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Diagnostic Value of Magnetic Resonance Imaging in Prediction of Malignancy in Adnexal Masses

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ABSTRACT

Ovarian cancer is the leading cause of death in women among gynecological cancers. For this reason adnexal masses diagnosis is important to make differentiation of malignant lesions from benign lesions. Ultrasound is generally used as a second step of evaluation of adnexal masses after pelvic examination. Unfortunately ultrasound may not be enough to detect malignant lesions in adnexa. For this reason several diagnostic approaches are being used. Magnetic resonance imaging can be used in adnexal masses which have malignancy suspicion. This study aims to show the diagnostic value of MRI in diagnosis of adnexal masses.

Files of 98 patients who underwent surgery for adnexal masses were retrospectively investigated. Patients under 18 years of age, patients whose adnexal mass were incidentally diagnosed during surgery and patients who don't have preoperative imaging studies were excluded from the study. Postoperative pathology results and preoperative MRI findings were compared.

For MRI evaluation of the patients; the contrast enhancement was found to be more positive in masses diagnosed as malignant (44%vs.6.4%). Also presence of both omental cake and free fluid was found to be related with diagnosis of malignancy in final result. Bilaterally located masses in MRI were found to be more malignant (57%vs.27.14%).

When MRI finding were evaluated as malignant or benign the consistency with the final pathology results were studied. A moderate correlation with the final results was found with the MRI results. MRI can be used in differentiation of malignant adnexal masses.

Key Words: Adnexal mass, MRI, Malignancy

Introduction

Part of the ovary or an adnexal mass that is detected during ultrasound which is inconsistent with normal physiology can be defined as adnexal lesion (1). Adnexal masses may present themselves with many symptoms. These lesions are important in respect to malignant potential. Among gynecological cancers ovarian cancers are the leading cause of mortality. Every one woman in 95 has the risk of ovarian cancer in life time. Unfortunately majority of the patients with ovarian cancer are diagnosed in stage III or IV and 5 years survival rate decreases from 90% (in women cancer confined to ovary Stage I) to 30-73% by this stage shift (2). For this reason malignant potential of the adnexal masses are very important. Adnexal masses can be incidentally diagnosed; a woman has a life time risk of undergoing surgery for an incidentally diagnosed adnexal mass is 5-10 %. The incidentally diagnosed adnexal masses are challenging because of difficulty in differentiating whether it is malignant or benign (3,4).

Ultrasound is generally used for detection of suspicious adnexal lesions during physical examination or adnexal lesions are diagnosed during an ultrasound performed for another reason. In diagnosis of malignancy MRI has a sensitivity and specificity of 100% and 94% respectively. MRI provides a confident diagnosis of adnexal lesions in benign nature (5,6).

The aim of this study is to evaluate diagnostic value of MRI in adnexal masses.

Materials and Methods

This study was conducted in a tertiary center in between 2011 and 2017. Patients with adnexal mass/es were included in the study. Files of 98 patients who underwent surgery for adnexal masses were retrospectively investigated. Patients under 18 years of age, patients whose adnexal mass were incidentally diagnosed during surgery and patients who don't have preoperative imaging studies were excluded from the study. Demographic features of the patients, ultrasound findings, MRI findings, intraoperative frozen

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Table 1. Demographic features of patients

		Median	Min	Max
Age		45	18	80
Gravida		3	0	15
Parity		2	0	9
Abort		0	0	9
Menopausea	Pre-menopausal	56	57.7	
	Post-menopausal	41	42.3	
Complainta	No complaint	25	25.8	
	Abdomino-pelvic pain	69	71.1	
	Vaginal bleeding	3	3.1	

[a] for categorical variables instead of median n is used, for minimum and maximum results % is used

Table 2. Ultrasound features of the adnexal masses

		n	%	
Location of the mass	Right	41	42.3	
	Left	43	44.3	
	Bilateral	13	13.4	
Free Fluid	Present	19	19.6	
	Absent	78	80.4	
Feature of the Mass	Pure Cystic	6	6.2	
	Solid	30	30.9	
	Mix	15	15.5	
	Septated	10	10.3	
	Heterogenic	36	37.1	
Extra finding	Uterine mass	7	7.2	
	Mass in other organ	3	3.1	
	No Extra finding	86	88.7	
	Intraabdominal mass	1	1.0	
Size 1a		73.0	30.0	250.0
Size 2 a		67.0	24.0	200.0
Mean Size a		67.0	28.0	225.0

[a] for continuous data % is used instead of minimum and maximum values and median is used for n

section results and final pathology results were recorded. Ethical approval was taken from the universities local ethics committee.

Ultrasound findings were recorded as the side of the mass, presence of the free fluid in the abdominal cavity, nature of the mass (cystic/solid) and the two dimensional sizes. MRI findings were the contrast enhancement of the lesion, side of the lesion, presence of the additional findings.

