Value of Magnetic Resonance Imaging (MRI) and Diffusion Weighted (DWI) MR in Diagnosis of Ovarian Lesions

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Abstract: Introduction: Determining whether a clinically diagnosed ovarian mass is benign or malignant is frequently not possible until surgical exploration and histologic examination are performed. Consequently, it may not be possible to decide preoperatively whether conservative or radical surgery is appropriate. A reliable method with which to differentiate a benign from a malignant ovarian mass would provide a basis for optimal preoperative planning. Magnetic resonance (MR) imaging provides useful information for characterization of various ovarian masses. Diffusion-weighted imaging is sensitive to changes in the microdiffusion of water into both intracellular and extracellular spaces and its use may improve MR characterization of ovarian lesions. Restricted water diffusion demonstrates high signal intensity on DWI and lower ADC values on ADC map. This study aims at reviewing and emphasizing the role of MRI and diffusion-weighted MR in characterization of ovarian lesions. **Patients and methods:** This study was performed on 40 patients referred to the radiology department from the Gynecology department by ovarian masses. Pelvic enhanced MR with DWI was done for all patients, DWIBS was done for 7 patients. Thrity-nine patients underwent surgery with pathologic correlation. Only one patient was put under regular follow up US for 3 months. **Results:** The sensitivity of MRI was 99.9% while that of DWI was 100%. The specificity was higher for DWI (78.3%) compared to conventional MRI (58.3%), as well as the accuracy which was 73.9% for MRI while that of DWI was 86.9%. The mean ADC values for malignant lesions were (0.93x 10^{-3} ± 0.43 SD mm^2/s), while that for benign lesions were (1.3 x 10^{-3} ± 0.6 SD mm^2/s), with cut off value 1.15x10^{-3}. And p value = 0.005. Mature teratomas showed restricted diffusion with ADC values 0.5x103mm2/s (false positive), due to mixed cellularity of the teratoma. **Conclusion:** Combination of DWI to conventional MRI improves the specificity of MRI and thus increasing radiologist's confidence in image interpretation which will finally reflect on patients' outcome and prognosis.

[Enas ahmed, Ikram Hamed, Noha Abdel Shafy, Ahmed Abdel Fattah,. **Value of Magnetic Resonance Imaging (MRI) and Diffusion Weighted (DWI) MR in Diagnosis of Ovarian Lesions.** *Researcher* 2018;10(8):11-20]. ISSN 1553-9865 (print); ISSN 2163-8950 (online). http://www.sciencepub.net/researcher. 2. doi:10.7537/marsrsj100818.02.

Keywords: Diffusion weighted; Magnetic resonance imaging; Ovarian lesions

1. Introduction

Ovarian masses remain the first indication for gynecologic surgery. The objectives of the use of imaging techniques are to reduce the number of women unnecessarily undergoing cancer surgery, to preserve fertility in young women (by allowing laparoscopy) and, when necessary, to enable the referral of patients to a tertiary referral center with a specialist gynecologic oncologist to ensure optimal primary surgical treatment **(14).**

Determining whether a clinically diagnosed ovarian mass is benign or malignant is frequently not possible until surgical exploration and histologic examination are performed. Consequently, it may not be possible to decide preoperatively whether conservative or radical surgery is appropriate. A reliable method with which to differentiate a benign from a malignant ovarian mass would provide a basis for optimal preoperative planning and may also reduce the number of unnecessary laparotomies patients undergo for benign disease **(12).**

Functional imaging is becoming increasingly important in the evaluation of cancer patient in initial diagnosis and the assessment of response to therapy. Recent technical advances allow the use of diffusion MR imaging in abdominal and pelvic applications **(16)**.

MRI of ovarian tumor is recommended for accurate characterization of internal architecture, especially for delineation of necrosis, papillary projections, solid components, septations and, peritoneal implants **(17).**

Pelvic MRI is helpful in difficult cases and may provide a more definitive diagnosis. MRI is commonly utilized for evaluation of cystic or solid ovarian masses in which ultrasound cannot be diagnostic or when there are worrisome or indeterminate ultrasound features. MRI may identify the location of the mass and determine if it is a cystic, solid, or complex. MRI has a high accuracy in differentiating benign from malignant masses. Teratomas, endometriomas, simple and hemorrhagic cysts, fibromas, exophytic or extrauterine fibroids and hydrosalpinges can be diagnosed with high confidence **(11).**

DWI is anon invasive modality that help in discrimination between benign and malignant lesions, increase the contrast between lesions and surrounding tissues, and improve the detection and delineation of peritoneal implants at both initial staging and follow-up. Moreover, diffusion-weighted imaging provides quantitative information about tissue cellularity that may be used to distinguish viable tumors from treatment-related changes **(6).**

When diffusion-weighted MR imaging is used in gynecologic applications, cancers have shown lower apparent diffusion coefficient (ADC) values. Increasing ADC values is noted in carcinomas responding to radiation therapy, so it can be used as a biomarker for treatment response, and in the evaluation of recurrence and, multi focality **(9).**

