The Technical Value of Magnetic Resonance Imaging and Ultrasonography in Identifying Characterization of Ovarian Cysts

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Abstract

An accurate diagnosis of ovarian cysts is of utmost importance to determine the timely treatment to preserve fertility.We sought to determine the effectiveness of ultrasonography and MRI modalities for diagnosing the most common ovarian lesions and differentiate between benign and malignant lesions in order to guide patients to appropriate treatment. This study was conducted on 94 women, the age group between 14-70 years, in the period of January 2020 to October 2021. Were all women suffering from abdominal pain, swelling, nausea or vomiting and bleeding and irregular menstrual cycle. Was suspected clinically in the presence of lesions in the ovary was confirmed by tests of ultrasound and magnetic resonance. The entire cases were subjected to transvaginal and transabdominal ultrasound and magnetic resonance imaging to assess ovarian lesions in terms of content (somatic, cystic solid), nodules, septal characteristics, wall thickness, vascular lesion and ascites.In USG, there were 16% cases of malignant ovarian lesion and 84% cases had benign lesions. MRI reports showed that 10.6% cases had malignant ovarian lesions and 89.4% cases had benign lesions. Findings of USG with HPE have 100.0% sensitivity, 89.1% specificity and 91.07% diagnostic accuracy. In MRI findings with HPE have 100.0% sensitivity, 100% specificity, and 100.0% diagnostic accuracy. MRI had high specificity and more accuracy value in terms of diagnostic performance than USG. The ultrasonography diagnostic value in case of characterization of adnexal mass lesion was significantly lower than in the MRI.

Keywords: *USG, MRI, histopathology, adnexal lesions,ovarian cyst, adnexal masses.*

Introduction

One of the common disorders in gynecology is ovary cysts, also known as adnexal masses or ovarian masses. Ovarian masses pose a dilemma for gynecologists since the diagnosis of variation is complex and difficult. Among the most serious types of gynecological cancer are ovarian malignancies, which are characterized by a late onset and poor response to therapy[1-4].Adequate surgical management of ovarian cancer remains as the cornerstone treatment for possible malignancy of the ovary and minimal invasive surgery (i.e. laparoscopy or laproectomy) if the tumor is benign.One of the routine gynecological investigation and primary diagnostic in cases of suspected a lesion and identification ovarian mass is an ovarian ultrasound [2]. Where the mass in adnexal region is recognized as undefined on ultrasound when it couldn't be surely located into either the malignant or benigntumor, even after thorough examination including evaluation by the Doppler, or for which the location of source, from the uterus, ovary

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or other structures of the pelvis, stays to be decided [3]. When findings of the ultrasound are equivocal or nondiagnostic, the magnetic resonance imaging can be solve the problem, an auxiliary method of assessing lesions in adnexal region, appropriate for even providing information on surgical readiness with avoiding the radiation exposure.Magnetic Resonance Imaging (MRI) can be used specifically to provide accurate details of fat, collagen, and hemorrhage[5-7]. Also, it can detect several kinds of masses in the pelvis and distinguish between malignant and benign ovarian tumors with high accuracy ranging from 88-93%[1, 7].MRIdue to its higher contrast to the soft tissue and high spatial resolution abilities can improve characterization and definition of normal anatomy pelvic organs with diffuse and focal conditions of the uterus. MRI has the advantage of a noninvasive test, without radiation risk, less operator-dependent and not need anesthesia[8].Characteristics of benign tumors are more indicative, a wall thickness smaller than 3mm,completely cystic consistent, a diameter smaller than 4cm, absence of inner structure and the lack abdominal fluid (as cites), adenopathy or disease of peritoneal [9]. MR imaging has become an essential device in the valuation of patients with adnexal lesion, and its role continues to develop.Some benign structures can be diagnosed by magnetic resonance imaging with a high grade of sureness, such as endometriomas,simple andhemorrhage, teratomas, simple andhemorrhagic cysts, fibromas, and hydrosalpinx[10]. In cases of malignant tumors, MR imaging may be more exact than other modalities for staging, lesion characterization, and follow-up [11]. Most significant morphological characteristics of ovarian masses at significant risk involve (a) the lesions is solid or solid / cystic with a high diameter greater from 4 cm; (b) The appearance of unequal, non-fatty, Solid avascular zones larger than 28 mm in diameter (c) In a cystic lesion, the existence of papillary bump and thick wall and septa larger from 3mm [12, 13].

