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External Validation of Simple Role Risk (SRRisk) of Malignancy in Adnexal Masses Based on IOTA Simple Rules

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ABSTRACT

Background: One technique in order to categorize adnexal cancers as benign or malignant is International Analysis of Ovarian Tumors (IOTA) basic guidelines. It has been suggested that there is a new malignancy risk based on these guidelines, therefore we thought it was important to assess how well it predicts malignancy.

Aim: To assess the new risk of cancer using the straightforward IOTA criteria. **Patients and methods:** Patients of this observational cohort study had at least one adnexal mass (ovarian, paraovarian, or tubal). They were chosen by the surgery physician in the Ultrasound and Fetal Medicine Unit of Obstetrics and Gynecology Department, Faculty of Medicine, Zagazig University. Women with big masses that could not be completely seen by the transvaginal technique underwent transabdominal sonography. Serum CA-125 levels were measured. IOTA's Simple Rules were used.

Results: Nine of the 23 benign instances identified by IOTA were benign according to the histopathological report. In identifying benign instances, IOTA displayed sensitivity (100%), specificity (64.1%), PPV (39.13%), NPV (100%) and accuracy (70.83%). In the histology report, 10 of the 10 malignant instances from the IOTA findings were malignant. In detecting malignant cases, IOTA demonstrated sensitivity (26.3%), specificity (100%) and accuracy (41.6%).

Conclusion: The IOTA simple principles distinguish between benign and malignant adnexal masses. With C 125, they performed better than the IOTA Simple Rules alone in terms of diagnostic accuracy.

Keywords: Adnexal Masses, SRRisk, IOTA**.**

INTRODUCTION

Ovarian cancer is the sixth most common cancer in women worldwide, with the greatest mortality rate among all gynecological cancers [(1)]. It is identified in about 60% of cases at an advanced stage with regional or distant dissemination and a poor prognosis over the long term. Stages of the disease affect five-year survival, which ranges from 90% at stage I and 4% at stage IV, ranging from 46% for all stages [(2)]**.** Specifically, epithelial ovarian cancers (EOC) quickly growing tumors, account for the majority of ovarian malignancies, making early diagnosis of these conditions crucial. A proper referral to a gynecologist and appropriate therapy are ensured by prompt diagnosis of the mass' nature [(3)]**.**

Prior to surgery, it is crucial to distinguish between malignant and benign adnexal tumors optimal therapy and patient counseling because the methods for treating the two disorders are frequently different. It is essential to appropriately distinguish between cancerous and benign tumors for clinical purposes. Referring patients with malignant adnexal tumors to gynecologic tertiary hospitals with oncologists for debulking surgery and proper systemic therapy is one option to assist them [(4)]**.**

Contrarily, depending on the clinical situation, those who have benign lesions may be managed. General gynecologists may treat women conservatively or with minimally invasive surgery, sparing ovarian function or preserving fertility [(5)]**.**

To recognize cancerous from normal adnexal tumors, a number of approaches have been proposed and developed, including clinical indicators, tumor markers, and pelvic ultrasound. Since its inception, the Risk of Malignancy Index (RMI) has been used to a long time, is one of the most popular techniques in low-income nations. The combination of numerous clinical parameters is scored using the RMI system. It was created to increase the diagnostic precision of ovarian cancer prediction. **Jacobs *et al*.** [(6)] first created the RMI method based on a combination of sonographic results, menopausal state, and serum CA 125 values. RMI has an 85.4% sensitivity rate and a 96.9% specificity rate, respectively. **Tingulstad *et al.*** [(7)] later developed RMI 2 to improve diagnosis accuracy. They showed that RMI 2 was more accurate at predicting malignancy than RMI 1 was, with a sensitivity of 80% and specificity of 92%**.**