As for peritoneal implants from ovarian cancer, the diagnosis represents a Privilege for diffusion weighted MR imaging, as the small seeds invaginated Within peritoneal reflections, or coating the serosal surface of intestinal loops and Solid viscera, are often masked by the similarity of their attenuation or signal Intensity to that of adjacent structures using CT or conventional MRI. On diffusion-weighted imaging, malignant deposits on the visceral peritoneum are more conspicuous because of signal suppression from surrounding ascites, bowel contents, and fat **(8).**

Avoiding the potential pitfalls, of the technique, can be accomplished when diffusion weighted images are interpreted in association with anatomic MR images. Increasing familiarity with diffusion coefficient calculation and software manipulation, will allow radiologists to provide new information for the diagnosis of patients with known or suspected gynecologic malignancies **(3).**

Limitations of diffusion weighted MR imaging, in abdomen and pelvis, due to motion and susceptibility artifacts has been overcome by the development of new imaging techniques, particularly novel methods of data acquisition and parallel imaging, allowing much faster data acquisition with fewer artifacts, resulting in significant improvement in image quality in body applications **(10).**

The recently introduced concept of "diffusion-weighted whole-body imaging with background body signal suppression"(DWIBS) now allows acquisition of volumetric diffusion-weighted images of the entire body. This new concept has unique features different from conventional DWI and may play an important role in whole-body oncological imaging. DWIBS may especially be useful to detect relatively small lesions because of its high " the contrast-to-noise ratio" (CNR). DWIBS is apotential tool for detecting peritoneal dissemination of ovarian cancer. Another potential application of DWIBS is in the assessment of radiation and/or chemotherapy efficacy **(5).**

The aim of this work is to evaluate the role of MRI and diffusion-weighted MR imaging in the diagnosis of ovarian mass lesions.

1.1. Patients and methods

This study was performed on 40 patients presented by ovarian masses, referred to the radiology department from the Gynecology department based on U/S study as a prospective study.

Pelvic enhanced MR with DWI was done for all patients, DWIBS was done for 7 patients.

Thrity-nine patients underwent surgery with pathologic correlation. Only one patient was put under regular follow up US for 3 months.

The study was conducted from January 2016 to May 2017 at the National Cancer Institute and Beni Sueif Hospital.

The patient's age ranged from 12 to 75 years.

20 patients presented by long standing abdominal pain, 6 were complaining of abdominal enlargement, other cases came with different complaints such as: infertility, frequency of micturarion, dysuria and loss of weight. In other cases the adnexal masses were accidentally discovered during transabdominal pelvic US examination.

All cases had been subjected to the full history taking with aspecial emphasis on: age, parity, menstrual history, past history of gynecological troubles or operations, Pelvi-abdominal U/S TV/US and previous MRI.

1.2. MR imaging

MR imaging was performed on a 1.5-T MR imaging unit (Achieva, Philips medical system). All the patients were imaged in the supine position using pelvic phased-array Torso coil.

1.2.1. Patient preparation

Intravenous administration of an antispasmodic drug (10 mg of visceralgine) was given immediately before MR imaging to reduce bowel peristalsis.

2. MR imaging protocol

Non contrast.

Axial T1-weighted (TR/TE, 487/10 ms).

Axial T2-weighted (TR/TE, 8436/115ms).

Slice thickness, 6 mm. Gap, 1 mm. FOV, 32–42 cm. Matrix,256x256.

Sagittal T2-weighted and Coronal T2-weighted, Slice thickness, 8–10 mm. Gap, 1 mm. FOV, 40–50 cm. Matrix,256x256.

DW-MRI was acquired in the axial plane prior to administration of contrast medium by using a single shot echoplanar imaging sequence. With b values (0, 500, 1000 & 1500). TR/TE, 1763/63. Slice thickness, 6 mm. Gap, 1 mm. FOV, 36 cm. Matrix,128x128.

contrast-enhanced MRI: images were obtained immediately after manually injected gadolinium at a dose of 0.1 mmol/kg of body weight (maximum, 20 mL), this was followed by injection of 20 mL of normal saline flushing the tube. Images were obtained sequentially at 0, 30, 60, 90 and 120 s. Finally, transverse, sagittal and coronal T1-weighted gradient-echo images were acquired.

DWIBS **(**diffusion-weighted imaging with background body signal suppression).

2.1. MR imaging analysis

MR images were analyzed for the following: MR appearance ofthe tumor; either cystic, solid or mixed, involvement of one or both ovaries, size of the lesion, signal intensity of the tumor, enhancement of the solid component if present, wall thickness and regularity of the tumor and its enhancement, presence of vegetation and septations, their enhancement pattern and their size. MR images were analyzed for the presence of ascites, presence of infiltrated pelvic or para aortic lymph nodes, involvement of other pelvic organs and presence of peritoneal and omental deposit.

