	21	22
41-50	15	16
More than 50	32	34

Table no 2 Shows distribution of cases according to their presenting complaints. Majority of females presented with per vaginal bleeding (36%). This was followed by 34% of the females having pain in abdomen, 11% females came for antenatal check up and 7% females had dysmenorrhea. Very few cases like 6% females had menorrhagia and 3% cases had amenorrhoea and irregular menses.

Table no 2 : Distribution of cases according to presenting complaints

Complaints	Number	Percent
Antenatal check up	10	11
Pain abdomen	32	34
Per vaginal bleeding	35	36
Irregular menses	3	3
Dysmenorrhoea	6	7
Menorrhagia	5	6
Amenorrhea	3	3

Table no 3 Shows distribution and division of pathological lesions. Majority of females had ovarian lesions (29%). This was followed by 26% of the females having lesions in uterus, 25% females with lesions in endometrium, and 13% females with cervical lesions. Very few cases like 6% females had mullerian anomaly and only 1% case had non ovarian adnexa.

Table no 3 : Distribution and division of pathological lesions

Pathology	Number	Percentage
Uterus	25	26
Endometrium	23	25
Cervix	12	13
Ovarian	28	29
Non ovarian adnexa	1	1
Mullerian anomaly	5	6

Table no 4 Shows distribution for types of pathological lesions. Majority of lesions were malignant in nature (42%) and few were benign (40%). 18% of cases were of unknown status.

Table no 4 : Pathological types of lesions

Pathology	Number	percentage
Benign	37	40
Malignant	40	42
Others	17	18

Table no 5 Shows distribution of cases according to their organ wise pathologies on ultrasound and MRI. In uterus, most pathologies were identified on both modalities. Adenomyosis had high specificity on MRI because of its distinctive features. In our study no case of adenomyosis was missed on ultrasonography because it was performed by senior faculty. Correlation with MRI helped us to improve our ability to pick up

adenomyosis on ultrasonography. Nearly all endometrial pathologies correlated in conclusions on both ultrasonography and MRI. But, MRI picked up 3 cases of endometrial carcinoma which were within the thickened endometirum and could not be picked on ultrasonography. Placental invasion was picked up on ultrasonography and MRI almost equally except in one case where placenta was posteriorly located in which ultrasonography showed false positive result. Cervical pathologies were identified on both the modalities except in 3 cases where ultrasonography showed bulky cervix which turned out to be carcinoma cervix on MRI. One case which was diagnosed as carcinoma ovary on ultrasonography, got diagnosed as dermoid on MRI.

**Table no 5:** Organ wise pathologies on ultrasound and MRI

Uterine pathology	USG	MRI
Fibroid	13	12
Adenomyosis	10	10
Molar pregnancy	4	4
Uterine AVM	3	3
Endometrial Pathology	USG	MRI
Ca endometrium	15	18
Adenomyosis	10	10
Endometrial polyp	1	1
Thickened	3	-
Placental appearance	USG	MRI
Placental invasion	5	4
Cervical Pathology	USG	MRI
Ca cervix	9	12
Bulky cervix	3	-
Ovarian Pathology	USG	MRI
Ca ovary	7	6
Simple cyst	2	1
Complex cyst	4	2
Hemorrhagic cyst	6	7
Dermoid	2	3
Hydrosalpinx	2	4

Table no 6 Shows distribution of additional findings on ultrasonography and MRI. Hydrosalpinx was easily seen on MRI while ultrasonography needed experience. Peritoneal enhancement and thickening and lymphadenopathy were more easily seen on MRI due to its multiplanar capability

Table no 6: Detection of additional findings on ultrasonography and MRI

Findings	USG	MRI
Renal agenesis	2	2
Ascites	3	3
Liver lesions	1	1
Hydrosalpinx	2	4
Collection	2	2
Ectopic kidney	2	2
Lymphadenopathy	1	5
Peritoneal deposits	0	1

