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Radiology

KEY WORDS: Mass; MRI; Pelvic; Ultrasonography

ROLE OF ULTRASONOGRAPHY AND MRI IN CHARACTERIZATION OF FEMALE PELVIC MASSES WITH HISTOPATHOLOGICAL CORELATION

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ABSTRACT

Patients with clinical suspicion of pelvic masses and incidentally detected pelvic masses on ultrasonography were subjected to MRI pelvis over a period of 2 years. A total of 62 pelvic lesions were detected in 50 patients on MRI. 26 patients (31 lesions) were operated and their findings on MRI and USG were correlated with operative and histopathological findings. Objective of this study was to determine the origin and tissue characterization of sonographically indeterminate uterine and adnexal masses on MRI. MRI is superior to ultrasound and in difficult or equivocal cases the multiplanar imaging capability allows accurate identification of origin of mass, and also the tissue characterisation. The sensitivity of MRI and USG for diagnosing malignancy of pelvic lesions is similar however, due to better specificity and higher sensitivity in detecting invasion of adjacent organs and organs of origin of lesions, MRI is superior in sonograpically indeterminate masses.

INTRODUCTION: Ultrasound is considered the first line of imaging for the female pelvis. However, there are many limitations with this modality which include limited field of view, artifacts caused by the presence of bowel gas, its dependence on the skill and experience of the operator and limited assessment of parametrial spread of disease.[1] Transvaginal Sonography can assess pelvic pathologies with higher resolution and helps in earlier diagnosis , however it is not able to visualise masses that lie high in the pelvis as a result of poor penetration. MRI because of its superb soft tissue contrast and direct multiplanar capabilities can better delineate and characterize normal pelvic anatomy and focal and diffuse pelvic conditions. MRI is non-invasive, has no risk of radiation, requires no anesthesia and is less operator dependant. Since MRI is more expensive and less readily available than USG, it is important to know when patients should undergo MRI. MRI should be considered for the evaluation of uterine and adnexal pathology when Sonographic characteristics are not definitive to determine the origin of the mass and to determine the likelihood of malignancy.[2]

OBJECTIVES OF STUDY: Characterization of pelvic masses as benign or malignant. To determine the origin, tissue characterization of sonographically indeterminate uterine and adnexal masses.

MATERIALS AND METHODS: The study included 50 patients referred to Department of Radiodiagnosis for MRI of pelvis with clinical suspicion of pelvic masses and incidentally detected pelvic masses on ultrasonography over a period of 2 years. Patients of all age groups were included in the study. Exclusion criteria: Patients with bladder carcinoma and rectal carcinoma. Patients who had undergone treatment for pelvic mass. Patients with metallic implants, cardiac pacemakers, cochlear implants. Patients who were claustrophobic or unwilling for imaging. Ultrasonography of pelvis was done on Samsung USS RS8 CF4K/WR using a high frequency endocavitary probe as well as curvilinear transabdominal probe. MRI Imaging was done with 1.5 tesla Philips Achieva machine using body coils. The following sequences were selected as required T1WI, T2WI AND T1 SPIR (in axial plane). T2WI (in coronal plane).T2WI ,T2W SPAIR,T1W SPIR (in sagittal plane). Contrast was used as and when required in a dose of 0.1 mmol/kg body weight. Post contrast study included T1W FAT SUPPRESSED Sequence (in axial and sagittal planes). Vaginal gelly was used in suspected cases of Endometriosis and for vaginal invasion in ca cervix. The data was by calculating the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of the techniques.

RESULTS: A total of 62 pelvic lesions were detected in 50 patients on MRI. Out of 50 patients, 26 patients (31 lesions) were operated and their findings on MRI and USG were correlated with operative and histopathological findings. Out of remaining 24 patients, 10 patients (11 lesions) were followed up with either USG or MRI for change in size/characteristics/stability of lesions with or without treatment. Remaining 14 patients were not operated and were also lost to follow up and were analysed only on basis of imaging findings. Out of 62 lesions 54 were benign and out of these 54 benign lesions 17(31.4%) were less than 4cm in size while 37(68.5%) were more than 4cm in size. Out of the remaining 8 malignant lesions 2(25%) were less than 4cm in size while 6(75%) were more than 4cm in size. The lesions were further characterized on the basis of the type of their contents as solid, cystic or complex solid/cystic. A total 39 lesions were purely cystic in nature out of which only 1 was malignant, out of 8 complex lesion 3(37.5%) were malignant whereas out of 15 solid lesions 4(26.7%) were found to be malignant. Papillary projections/ mural nodules were seen in 2 out of 39(5.1%) of benign and in all (100%) malignant cystic lesions. Wall and Septum characteristics in cystic and predominantly cystic lesions and their frequency in various benign and malignant lesions is shown in Table 1.