Suggestive MRI signal for benign masses:

- High signal intensity on T1WI is considered either fat or blood. (e.g. dermoid/teratoma and endomterioma). On fat suppressed images low signal is noted with fat while high signal is still noted in blood.
- Solid masses with very low signal intensity in T2WI are characteristic to fibrous tumor (e.g. ovarian fibroma, or Brenner tumor or pedunculated subserous fibroid).

Malignant MR criteria according to (5):

presenceof wall thickness >3 mm, solid vegetations more than 1 cm. Thick septa >3 mm and areas of necrosis and breaking down. Signs of tumor spread for staging: enlarged lymph nodes, ascites, peritoneal and omental deposit. Post contrast images were used for the recognition of enhancement of the solid component, the tumor wall, septations and vegetations.

3. Interpretation of DWI

3.1. Qualitative analysis

Regarding the signal intensity:

we comment if the lesion shows low signal intensity on diffusion images with high signal in the corresponding ADC maps (facilitated) for benign masses or shows high signal intensity on diffusion images with lowering of the signal in the corresponding ADC maps (restricted) for malignant masses.

3.2. Quantitative analysis

Regarding the quantitative analysis of DWI, we generated the ADCmap, then we selected the ROI (region of interest) manually on the solid and the cystic component of the tumors, which was then automatically calculated on the work station to get the ADC values. According to a study done by Li and colleagues in 2011 (7), mean ADC value for benign lesions was ($1.69 \times 10^{-3} \pm 0.6$ SD mm^2/s), and for the malignant was ($0.93\times 10^{-3} \pm 0.43$ SD mm^2/s) with cut off value 1.15×10^{-3}.

3. Results

This study included 40 patients. The patient's age ranged from 12 to 75 years. The age in cases with benign tumors ranged from 21 to 60 years (mean age 41.83 +/-12.8 SD). While the age in cases with malignant tumors; ranged from 12 to 75 years (mean age 47.69 +/-12.53SD). Thrity-nine (39 cases) were pathologically proved. The tumors pathologically were classified into: 22 benign, 1 borderline and 16 malignant tumors. Benign tumors included: 6 fibrothecoma, 3 serous cystadenomas, 2 papillary serous cystadenofibroma, 4 mature cystic teratomas, 2 mucinous cystadenoma, 1 endometriomas, 1 tubo-ovarian abscess, one infected infarcted ovarian fibroma, 1 struma ovarii, and 1hemorrhagic infarction in simple cyst. Borderline tumor was: sex cord stromal tumor (sertoli-leydig tumor). Malignant tumors included: 5 mucinous cystadenocarcinomas, 1 dysgerminomas, 5 papillary serous cystadenocarcinoma, 2 immature teratoma, one clear cell carcinoma, and two juvenile granulosa cell tumor.

Missing case that was not pathologically proved with no surgical excision, just follow up (hemorrhagic cyst). The lesions varied in their composition from being solid, complex cystic, mixed cystic and solid lesions. Ten cases showed typical criteria of malignant lesions by MRI. As size more than 6 cm, wall thickness and septae more than 3 mm and solid vegetation more than 1 cm. Five cases suspected to be malignant by MRI according to size, thick septae and solid nodule were proved to be benign by pathology: 1) struma ovarii, 2) haemorragic infarction in simple cyst, 3) fibrothecoma, 4) mature cystic teratoma, 5) papillary serous cystadenofibroma.

Table (1) the pathological type of the adnexal masses included in the study

Pathology	Number	Frequency %
Benign	22	(56.4%)
Borderline	1	(2.6%)
Malignant	16	(41%)
Total	39	(100%)