Statistical Analysis: SPSS version 23.0 was used for analysis of the data. Normal distribution of the variables was evaluated with visual (histogram and probability graphics) and analytic methods (Kolmogorov-Smirnov/Shapiro-Wilk tests). Descriptive analysis was given by usage of mean and standard deviation for normally distributed variables. Pearson Chi-square and Fisher's Exact tests were used. If the normal distribution of the variables are not shown Mann Whitney U test was used. ROC analysis was used to define diagnostic cut off levels for MRI. Conditions in which p level is less than 0.05, is accepted as statistically significant.

Results

Ninety seven patients with adnexal mass or masses were included in the study. Median age for all patients was 45 (18-80). Fifty six patients were in premenopausal state and 41 of them were in postmenopausal state. Seventy one percent of the patients had abdominopelvic pain and 25% patient had no complaints. (Table 1) shows the demographic

Table 3. Intraoperative and postoperative pathological results of adnexal masses

		n	%
Intraoperative Frozen Result	Malignant	23	23.7
	Benign	66	68.0
	Left for paraffin	2	2.1
	Borderline	6	6.2
Final Result	Malignant	25	25.8
	Benign	72	74.2
	Borderline	0	0.0

Table 4. MRI features of adnexal masses

		n	%	
Contrast enhancement	Present	50	51.5	
	Absent	47	48.5	
Extra findings	Omental Cake	1	1.0	
	Free fluid	10	10.3	
	Fluid+ Omental Cake	13	13.4	
	No Extra finding	73	75.3	
MRI location	Right	36	37.1	
	Left	47	48.5	
	Bilateral	14	14.4	
MRI size-1 a		76.0	31.0	200.0
MRI size-2 a		65.0	25.0	170.0
MRI mean size a		68.5	30.5	180.0

[a] for continuous data % is used instead of minimum and maximum values and median is used for n

findings and the complaints of the patients.

Ultrasound findings of the patients were evaluated. Forty two percent of the lesions were located in right side and 44% of the lesions were located in the left side and 13% of the lesions were located on both sides. In 80% of the cases there was no free fluid in the abdominal cavity. Six percent of the cases was pure cystic, 30% was solid, 15% was mixed type and 37% defined as heterogeneous in nature. Seven patients had an accompanying uterine mass and 3 of them had accompanying lesion in other organs. Median sizes for masses were 73 mm, 67 mm for two dimensions and the median of two dimensions was 67 mm. (Table 2) shows the ultrasound features of the adnexal masses.

Pathological findings of the masses are divided into two. The intraoperative frozen section results were; 23% were malignant and 66 were benign in nature. Six patients were diagnosed as borderline tumors and 2 patients diagnosis were left for final diagnosis after paraffin sections. The final pathology results were; 25% were malignant, 74% were benign in nature and none of the patients had the diagnosis of borderline tumor in final pathology results. (Table 3) shows the malignancy patterns of the adnexal masses intraoperatively and postoperatively.

When MRI findings were evaluated 51% of the masses had contrast enhancement, omental cake was found only in one patient and 10 patients had free fluid in abdominal cavity and 13 patients had both omental cake appearance and free fluid in the abdominal cavity. Forty eight % of the patients had masses located in the left side and 14% had bilateral lesions. (Table 4) shows the MRI features of adnexal masses.

When the final pathology results in respect to preoperative imaging findings and demographical features of the patients were evaluated, the increased age was shown to increase malignancy rate. Thirty six percent of the masses detected during

Table 5. Evaluation of measurable variables according to pathology result

	Pathology result						p
	Malignant			Benign			
	Median	Min	Max	Median	Min	Max	
Age	50	23	80	44	18	73	0.042
Gravida	3	0	15	3	0	12	0.320
Parity	3	0	9	2	0	9	0.305
Abort	0	0	6	0	0	9	0.408
USG size -1	90.0	30.0	250.0	70.0	31.0	214.0	0.509
USG size -2	70.0	30.0	200.0	65.5	24.0	180.0	0.304
USG mean size	81.5	35.0	225.0	66.5	28.0	190.0	0.428
MRI size -1	73.0	39.0	200.0	77.0	31.0	200.0	0.849
MRI size -2	72.0	42.0	140.0	65.0	25.0	170.0	0.283
MRI mean size	78.5	45.5	170.0	67.7	30.5	180.0	0.520

Mann-Whitney U test

postmenopausal period was found to be malignant, only 18 % of the masses detected during premenopausal period was found to be malignant ($p<0.05$). Among patients who has free fluid in the ultrasound, 78 % was found to be malignant and only 12 % of patients who did not have free fluid in the ultrasound was found to be malignant ($p<0.05$). Solid lesions under ultrasound view were found to be more malignant than the pure cystic lesions ($p<0.05$). All patients (n=3) who have extra finding in other organs were noted during ultrasound were found to be malignant in final pathology results ($p<0.05$).