Table1: Wall/ Septum characteristics in cystic and predominantly cystic lesions

Characterictics	Total	Benign		Malignant	
		no	%	no	%
Thin & smooth ,no septae	22	22	100	0	00
Thin & smooth with septae	14	14	100	0	00
Thick &smooth ,no septae	0	0	-	0	-
Thick & smooth with septae	04	4	100	0	00
Thick and irregular with septae	04	3	75	01	25

Fat planes with adjacent organs were involved in 3 out of 8 (37.5%) of malignant lesions and in none of the benign lesions. Omental caking/nodules was seen in 1 out of 7(14.2%) of malignant lesions and in none of the benign lesions. MRI had detected 62 lesions and USG detected 60 lesions, 2 lesions were not detected on USG. One of them was hematosalpinx which was seen in patient with ovarian dermoid cyst and not detected on USG because of posterior acoustic shadow of dermoid cyst and bowel gas. Another that was not detected on USG was small endometrioma which was seen in association with infective tubo-ovarian mass and was obscured because of bowel shadow. In 40% cases both USG and MRI lead to diagnosis, in 58% cases USG was indeterminate and MRI solved the diagnostic dilemma. In 2% cases both USG and MRI were inconclusive. For total no of 20 cases of clinically suspected mullerian anomaly presenting with pelvic mass number of cases in which definitive diagnosis could be made by USG alone was 25% and in the rest 75% cases MRI was needed to establish the diagnosis (Fig1). Sensitivity, specificity and accuracy of MRI and USG in diagnosing malignant lesions in 26 operated patients is shown in Table 2 and 3.

DISCUSSION: The present study was conducted on 50 female patients with pelvic mass lesions which were studied by USG and MRI modalities.

Table2: Sensitivity, specificity and accuracy of MRI in diagnosing malignant lesions in 26 operated patients with 31 pelvic lesions (n=31lesions).

	Histopathologically positive for malignancy	Histopathologically negative for malignancy	Total
Mri positive for malignancy	5(tp)	2(fp)	07
Mri negative for malignancy	0(fn)	24(tn)	24
Total	05	26	31

Sensitivity = (TP/TP+FP) x100 =100%
Specificity = (TN/TN+FP) x100= 92.3%
Accuracy = (TP+TN/TP+TN+FP+FN)x100=93.5%

Table3: Sensitivity, specificity and accuracy of USG in diagnosing malignant lesions in 26 operated patients with 31 pelvic lesions (n=31lesions)

	Histopathologically positive for malignancy	Histopathologically negative for malignancy	Total
Usg positive for malignancy	5(tp)	3(fp)	08
Usg negative for malignancy	0(fn)	23(tn)	23
Total	05	26	31

Sensitivity = (TP/TP+FP) x100 =100%
Specificity = (TN/TN+FP) x100= 88.4%
Accuracy = (TP+TN/TP+TN+FP+FN)x100=90.3%.

Among 50 cases, 26 cases underwent surgical procedures and the excised tissue was subjected to histopathological examination for final diagnosis. Guerra et al observed in their study of 161 patients that MRI had high accuracy of 95% to differentiate between malignant and non-malignant lesions.[3] Other authors have reported accuracies ranging from 83 to 94%.[4,5]Dodge et al in their meta-analysis found that the sensitivity and specificity of MRI for correct detection of malignancy can reach 92% and 88%, respectively.[6] In the present study, we found that MR imaging in the detection and characterization of pelvic masses had a sensitivity of 100% and specificity of 92.3% which signifies that MR imaging is highly accurate in the characterization of pelvic mass lesions. In a study done by Sohaib et al accuracy of MR imaging in the detection and characterization of adnexal mass lesions was reported to have a sensitivity of 95% and specificity of 88%.[7] Site, tissue of origin and tissue characterization of pelvic masses are all well delineated by MRI. Unenhanced T1- and T2-weighted imaging is important for accurate tissue characterization.