In this study, we aimed to investigate the effectiveness of ultrasound and magnetic resonance imaging (MRI) for diagnosing the most common ovarian lesions. In addition, we studied the cases to determine the precision of ultrasonography (USG) and magnetic resonance imaging (MRI) in ovarian cyst characterization to differentiate between benign and malignant lesions in order to guide patients to appropriate treatment.

Patients and Methods

Ninety four consecutive patients, with age group(14–70)years; the mean age was 39.13 years diagnosed with adnexal lesions by ultrasound and MRI in the department of radiology in Al-Hakeem in Najaf teaching hospital, the women present with variation of symptoms include abdominal swelling, irregular cycle, abdominal pain, bleeding, incidental. MR imaging was achieved on 1.5T unit of MR to do T1-weight edimages(T1W), T2-weighted images, and fat-suppression image T1-weighted pre and post intravenous MRI contrast agent (gadolinium). Ovarian cysts have features that include shape, size, content (solid - cyst), nodal or vascular septum, and reinforcement. In addition, other features appeared includes peritoneal disease, enlarged lymph nodes and ascites.We differentiate surgical and pathologic findings with the image features. On all MR imaging features, multiple logistic regression analysis was performed without clinical details. They were classified as benign or malignant, according to the image features that were differentiated to the pathological findings and surgical.

U/S and Doppler Protocol

The systems used were the PhilipsHD11xe and GE Vivid E9, and GE volusion E6. All devices had a transabdominal probe of about 2–5 MHz and an endovaginal probe with 5-7 MHz All devices had both pulsed Doppler and colorability. Where U/S and Doppler of the abnormality in ovarian may have been endovaginal performed, transabdominalDoppler U/S of the abnormality may have been used for non characterization outcomes. Before menstruation of females were arranged for the USG in eight days to the beginning their menses .

The protocol of MR Imaging

MR imaging was performed on 1.5-T units (Siemens Medical Systems). For imaging the pelvic, we used the multi-coil array, while for imaging the abdomen, we used body-coils. The sequences used to females pelvis was transverse T2-weighted sequence fast spin-echo (5,100–6,100/104–128 ((TR) msec/TE msec)) with a number of echoes acquired in given TR (ETL) of 15, a thickness of slice 4–10mm, and gap 1–2.5mm. 256 × 256 matrix size with twain signals obtained. These series recurred as seen in sagittal and coronal sequences. Atranservse T1-weighted image sequence (510-810/12-20) with T2-weighted sequence similar to spatial resolution was then accomplished. After injections intravenous (10-15) mL of gadolinium, the T1W images recurrent. By an axial fat-suppressed T1W spin-echo sequence and an axial T2W fast spin-echo sequence, the residue of the pelvis and abdomen were imaged. There was 16 of an echo train length, an 5-9mm thickness of the slice, and a gap 1-2.5-mm in the T2-weighted sequence (4,100/101-125). The matrix was 256 or 256×192 by 2 to 4 signals obtained, in the planes of coronal and sagittal, this sequence was repeated. The sequence of T1-weighted (400–610/12–21) an 4–8-mm thickness of slice with a gap 2-mm. The two signals with a matrix o 256×128–192.

Results

Table 1: The Distribution of patientsaccording to finding by ultrasound and MRI regarding ovarian cyst (N=94)

Study variables	Ultrasound	MRI
Ovarian cyst size (cm2)	(25.46 ± 22.61)	(27.97 ± 25.92)
Content Cystic Solid	 80 (85.1) 14 (14.9)	 82 (87.2) 12 (12.8)
Nodule Present Absent	 1 (1.1) 93 (98.9)	 4 (4.3) 90 (95.7)
Septum characteristics Present Absent	 9 (9.6) 85 (90.4)	 10 (10.6) 84 (89.4)
Vascularity Present Absent	 9 (9.6) 85 (90.4)	 9 (9.6) 85 (90.4)
Laterality Unilateral Bilateral	 86 (91.5) 8 (8.5)	 86 (91.5) 8 (8.5)

Table 2: Sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of US results in diagnosis of ovarian cyst in comparison to histopathological results