Figure 1: Detection of additional findings on ultrasonography and MRI
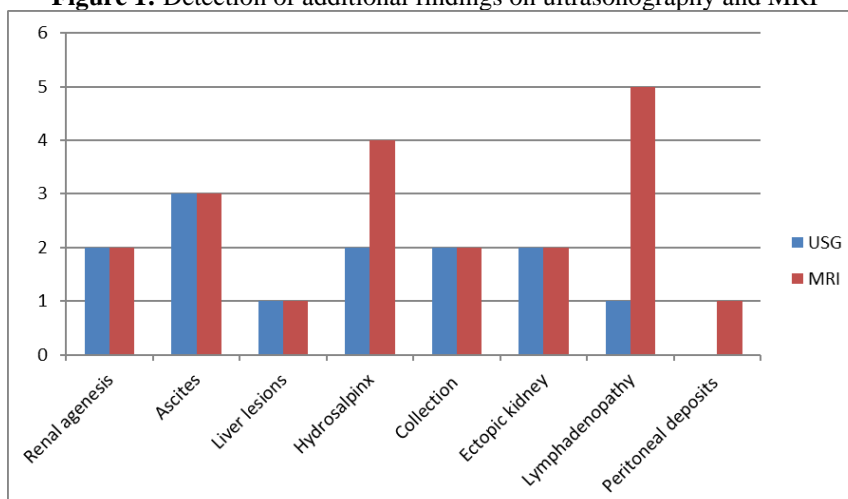
IV. Discussion

In females, pelvic masses are commonly observed over a wide age interval. Many factors are etiological responsible for pelvic masses and accurate diagnosis is often a challenge. Timely management of pelvic masses depends on appropriate preoperative assessment using clinical examinations, laboratory tests, and different imaging techniques[9]. Modalities like MRI and ultrasonography can provide valuable adjunct in pre and post-operative evaluation. In women, unnecessary surgeries can be avoided by accurate pelvic and adnexal mass detection. Moreover, in young women, limiting unnecessary surgeries can help to preserve childbearing capability in them. MRI and ultrasonography has an established role in the identification and accurate diagnosis for pre-surgical workup of pelvic masses[10]. Hence we conducted this study to assess and correlate characterization of pelvic pathologies in females by ultrasound and MRI. The present study was a prospective study done in Department of Radiodiagnosis, at a tertiary care teaching hospital, Maharashtra in the time interval of November 2022 to November 2023

In present study, maximum cases pertained to age group more than 50 years of age interval with vaginal bleeding as commonest presenting complaint. Patel et al., highlighted mean age as 35 years with the common presenting complaint as lower abdominal pain followed by complaint of menorrhagia in their study[2].Vijetha et al., also appraised bleeding per vagina (38%), followed by pain abdomen(28%), post menopausal bleeding (16%) as commonest symptoms[3].

Togashi et al., found 71 cases with fibroid, 16 with adenomyosis, 6 with both fibroid and adenomyosis[11]. This was in consensus with our study as, we found 12 patients with fibroid and 10with adenomyosis. Adenomyosis had high specificity on MRI because of its distinctive features. In our study, no case of adenomyosis was missed on ultrasonography as it was done by senior faculty. Correlation with MRI helped us to improve our ability to diagnose adenomyosis on ultrasonography.

Bhatnagar et al., in 2 cases of their study diagnosed endometrial hyperplasia on MRI, which turned out to be endometrial carcinoma by histopathology. Another patient who had invasion in MRI could not be diagnosed in transvaginal sonography in their study[9]. This was in accordance to our study, as MRI diagnosed 3 cases of endometrial carcinoma which were within the thickened endometrium and were missed on ultrasonography.

Bhatnagar et al., correlated all 20 cases of cervical carcinoma with ultrasonography and MRI. Only 10 cases were correctly diagnosed by ultrasonography in their study[9], whereas in our study in 3 cases ultrasonography showed bulky cervix which turned out to be carcinoma cervix on MRI.

Vijetha et al., found that ultrasonography was able to diagnose carcinoma cervix as well as ovary grossly but MRI was able to delineate the lesion and help with the staging of which was not possible with ultrasonography[3]. In our study, 1 case was diagnosed as dermoid on MRI, which was earlier diagnosed as carcinoma ovary on ultrasonography. Atrophic or small sized ovaries were well visualized on MRI than ultrasonography.

In another study, it was found that USG was able to diagnose 2% case of congenital defect while MRI diagnosed 4% of congenital defects with ease[3]. Patel et al., found 40% haemorrhagic cysts on MRI, which were otherwise missed on ultrasonography. Both modalities were equally effective in identifying dermoid cysts, simple ovarian cysts, serous cystadenoma, endometriomas, hydrosalpinx and arteriovenous malformations in their study[2]. In our study, hydrosalpinx was easily seen on MRI. Also, peritoneal enhancement, thickening and lymphadenopathy were more easily seen on MRI due to its multiplanar capability.

V. Conclusion

Although ultrasonography is the most appropriate modality to begin evaluation in suspected pathologies of the female pelvis, MRI is better in characterization of the lesions and accurate delineation. MRI is a costlier imaging modality and needs expertise. But, due to its good tissue characterization and multiplanar imaging capability, it can be considered as a precise preoperative imaging modality for diagnosing and distinguishing the distinct features of various female pelvic masses.

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