Chart (1) the different pathological types of benign tumors

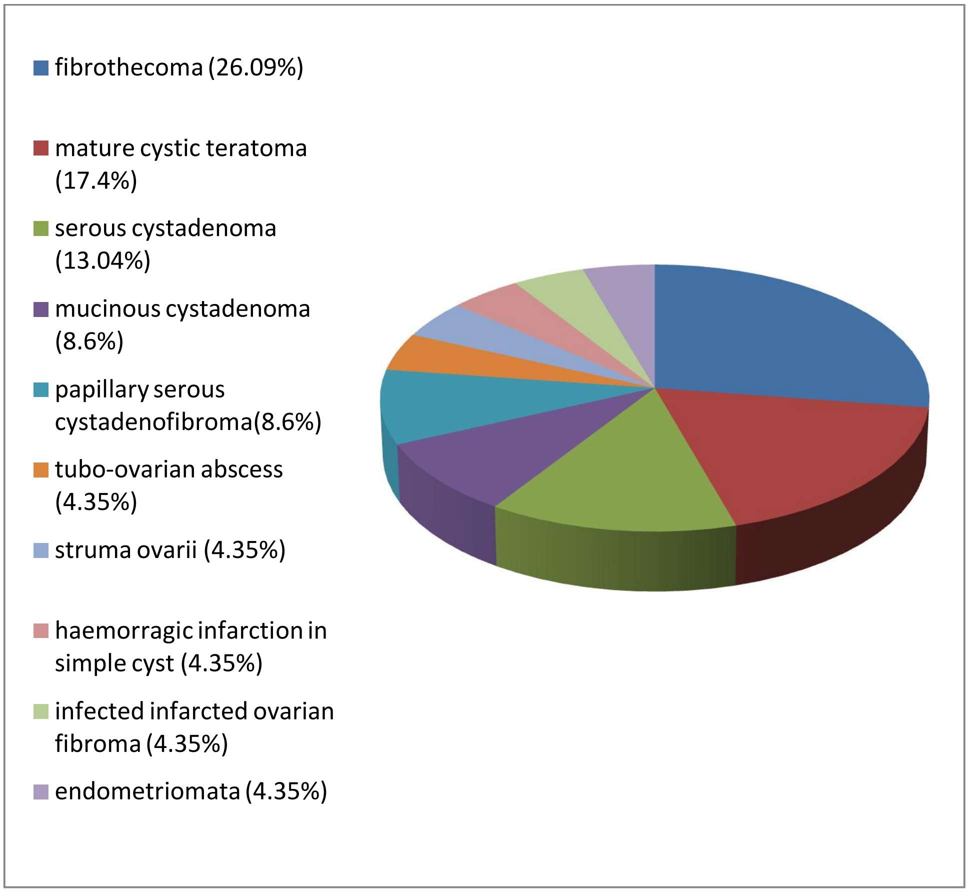


Chart (2) the different pathological types of malignant tumors

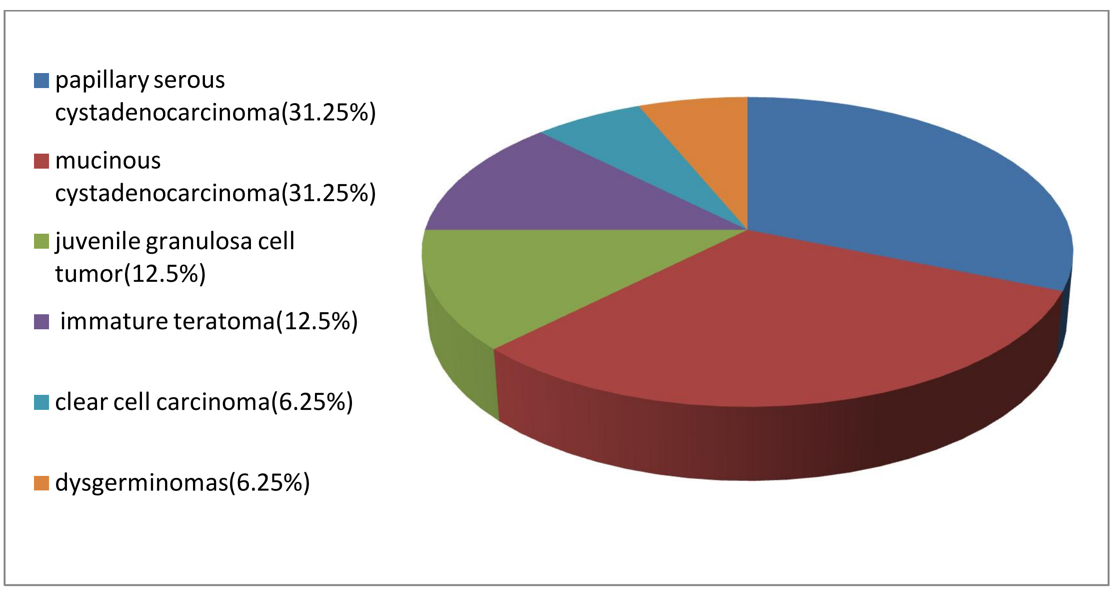


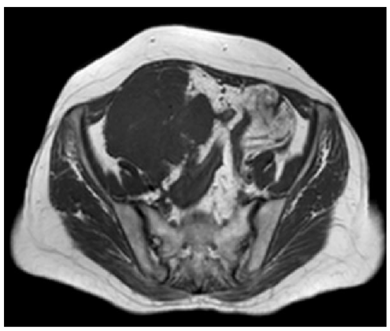
Table (2) showing the different ADC values of some pathological entities

Pathology	ADC values
1. Fibrothecoma (n=6)	**(1 x 10^{-3} mm^2/s)**
2. Papillary serous cystadenocarcinoma (n=5)	**(0.5 -1.1x 10^{-3} mm^2/s)**
3. Mucinous cystadenocarcinoma (n=5)	**(1.1 x 10^{-3} mm^2/s)**
4. Juvenile granulosa cell tumor (n=2)	**(0.7 x 10^{-3} mm^2/s)**
5. Clear cell carcinoma (n=1)	**(1.1 x 10^{-3} mm^2/s)**
6. Borderline sertoli-leydig tumor of low malignant potential (n=1)	**(1 x 10^{-3} mm^2/s)**
7. Mature cystic teratoma (n=4)	**(0.6 x 10^{-3} mm^2/s)**
8. Serous cystadenoma (n=3)	**(1.9 x 10^{-3} mm^2/s)**
9. Tubo-ovarian abscess (n=1)	**(0.9 x 10^{-3} mm^2/s)**
10. Papillary serous cystadenofibroma (n=2)	**(1.9 x 10^{-3} mm^2/s)**
11. Mucinous cystadenoma (n=2)	**(0.8 - 2.6 x 10^{-3} mm^2/s)**