Ultrasound diagnosis	Histopathology		Total
	Malignant ovarian cyst	Benign ovarian cyst	
Malignant ovarian cyst	10	5	15
Benign ovarian cyst	0	41	41
Total	10	46	56

Sensitivity of US= 10/10 * 100= 100.0% ; Specificity of US= 41/46 * 100= 89.1% ; PPV of US= 10/15 * 100= 66.7% ; NPV of US= 41/41 * 100= 100.0% ; Overall accuracy of US= (10+41)/ 56 * 100= 91.07%

Table 3: Sensitivity, specificity, positive predictive value, negative predictive value and overall accuracy of MRI results in diagnosis of ovarian cyst in comparison to histopathological results

MRI diagnosis	Histopathology		Total
	Malignant ovarian cyst	Benign ovarian cyst	
Malignant ovarian cyst	10	0	10
Benign ovarian cyst	0	46	46
Total	10	46	56

Sensitivity of MRI= 10/10 * 100= 100.0% ; Specificity of MRI = 46/46 * 100= 100.0%

PPV of MRI = 10/10 * 100= 100.0% ; NPV of MRI = 46/46 * 100= 100.0% ; Overall accuracy of MRI = (10+46)/ 56 * 100= 100.0%

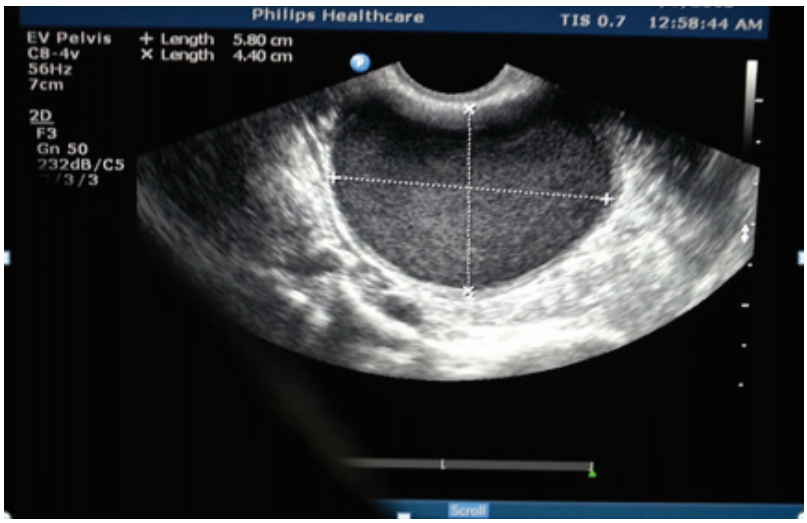

Figure1: 27 years female patient presenting with dysmenorrhea and irregular cycletransvaginal ultrasound show cystic lesion with homogenous low level internal echo.

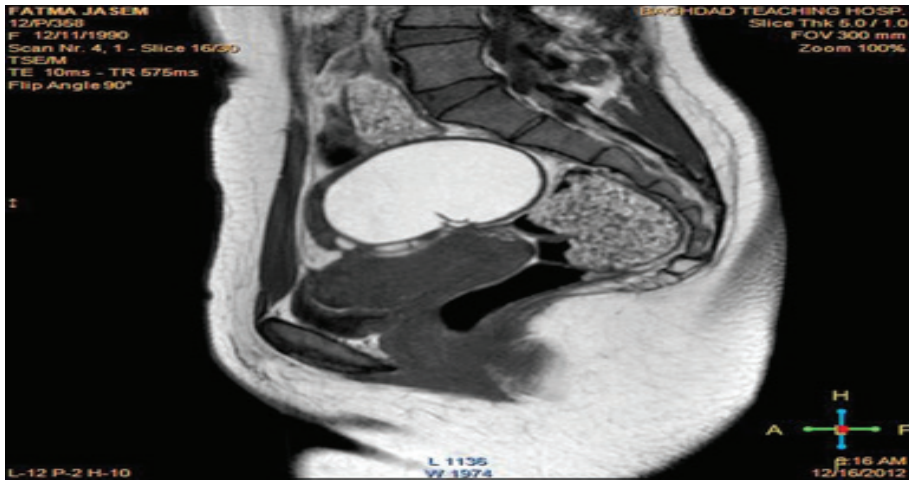

Figure2: T2 weighted imagesagittal MRI views high signal intensity.