Therefore, it is crucial to use exact methods when describing an ovarian tumor's characteristics prior to surgery. The International Ovarian Tumor Analysis (IOTA) group first mentioned the Simple Rules in 2008 [(8)]**.** These are based on a collection of five ultrasound traits that identify benign tumors as benign (B-features) and malignant tumors as malignant (M-features). If only B-features are present, a tumor is categorized as benign using the Simple Rules and as malignant if only M-features are present. If no symptoms are present or if there are contradicting traits, the Simple Rules cannot establish whether a tumor is benign or cancerous. Masses that the Simple Rules produce an illuminating result for, can be classified in one of two ways: either using a skilled ultrasound operator's subjective assessment or, to increase

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the sensitivity for ovarian cancer, labelling them all as malignant due to the high prevalence of malignancy in this group [9]. Simple Rules, which are simple to apply in clinical practice to determine the risk of malignancy, were described by IOTA. In comparison to other well-known models, they discovered that their model's sensitivity was 91% and its specificity was 93% [3, 10].

As a result, we intended to focus on progress and dependability of the computation of the likelihood of cancer in adnexal masses using Simple Rules.

PATIENTS AND METHODS

Patients of this observational cohort study had at least one adnexal mass (ovarian, paraovarian, or tubal). They were chosen by the surgery physician in the Ultrasound and Fetal Medicine Unit of Obstetrics and Gynecology Department, Faculty of Medicine, Zagazig University. The following were excluded from the study: women who were pregnant at the time of the examination, young girls who had not yet reached menarche, women who refused transvaginal ultrasound, and women who underwent surgery more than 120 days following the ultrasonography check.

Every patient had a thorough history-taking process that covered their current menstrual, obstetrical, family, and personal complaints prior histories. They also underwent a standard physical examination that included a breast exam as well as general, abdominal, and pelvic exams. A lead radiologist or gynecologist with substantial gynecological training in ultrasonography examined each patient using a conventional transvaginal ultrasound. In cases when transvaginal sonography was unable to fully visualize big masses, transabdominal sonography was added. The serum level of CA-125 and other tumor markers were measured as needed. The following details were necessary to apply the Simple Rules: the size of the lesion (in millimeters), the size of the largest solid component (in millimeters), the type vascularization on Doppler ultrasound, the kind of tumor (unilocular, unilocular-solid, multilocular, multilocular-solid, solid), the quantity of papillary structures, the presence of wall irregularity, ascites, acoustic shadows, and the color score.

Instead of being explicitly recorded, the 5 B-features and 5 M-features were derived from the aforementioned variables. The benign characteristics are unilocular cyst, solid components with a maximum diameter of 7 mm, acoustic shadowing, smooth multilocular tumor with a maximum diameter of 100 mm, no blood flow, and B1 (1 color score). Malignancy was indicated by the following characteristics: M1, irregular solid tumor; M2, ascites; M3, at least four papillary formations; M4, irregular, multilocular solid tumor with maximum diameter of 100 mm; and M5 (color score of 4); very high blood flow.

Following admission, a second ultrasonogram was performed, and a gynecologist identified adnexal masses using IOTA's straightforward principles. Following surgical resection, the tumor's histopathologic analysis revealed whether it was benign or malignant. Through laparoscopy or laparotomy, surgery was carried out.

Ethics approval:

Both the local Ethics Committee and the Institutional Review Board [IRB] of Zagazig University's Faculty of Medicine approved the study's methodology. All the participants gave their written consent after being fully provided with all the necessary information regarding the study. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Statistical analysis

The data were analysed using the SPSS programme, headquartered in the USA, version 18. The quantitative data were displayed as mean±standard deviation (SD) and range while qualitative data were displayed as frequency and percentage. At P 0.05, the significance level was established.

RESULTS

The mean age of patients was 50.3 ± 15.5. The most common comorbidity was HTN (Table 1).

Table 1: Baseline data of the studied patients

Variables	Patients (N=48)
Age	50.3 ± 15.5 16-80
BMI	22.7 ± 1.97 18-33
Marital status	
Married	44 (91.7%)
Single	4 (8.3%)
Co-morbidities	
None	24 (50%)
DM	11 (22.9%)
HTN	14 (29.2%)
HCV	4 (8.3%)
Asthmatic	2 (4.2%)
DVT	1 (2.1%)
Cardiac	2 (4.2%)
Immunothrombocytopenia	1 (2.1%)
Menstrual status	
Pre-menopausal	23 (47.9%)
Post-menopausal	25 (52.1%)
Age of menarche	10.8 ± 0.99 9-13
Age of menopause (in postmenopausal women only)	51.3 ± 2.9 49-55

BMI: body mass index, DM: diabetes mellitus, HTN: hypertension, DVT: deep venous thrombosis.