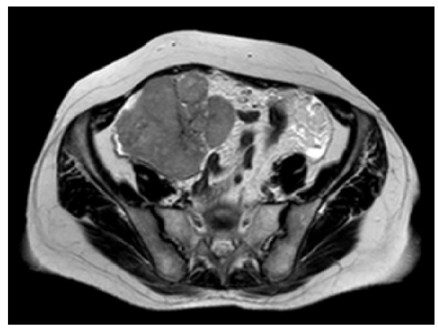
Case presentation:

Case 1

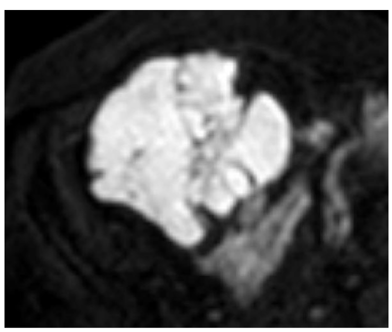
Female patient 53 years old complaining of abdominal enlargement. US showed right adnexal mass lesion. MRI was done.



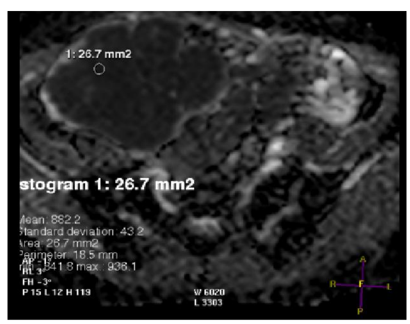
(a) axial T1 WI (TR/TE,487/10ms)



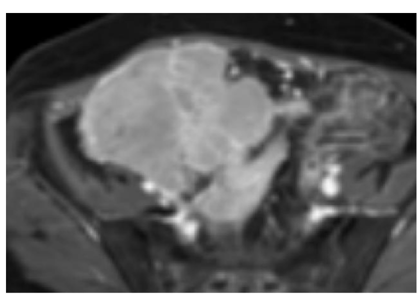
(b) Axial T2 WI (TR/TE,8436/115)



(c) DWI (TR/TE 1763/63)



(d) ADC



(e) T1post contrast

Description

Conventional MRI images (a & b) confirmed the presence of right adnexal predominantly solid mass with small areas of cystic breakdown. It elicits low signal on T1 and intermediate signal on T2, measuring about 5x4cm in maximal TS X AP dimensions respectively, associated with peritoneal nodules.

Conventional MRI based Diagnosis:

The patient was diagnosed as having right adenxal mass likely neoplastic, for histopathological correlation.

DWI (c & d):

The lesion shows restricted diffusion on DWI, low signal on the corresponding ADC maps. ADC value was 0.9 x 10 -3mm2/s.

CE-MRI (e):

The lesion showed heterogeneous contrast enhancement.

Radiological diagnosis

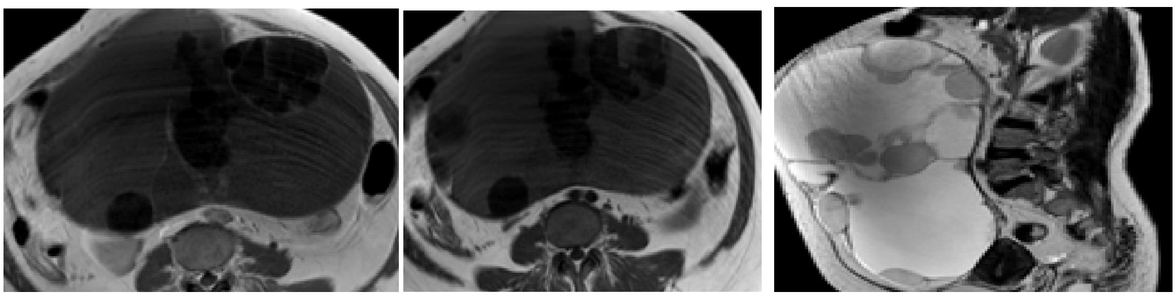
Right adenxal mass likely neoplastic.

Pathological diagnosis:

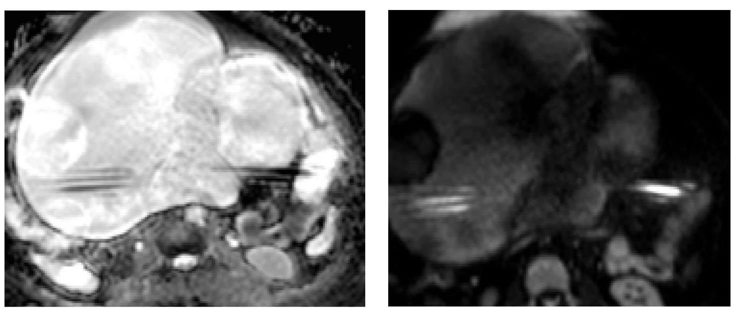
Pathology revealed: papillary serous adenocarcinoma.