For MRI evaluation of the patients; the contrast enhancement was found to be more positive in masses diagnosed as malignant (44%vs.6.4%) ($p<0.05$). Also presence of both omental cake and free fluid was found to be related with diagnosis of malignancy in final result ($p<0.05$). Bilaterally located masses in MRI were found to be more malignant (57%vs.27,14%) ($p<0.05$). (Table 5) and (Table 6) shows evaluation of variables according to pathology result.

When MRI finding were evaluated as malignant or benign the consistency with the final pathology results were studied. A moderate correlation with the final results was found with the MRI results (Kappa score:0.715) ($p<0.05$).

Discussion

Ovaries are pelvic organs that are hard to be reached during pelvic examination. Bimanual pelvic examination is not enough for detection of adnexal masses in early stages. The pelvic examination may be insufficient especially for lesions less than 5 cm. Those lesions can be detected with ultrasound (7). Currently together with ultrasound new markers increased the diagnostic accuracy of adnexal masses.

Grab et al. (8) evaluated the diagnostic value of the ultrasound, MRI and positron emission tomography (PET) in adnexal masses. They reported that addition of MRI and PET increased the diagnostic accuracy of the adnexal masses. We also evaluated the diagnostic value of the MRI in adnexal masses in respect to malignancy.

Median age in the present study was found as 45 and 42 % was in postmenopausal state. Similarly Meray et al (9) found median age as 43,5. Ashley et al, (10) revealed a median age of 46 in a similar study population. MRI is preferred as a second step diagnostic modality in differentiation of the complex adnexal masses. In several studies MRI was found to be superior to ultrasound in respect to malignancy detection (11-13). We found sensitivity and specificity of MRI 85 and 88 % respectively. The positive predictive value was detected as 77.2 % and negative predictive value was detected as 92.6 for MRI in diagnosis of adnexal masses. Grab et al found sensitivity 83% and specificity 84% with a PPV 42% and NPV as 97% [8]. Komatsu et al (12) found sensitivity as 100% and specificity as 98 %. Russel et al reported sensitivity of 90 % and specificity of 88% with a PPV of 98% and NPV of 23% (14). Trappen et al also showed a sensitivity of 78% and specificity of 86 % for diagnosis adnexal masses (10). Nam et al also found a sensitivity of 82.5% and specificity of

Table 6. Evaluation of non-measurable variables according to pathology results

		Pathology result				p
		Malignant		Benign		
		n	%	n	%	
Menopausal state	Premenopausal	10	17.9	46	82.1	0.037 a
	Postmenopausal	15	36.6	26	63.4	
Complaint	No complaint	6	24	19	76	0.743 b
	Abdominopelvic pain	19	27.5	50	72.5	
	Bleeding	0	0	3	100	
Mass location in ultrasound	Right	10	24.4	31	75.6	0.005 a
	Left	7	16.3	36	83.7	
	Bilateral	8	61.5	5	38.5	
Free fluid in ultrasound	Present	15	78.9	4	21.1	<0.001 b
	Absent	10	12.8	68	87.2	
Feature of the Mass in ultrasound	Pure cystic	0	0	6	100	0.008 b
	Solid	14	46.7	16	53.3	
	Mix	5	33.3	10	66.7	
	Septated	2	20	8	80	
	Heterogenic	4	11.1	32	88.9	
Extra finding in ultrasound	Uterine mass	1	14.3	6	85.7	0.029 b
	Mass in other organ	3	100	0	0	
	No Extra finding	21	24.4	65	75.6	
Contrast enhancement ın MRI	Intraabdominal mass	0	0	1	100	<0.001 a
	Present	22	44	28	56	
	Absent	3	6.4	44	93.6	
Extra findings in MRI	Omental Cake	1	100	0	0	<0.001 b
	Free fluid	4	40	6	60	
	Fluid+ Omental Cake	9	69.2	4	30.8	
	No Extra finding	11	15.1	62	84.9	
Location of mass in MRI	Right	10	27.8	26	72.2	0.006 a
	Sol	7	14.9	40	85.1	
	Bilateral	8	57.1	6	42.9	

a Chi-square test, b Fisher's exact test

Table 7. Sensitivity and specificity of MRI in diagnosis of adnexal masses in different studies

Study	Year	N	Sensitivity	Specificity	PPV	NPV
Komatsu et al.	1990	82	100	98	-	-
Grab et al.	2000	101	83	84	42	97
Russell et al.	2005	76	90	88	98	23
Trappen et al.	2007	196	78	86	-	-
Nam et al.	2010	95	82.5	63.6	86.7	56
Haggerty et al.	2014	237	95	94.1	-	-
Kerimova et al.	2017	97	85	88.3	77.2	92.6

63.8 with a PPV of 86.7% and NPV of 56% (15). Haggerty et al studied largest population number among all studies that were discussed, they found 95% sensitivity and 94.1% specificity for diagnosis of adnexal masses with usage of MRI. (Table 7) shows different studies showing sensitivity and specificity of MRI in diagnosis of adnexal masses.

The pathological results are moderately correlated with MRI findings in our study. We prefer performing a MRI study before surgery to refer patient to a gynecologic oncology expert.

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