Data are presented as mean±standard deviation and range or as frequency and percentage

The most common indication for ultrasound was accidently discovered (Table 2).

Table 2: Ultrasound indication data of the studied patients

Variables	Patients (N=48)
Indication on ultrasound	
Accidently discovered	22 (45.9%)
Abdominal pain	10 (20.8%)
Bleeding	12 (25%)
Fullness enlargement	4 (8.3%)

The mean CA-125 of benign and malignant cases is shown in table 3.

Table 3: CA 125 of the studied patients

Variables	Patients (N=48)
CA-125 of benign cases mean± SD	45.8 ± 7.3
CA-125 of malignant cases mean± SD	758 ± 66.3

Data are presented as mean±standard deviation and range
The greatest diameter of benign and malignant cases is shown in table 4.

Table 4: Tumor diameter of the studied patients

Variables	Patients (N=48)
Greatest diameter of benign cases (mm)	47.2 ± 4.7 30-120
Greatest diameter of malignant cases (mm)	68.2 ± 9.5 29-230

Data are presented as mean±standard deviation and range
79.2% of patients had malignant lesion by pathological examination, while 20.8% had malignant lesion by IOTA Simple Rules (Table 5).

Table 5: Pathology and IOTA data of the studied patients

Variables	Patients (N=48)
Pathology	
Benign	9 (18.8%)
Malignant	38 (79.2%)
Borderline	1 (2.0%)
IOTA simple rules	
Benign	23 (47.9%)
Malignant	10 (20.8%)
Borderline	15 (31.3%)

The criteria of the tumors according to **Timmerman *et al.*** [11] are shown in table 6.

Table 6: IOTA benign and malignant features data of the studied patients according to Timmerman *et al.* [11]

IOTA benign features	Number	%
B1 (unilocular cyst)	5	10.4
B2 (presence of solid components)	0	0
B3 (presence of acoustic shadowing)	7	14.6
B4 (smooth multilocular tumor with largest diameter < 100 mm)	2	4.2
B5 (no blood flow)	5	10.4
IOTA malignant features		
M1 (irregular solid tumor)	8	16.7
M2 (ascites present)	3	6.3
M3 (at least four papillary structures present)	9	18.8
M4 (irregular, multilocular solid tumor with largest diameter ≥ 100 mm)	1	2.1
M5 (very strong blood flow)	20	41.7

The most common final diagnosis was serous adenocarcinoma (43.8%) (Table 7).

Table 7: Final diagnosis of the studied patients

Final diagnosis	Number	%
Serous adenocarcinoma	21	43.8
Metastatic differentiation	2	4.2
Papillary carcinoma	4	8.3
Endometroid carcinoma	1	2.1
Atypical endometrial hyperplasia	2	4.2
Mucinous adenocarcinoma	4	8.3
Dermatoid cyst	1	2.1
Hemorrhagic cyst	1	2.1
Serous cystadenoma	4	8.3
Cystadenofibroma	1	2.1
Dysgerminoma (Malignant)	2	4.2
Teratoma mixed solid (Malignant)	2	4.2
Fibroma (Benign)	2	4.2
Mucinous cystadenoma (Serous borderline tumor)	1	2.1

Out of 23 benign cases in IOTA findings, 9 were benign in histopathology report. The diagnostic indices of IOTA in predicting benign cases are shown in table 8.