Case 2

Female patient 50 years old complaining of dull aching pelvic pain. US showed huge pelvi-abdominal multi-loculated mass. No vascularity was detected on the color Doppler study. MRI was done.



(a) axial T1 WI (TR/TE, 487/10 ms) (b) T1post contrast (c) sagittal T2WI (TR/TE, 8436/115)



(d) DWI (TR/TE, 1763/63) (e) ADC

Description:

Conventional MRI (a & c) showed a large multiloculed adnexal lesion. It contains multiple locules of varying signal intensities, low on T1WI and high on T2-WI, measuring about 15x10cm in maximal TSX AP dimensions respectively.

Conventional MRI based Diagnosis:

A benign looking cystic ovarian lesion of variable degrees of signal intensities.

DWI (d & e):

The lesion showed Low signal on DWI with high signal on the corresponding ADC maps is suggestive of a benign adnexal mass lesion. ADC value of the lesion was 2.6 x 103mm2/s.

CE-MRI (b):

The lesion showed contrast enhancement of the internal septations.

Radiological diagnosis:

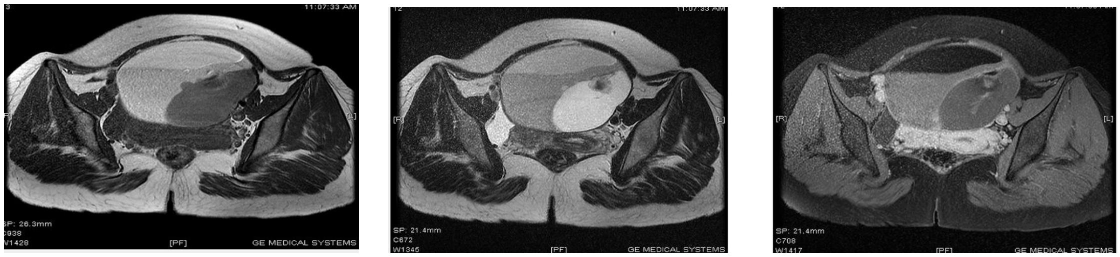
A benign looking cystic ovarian lesion of variable degrees of signal intensities, but no solid component is seen, highly suggestive of mucinous cystadenoma.

Pathological diagnosis:

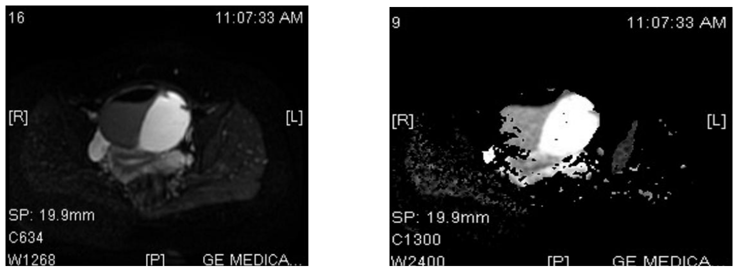
Pathology revealed: Benign mucinous cystadenoma**.**

Case 3

Female patient 34 years old complaining of lower abdominal pain. US showed complex adnexal mass lesion. MRI was done.



(a) axial T1WI (TR/TE, 487/10 ms) (b) axial T2WI (TR/TE, 8436/115) (c) T1 with contrast fat suppression



(d) DWI (TR/TE, 1763/63) (e) ADC

Description:

Conventional MRI (a-c) showed a well defined RT adenxal mass showing mixed signal with fat fluid level. Anterior part shows high T1 and T2 WI with loss of signal in fat suppression image consistent with fat content. Posterior part shows low T1 and high T2 consistenet with cystic part. It measures 7 x5 cm in its TSxAP diameters respectively. There is focal area of signal void seen in all pulse sequences consistent with calcification.

Conventional MRI based Diagnosis:

RT adenxal complex mass lesion.

DWI (d & e):

The cystic part showed high signal in DWI and ADC. ADC value of the lesion was 0.5 x 10 -3mm2/s.

Radiological diagnosis:

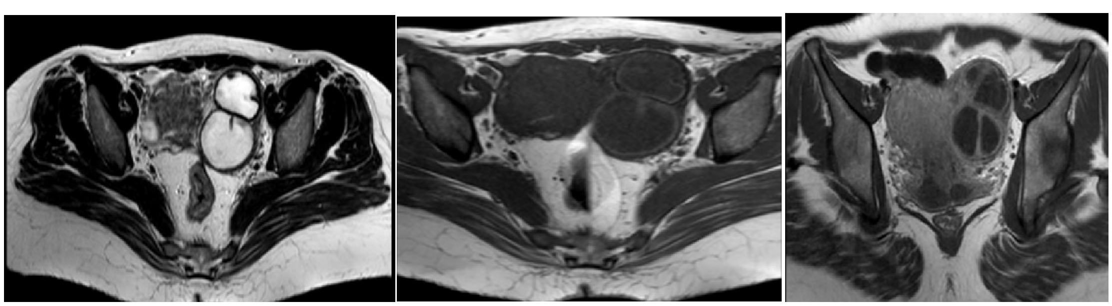
RT adnexal complex mass lesion, likely ovarian teratoma.