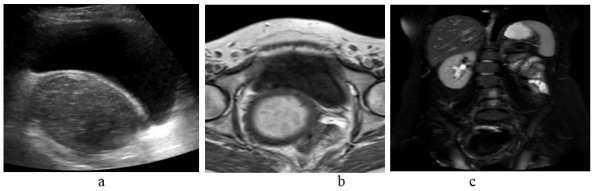

Fig 1: Unicornuate uterus (type II Mullerian Anomaly): a: USG showing bulky uterus with heterogeneous predominantly hyperechoic collection in endometrial cavity. b: MRI shows unicornuate uterus with gross collection in single right uterine horn and associated thinning of surrounding myometrium. c:Associated left renal agenesis.

MRI offers supplemental diagnostic information in cases of a suboptimal or equivocal ultrasound examination and in patients in whom there is discrepancy between sonographic findings and physical examination. MRI has high sensitivity and specificity which helps in staging of cancers, patient selection for treatment, and detection of disease recurrence.[8] A sonographically indeterminate pelvic mass is defined as one that has complexity but that, after thorough interrogation including Doppler assessment, cannot be confidently placed into either the benign or malignant category.[9] Indeterminate adnexal masses are within the "gray area" between complex benign disease and early malignancy.[10] In our study in 58% cases USG was indeterminate and MRI solved the diagnostic dilemma. 2 lesions were not detected on USG. One of them was hematosalpinx which was seen in patient with ovarian dermoid cyst and not detected on USG because of posterior acoustic shadow of dermoid cyst and bowel gas. Another that was not detected on USG was small endometrioma which was seen in association with infective tubo-ovarian mass and was obscured because of bowel shadow. In both cases, MRI was helpful in characterization of the lesions and delineating the extent of the lesion. In the case of the tubovarian masses in our study, associated with pelvic inflammatory disease, presence of more lesions and extent of the disease was better characterized on MRI than on USG. Bilateralism was detected in many cases only on the subsequent MRI scan. Studies have shown that the sensitivity of MRI in the diagnosis of PID was found to be 95%, with a specificity of 89%, and overall accuracy was 93% compared to the corresponding values of 81%, 78%, and 80% for TVS respectively.[11] Of the neoplastic lesions majority were diagnosed as large cystic lesion with thick wall, multiple thick septae and mural nodules on USG which turned out to be serous and mucinous neoplasms of the ovary. The ovary of origin could not be ascertained on the USG in most of these and MRI helped in these cases by showing a normal ovary on the other side.(Fig 2) Also other associated features such as ascites and enlarged lymph nodes could be better seen on the MRI scan. The main reasons for indeterminate sonographic diagnoses were the inability to determine origin because of location and large mass size and the appearances of purely solid or complex cystic masses.[12] In cases of Müllerian duct anomalies the uterine configuration and presence of ovaries could be clearly made out on the MRI, when it was difficult to visualize on USG because of bowel loops and inability to do transvaginal USG.

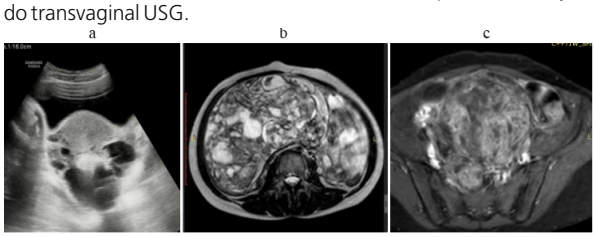

Fig 2: Immature teratoma of right ovary. a:USG showing a large heterogeneous pelviabdominal solid cystic lesion. Bilateral ovaries were not seperately visualized. b:MRI shows large well defined lobulated solid-cystic lesion extending from L1 to S4 vertebral body level hyperintense on T2W and fat suppressed sequences, showing multiple areas of fat and cystic areas within. c:Heterogeneous post contrast enhancement.

MRI remains the preferred imaging method, as it exquisitely details both the uterine cavity and external contours and has shown excellent agreement with clinical Müllerian duct anomalies subtype diagnosis.[13] Pellerito et al also noted that magnetic resonance imaging had the further advantage of detecting other incidental abnormalities, not found on ultrasound.[14]

CONCLUSION: USG is the primary modality for diagnosing pelvic masses. MRI is superior to ultrasound and can be used in difficult or equivocal cases. The multiplanar imaging capability allows accurate identification of origin of mass, and also the tissue characterisation. The sensitivity of MRI and USG for diagnosing malignancy of pelvic lesions is similar however, due to better specificity and higher sensitivity in detecting invasion of adjacent organs and organs of origin of lesions, MRI is superior in sonograpically indeterminate masses.

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