Table (8): Sensitivity and specificity of IOTA in predicting benign cases among the studied patients

Benign		Pathology		
		Yes	No	Total
IOTA	Yes	9	14	23
	No	0	25	25
	Total	9	39	48

Parameters	Value	95%CI
Sensitivity	100%	66.3 to 100%
Specificity	64.1%	47.1 to 78.8%
Positive likelihood ratio	2.79	1.83 to 4.24
Negative likelihood ratio	0	
Disease prevalence	18.75%	8.95 to 32.63%
Positive predictive value	39.13%	29.71 to 49.44%
Negative predictive value	100%	
Accuracy	70.83%	55.94 to 83.05%

Out of 10 malignant cases in IOTA findings, 10 were malignant in histopathology report. Out of 23 benign cases in IOTA findings, 9 were benign in histopathology report. The diagnostic indices of IOTA in predicting malignant cases are shown in table 9.

Table (9): Sensitivity and specificity of IOTA in predicting Malignant cases among the studied patients

Malignant		Pathology		
		Yes	No	Total
IOTA	Yes	10	0	10
	No	28	10	38
	Total	38	10	48

Parameters	Value	95%CI
Sensitivity	26.3%	13 to 43.1%
Specificity	100%	69.1 to 100%
Disease prevalence	79.1%	65.1 to 89.5%
Positive predictive value	100%	
Negative predictive value	26.38%	22.8 to 30.12%
Accuracy	41.6%	27.7 to 56.7%

The diagnostic indices of CA 125 in prediction of malignancy are shown in table 10.

Table 10: ROC curve analysis to predict the power of CA 125 in predicting malignancy (histopathology)

AUC	P value	Cut off	Sensitivity%	Specificity%
0.91	**<0.0001***	**35**	**83%**	**77%**

Combination between malignant IOTA criteria and CA125 >35 could diagnose 31 cases out of 38 cases (Table 11).

Table (11): Sensitivity and specificity of CA 125 and IOTA in differentiating between benign and malignant cases among the studied patients

		CA 125 >35 and malignant IOTA	CA 125 <35 and benign IOTA	Total
Histo-pathology	Malignant	31	7	38
	Benign	2	8	10
	Total	33	15	48

Parameters	Value	95%CI
Sensitivity	81.5%	65.6 to 92.2%
Specificity	80%	44.3 to 97.4%
Disease prevalence	79.1%	65.01 to 89.5%
Positive predictive value	93.9%	81.6 to 98.1%
Negative predictive value	53.3%	35.3 to 70.4%
Accuracy	81.25%	67.3 to 91.05%

DISCUSSION

The mean age in the current study was 50.3 ± 15.5, the mean BMI was 22.7 ± 1.97, and 91.7% of patients were married. The age ranged from 16 to 80 years. HTN (29.2%), DM (22.9%), and HCV infection (8.3%) were the most prevalent comorbidities.

Timmerman *et al.* [11] demonstrated that the patients' median age was 49 years, which is consistent with our data. 697 women were included by **Patel-Lippmann *et al.*** [12] (mean age, 41.9 ± 13.6 years; range, 17-91 years). According to **Auekitrungrueng *et al.*** [13]**,** the patients' mean age was 42.1 ± 12.5 years (with a range of 12-80 years).

However, **Sujata *et al.*** [14] discovered that the majority of the patients in their study were younger, ranging in age from 21 to 30 years (32%) and 31 to 40 years (30%) respectively. Their high sample size could be the cause of this disparity.

We found that the mean age of menarche and age of menopause were respectively 10.8 ± 0.99 and 51.3 ± 2.9, with 47.9% of patients being premenopausal and 52.1% being postmenopausal.

According to **Patel-Lippmann *et al.*** [12] 532 were premenopausal (76.3%) and 165 were postmenopausal (23.7%). According to **Auekitrungrueng *et al.*** [13]**,** the majority of the masses (n=364, or 76.0%) came from premenopausal women, while 24% (n=115) came from postmenopausal women. There were 212 women, or 48.0%, who were nulliparous. According to **Solanki *et al.*** [10] there were 140 patients in the premenopausal group and 34 in the postmenopausal group.

We found that unintentionally finding an ultrasound was the most frequent reason for doing so (45.9%), followed by bleeding (25%), abdominal pain (20.8%), and fullness enlargement (8.3%).