Pathological diagnosis:

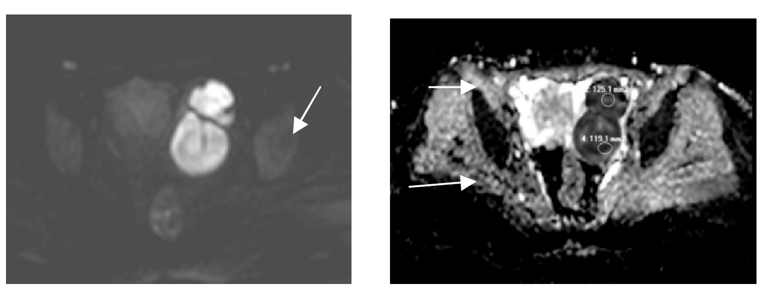
Pathology revealed: Mature (benign) cystic teratoma.

Case 4

female patient 35 year old complaining of fever and lower abdominal pain, US showed left bilocular cystic adnexal mass. MRI was done.



a) axial T1WI (TR/TE, 487/10 ms) (b) axial T2WI (TR/TE, 8436/115 ms) (c) coronal T1 post contrast.



(d) DWI (TR/TE, 1763/63) (e) ADC

Description:

Conventional MRI (a & b) showed left adnexal cystic mass lesion with thick septae. It elicits intermediate signal in T1 & bright signal in T2, measures about 6x2 cm in maximal TS X AP dimensions respectively.

Conventional MRI based Diagnosis:

Left adnexal cystic mass lesion.

DWI (d & e):

The mass showed restricted diffusion on DWI with low signal on the corresponding ADC maps. ADC value of the lesion was 0.8 x 10 -3mm2/s.

CE-MRI (c):

The lesion showed contrast enhancement of the thick septations.

Radiological diagnosis:

left adnexal cystic mass lesion with thick septae.

Pathological diagnosis:

Pathology revealed: Left tubo-ovarian abscess.

4. Discussion

The primary goal of imaging in the evaluation of an adnexal mass is to differentiate malignant from benign. Proper diagnoses will direct patients to the appropriate treatment algorithm to reduce the number of women unnecessarily undergoing cancer surgery, to preserve fertility in young women (by allowing laparoscopy), and, when necessary, to enable the referral of patients to a tertiary referral center with a specialist gynecologic oncologist **(4).**

For years, (MRI) had helped in identifying malignant lesions before surgery, particularly when US findings are suboptimal or indeterminate . MRI can reveal morphologic characteristics such as papillary projections, nodularity, septa, solid portions and signal intensity on T1- and T2-weighted images, but none of these criteria reliably distinguish between benign and malignant tumors **(18).**

DWI is one of the promising new functional imaging techniques that have shown to be effective in the differentiation of benign from malignant adnexal masses **(15).**

In this study according to DWI: the sensitivity of MRI was 99.9% while that of DWI was 100%. The specificity was higher for DWI (78.3%) compared to conventional MRIsequences (58.3%), as well as the accuracy which was 73.9% for MRI while that of DWI was 86.9% and so addition of DWI to the MRI is expected to increase the specificity and the accuracy of examination. The mean ADC values for malignant lesions were ($0.93x\ 10^{-3} \pm 0.43$ SD mm^2/s), while that for benign lesions were ($1.3 \times 10^{-3} \pm 0.6$ SD mm^2/s), with cut off $1.15x10^{-3}$ and pvalue = 0.005. Mature teratomas showed restricted diffusion with ADC values 0.5x103mm2/s. (falsepositive), due to mixed cellularity of the teratoma. Hemorrhagic cysts and endometriomas showed high signal not only on diffusion images but also on corresponding ADC map and ADC values 1.3 to 1.4x103 which can be explained as T2 Shine through. A study was carried out by Fujii and colleagues in 2008(3) on 123 ovarian masses that included 42 malignant and 81 benign lesions. He found that, the majority of the malignant tumors, mature cystic teratomas, and almost half of the endometriomas, showed high signal intensity on DWI, whereas most fibromas and other benign lesions did not. The main locations of abnormal signal intensity were solid portions in malignant ovarian tumors, keratinoid substances and Rokitansky protuberance in mature cystic teratomas, and intracystic clots in endometriomas. This agree with our results that all malignant lesions and two cases of mature cystic teratomas showed high signal on DWI, this may be attributed to keratinoid substance.