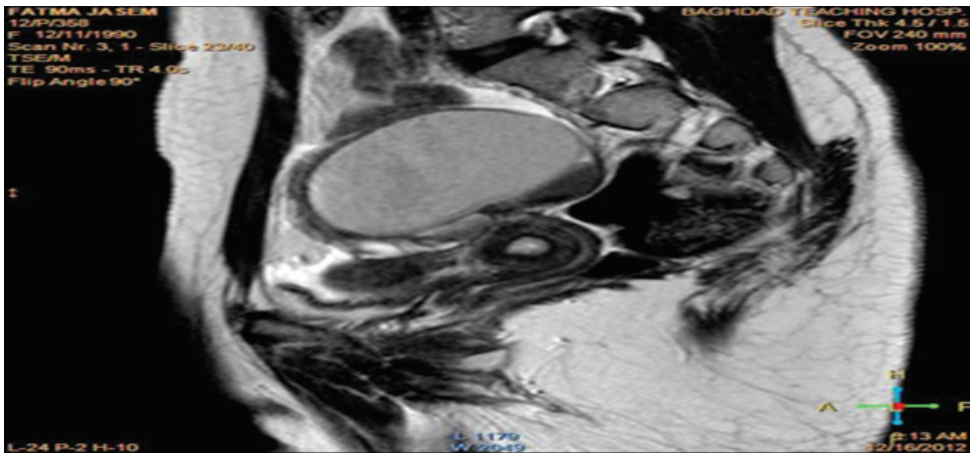

Figure3: Sagittal T1-weighted image.

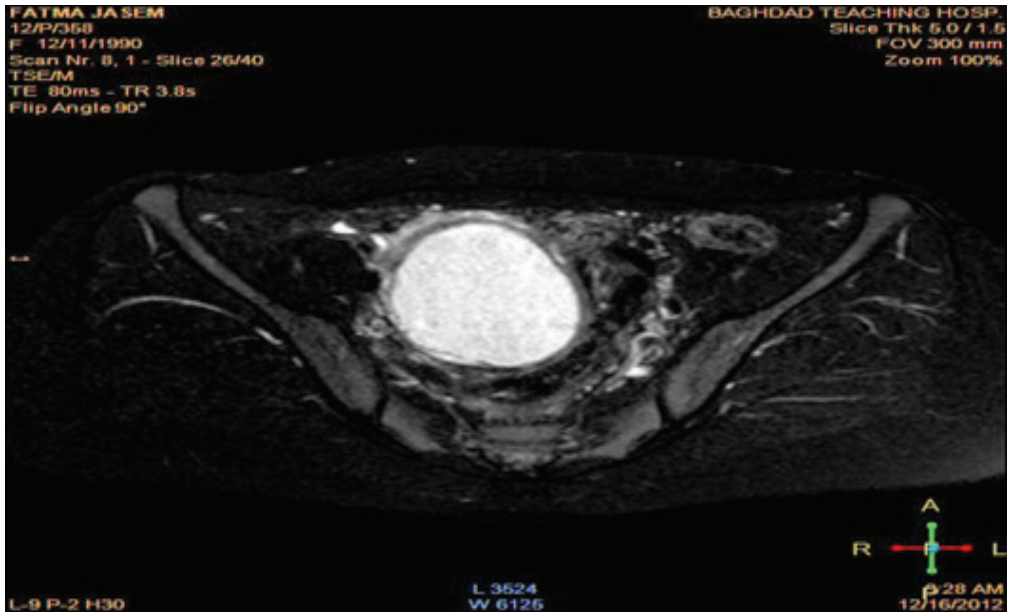

Figure4: AxialT1-weighted image with fat suppression high signal intensity showingrightendometerioma.