In 2013, Thomassin-Naggara et al **(14)** evaluated the contribution of DWI in conjunction with morphological criteria to characterize 77 complex adnexal masses (30 benign and 47 malignant). According to them, low signal intensity on T2-weighted images and disappearance of restricted diffusion signal in the solid component of the mixed adnexal masses may predict benignity. They attributed the presence of low mean ADC values elicited by benign fibrous tumors as fibromas, Brenner tumors and cystadenofibromas are due to dense network of collagen fibers within the extracellular matrix. In our study all the benign tumors did not show high signal on DWI except 2 cases of mature cystic teratomas, one case diagnosed as haemorragic infarction in simple cyst and another case diagnosed as struma ovarii.

A similar study was carried out by Takeuchi and colleagues in 2010 **(13)** on 49 ovarian tumors (39 malignant/borderline malignant, and 10 benign), it stated that the solid portions of all the 39 malignant tumors showed homogenous or heterogeneous high intensity on DWI, whereas only 3 of the 10 benign tumors (3 thecomas) showed high intensity, the mean ADC value in the 39 malignant tumors 1.03×10^{-3} mm^2/s and was significantly lower than that of the 10 benign tumors 1.38×10^{-3}, they concluded low DWI and high ADC intensity may suggest benign lesion.

Another study was carried out by Zhang and colleagues in 2012 **(18)** on one hundred and 91 patients with 202 ovarian masses; the purpose of this study was to evaluate differences in ADC values for the solid component of benign and malignant ovarian surface epithelial tumors with the goal of differentiating benign versus malignant ovarian tumors preoperatively. The results of that study showed that DWI appears to be a useful method for differentiating between benign epithelial ovarian tumors with solid components and malignant ovarian tumors, and is associated with high sensitivity and specificity, however, after exclusion of endometriomas, mature cystic teratomas and pure cystic adenomas from the analysis. The mean ADC value measured for the solid component was significantly differed between the benign and malignant lesions. Mean ADC value for benign lesions was 1.69 x 10^{-3} ± 0.25 SD mm^2/s, and for the malignant was 1.03 x 10^{-3} ± 0.22SD mm^2/s. The lower ADC values associated with the malignant group were found to be statistically significant. Their results suggest that an ADC value ≥ 1.25 x 10^{-3} mm^2/s may be an optimal cutoff value for differentiating benign and malignant ovarian tumors. In our study, the mean ADC value for malignant lesions was (0.93x 10^{-3} ± 0.43 SD mm^2/s), while that for benign lesions was (1.3 x 10^{-3} ± 0.6 SD mm^2/s), with 1.15 x 10^{-3} mm^2/s may be a cutoff value for differentiating benign and malignant ovarian tumors.

Also another study was carried out by fen et al, in 2016, **(2)** totally 64 patients pathologically confirmed as ovarian cancer were included in this study with a cutoff ADC value of (1.063x 10^{-3} mm^2/s) presented in this study, in our study cut off value 1.15x $10^{-3.}$

Regarding to ovarian carcinoma, in study was carried out by Ahmad and colleagues in 2015**(1)** on 20 women underwent DWI. The adnexal lesions were examined for several features including size, shape, character (solid-cystic), signal intensity and enhancement. Demonstrated that the sensitivity and specificity of *conventional MR and DW imaging* were 96.5 % and 89.1%. In our study the sensitivity and specificity of *conventional MR and DW imaging* were 100% and 78.3%.

A comparative study was carried out by Li and colleagues in 2011**(7)** on 35women to determine the accuracy of DWI imaging in the characterization of ovarian masses in patients undergoing pelvic MRI. The study included 26 benign tumors, 8 malignant tumors and 1 borderline tumor. Malignant lesions only showed definite high signal intensity in DW images.

Another study was carried out by Zhoa and colleagues in 2014**(19)** to investigate diffusion-weighted (DW) magnetic resonance (MR) imaging for differentiating borderline from malignant epithelial tumors of the ovary, the study included 60 borderline epithelial ovarian tumor (BEOTs) in 48 patients and 65 malignant epithelial ovarian tumors (MEOTs) in 54 patients, results of the study showed, the majority of MEOTs to be of high signal intensity on DW imaging, whereas most of BEOTs showed low or moderate signal intensity. The mean ADC value of the solid component of BEOTs (1.562± 0.346 x 10^{-3} mm^2/s) was significantly higher than in MEOTs (0.841 ± 0.209 x 10^{-3} mm^2/s). Our study included only one borderline tumor (sertoli-leydig tumor of low malignant potential), on DWI the tumor showed persistent high signal intensity, intermediate signal intensity on ADC map and a rather high ADC value (1.2 x 10^{-3} mm^2/s).

DWIBS **(**diffusion-weighted imaging with background body signal suppression) was done for seven cases which was useful to detect relatively small lesions because of its high "the contrast-to-noise ratio"(CNR).

5. Conclusion

The combination of DWI to conventional MRI implies:

- It increases the accuracy and the specificity of MRI.
- Using a completely noninvasive technique with no radiation exposure.
- Cost effective technique (no additional cost to MRI examination), easily added to the MR study protocols with no marked lengthening of examination time.
- DWI might be an alternative for contrast administration especially for those were contrast intake is better avoided as during pregnancy.

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8/25/2018