Discussion

The study was achieved on 94 females who had clinically suspected ovarian lesions who were primarily investigated with U/S then by MRI. The last diagnosis was confirmed by histopathological (HPE). Age patients ranged from 14 to 70 years; the mean age was 39.13 years. Most cases (91.5%) had unilateral lesions while 8.5% had bilateral lesions. These bilateral lesions were confirmed as malignant. 16% cases were suffered with multiple presentation, 62.7% abdominal pain,4.3% cases were with abdominal swelling, 8,5% cases were with abnormal bleeding and 58.5% cases were suffered with irregular cycles of menstruation (figure 2).Also, this study showed most of the benign lesions are simple cysts, thin wall of cyst with absent vegetations, nodules, or a solid component and without of significant contrast enhancement. Whereas, typical characteristics of ovarian lesion in MRI which pointed to a malignant pathology were,thick wall, present enhancing,septations, vascularity,solid areas,ascites,present nodules this agree withArun Prasad et al.[14].

USG findings showedmost lesions were cystic in nature80 (85.1%) than solid cystic 14(14.9%), Nodules was absent in 93(98.9%) cases and nodules was seen in 1 (1.1%) case. Ascites was absent in 89(94.7%) cases and present in 5(5.3) cases, 85(90.4%) cases absented with Septum while 9(9.6%) cases had with septum, vascularity was absent in 85(90.4%)and present in 9 (9.6%) as shown in table 1.

MRI findings of this study stated thatmost lesions were cystic in nature 82 (87.2%) than solid cystic 12 (12.8%)Nodules was absent in 90(95. 7%)cases and nodules was seen in 4(4.3% cases),Ascites was absent in 89(94.7%)and seen in 5(5.3%) cases , septum was absent in84(89.4%) and septum was seen in 10(10.6%), vascularity was absent in85(90.4%) and present in 9(9.6%) as shown in table1.

Also, on USG there were 15(16%) cases of malignant ovarian lesion and 79(84%) cases had benign lesions. MRI results showed that 10(10.6%) cases had malignant ovarian lesions and 84(89.4%)cases had benign lesions. Those results are roughly in agreement withChintaVittal Prasad et al. [15].

The comparison of findings of USG with HPE: The sensitivity of US results in diagnosis of malignant ovarian cyst was (100.0%) that mean ultrasound was able to diagnosed all patients with malignant ovarian correctly. The specificity of US results in diagnosis of benign ovarian cyst was (89.1%) that mean ultrasound was able to diagnosed (89.1%) patients with benign ovarian correctly. Positive predictive value (PPV) was (66.7%) that mean those diagnosed as malignant ovarian cyst by US was (66.7%) being malignant ovarian cyst by histopathology and negative predictive value (NPV) was (100.0%) that mean all those diagnosed as benign ovarian cyst by US being diagnosed as benign ovarian cyst by histopathology and overall accuracy was (91.07%) as shown in table 2.The sensitivity of MRI results in diagnosis of malignant ovarian cyst was (100.0%) that mean MRI was able to diagnosed all patients with malignant ovarian correctly. The specificity of MRI results in diagnosis of benign ovarian cyst was (100.0%) that mean MRI was able to diagnosed all patients with benign ovarian correctly. Positive predictive value was (100.0%) that mean those diagnosed as malignant ovarian cyst by MRI was (100.0%) being malignant ovarian cyst by histopathology and negative predictive value was (100.0%) that mean all those diagnosed as benign ovarian cyst by MRI being diagnosed as benign ovarian cyst by histopathology and overall accuracy was (100.0%) as shown in table 3.In this study ultrasound sensitivity was same as that MRI, however specificity and accuracy was more on MRI with small percentage difference in detecting malignancy in adnexal lesions that agree with Sadowski, E. A. et al.[16]and disagree withChintaVittal Prasad et al. [15] andYasmeenUsmaniet al.[17].

Conclusion

In USG, there were 16% cases of malignant ovarian lesion and 84% cases had benign lesions. MRI reports showed that 10.6% cases had malignant ovarian lesions and 89.4% cases had benign lesions.. The comparison

of findings of USG with HPE has 100.0% sensitivity, 89.1% specificity.66.7% PPV, 100.0% NPVand 91.07% diagnostic accuracy. In comparison of MRI findings with HPE have 100.0% sensitivity, 100% specificity, 100% PPV, 100.0% NPVand 100.0% diagnostic accuracy. The results conclude that MRI had high specificity, accuracy value than USG. MRI is dominant in diagnosis and characterization of ovarian cystic lesion than ultrasonography.MRI is superior to ultrasound and can be used in difficult or equivocal cases **.**

Ethical Clearance : Taken from Middle Technical University ethical committee

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Conflict of Interest : Nil

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