Sujata *et al.* [14] reported that abdominal pain was the most prevalent presenting complaint (73.7% of patients). 3.9% of patients expressed frustration with their inability to conceive, whereas 9.2% of patients experienced dysmenorrhea. Similar to this, 2.6% of patients had irregular periods, and 2.6% had amenorrhea. In addition, 2.6% of individuals experienced bleeding after menopause and 2.6% developed an abdominal tumor. Menorrhagia affected abdominal distension was experienced by 1.3% of patients.

The mean CA-125 of benign and malignant cases in the current study was 45.8 ± 7.3 and 758 ± 66.3, respectively.

According to **Sujata *et al.*** [14] and in agreement with our findings, the average CA-125 (u/ml) levels ranged from 22.849 in the benign group to 157.145 in the malignant group.

The largest diameter of the benign and malignant instances in the current study was 47.2 ± 4.7 mm and 68.2 ± 19.5 mm, respectively.

Patel-Lippmann *et al.* [12] demonstrated that the mean maximum diameter of the cystic lesions, which had a size range of 1 to 20.7 cm, was 4.2 ± 2.7 cm. The maximum diameter of the cystic lesions ranged from 2.3-20.2 cm, and the mean in women with benign neoplasms was 6.3 ± 4.1 cm.

By using a pathological examination, we were able to demonstrate that 79.2% of patients had malignant lesions, 18.8% had benign lesions, and 2% had borderline lesions.

Patel-Lippmann *et al.* [12] revealed that out the majority of the 744 cystic lesions, 651 (85.2%) were benign neoplasms, followed by 93 (12.2%) benign neoplasms **a**nd 20 (2.6%) malignant cystic tumors. Approximately one-third (7/20) of the pathologically diagnosed malignancies were classified as unclear, while two-thirds (12-13/20) were classified as malignant based on imaging categories. **Sujata *et al.*** [14] revealed that the majority of patients (81.6%) had benign lesions. 6.6% of patients were unclassified, while 11.8% of patients had malignant disease. **Auekitrungrueng *et al.*** [13] demonstrated that of the 334 (69.7%) of the 479 adnexal masses were pathologically benign, whereas 145 (30.3%) were malignant, including 130 (27.1%) cases of cancer and 15 (3.1%) masses with a low tendency for malignancy. Endometrioma was the most prevalent adnexal mass, accounting for 22.1% (n=106) of all masses. **Solanki *et al.*** [10] analysis of 174 cases, 144 (82.75%) of them were benign, 28 (16.09%) were malignant, and two (1.15%) were borderline. **Timmerman *et al.*** [11] reported that the overall malignancy rate was 34% (1665/4848).

Using IOTA's fundamental criteria, we were able to establish that 47.9% of patients had benign lesions, 20.8% had malignant lesions, and 31.3% had borderline lesions. The varied sample sizes between studies may explain for the variances in the percentage of malignancy.

Patel-Lippmann *et al.* [12] indicated that when readers applied the IOTA basic guidelines to the 764 cystic lesions, 664 (86.9%) were categorized as benign, 65 (8.5%) as indeterminate, and 35 (4.6%) as malignant.

We demonstrated that, out of 48 cases, 5 patients (10.4%) meet the B1 criteria, 0 patients (0%) the B2 criteria, 7 patients (14.6%) meet the B3 criteria, 2 patients (4.2%) the B4 criteria, and 5 patients (10.4%) the B5 criteria.

Sujata *et al.* [14] found that in 76 cases, the B1 criteria were met by 47 (61.8%) patients, the B2 criteria by 3 (3.9%), the B3 criteria by 29 (38.2%), the B4 criteria by 15 (19.7%), and the B5 criteria by 63 (82.9%) patients.

Out of 48 cases in the current study, 8 patients (16.7%) meet the M1 criteria, 3 patients (6.3%) meet the M2 criteria, 9 patients (18.8%) meet the M3 criteria, 1 patient (2.1%), the M4 criteria, and 20 patients (41.7%) meet the M5 criteria.

Sujata *et al.* [14] found that 12 (15.8%) patients out of 76 cases satisfied the M5 criteria, followed exhibited by 5 (6.6%) patients who match the M3 criteria, 7 (9.2%) patients who meet the M2 criteria, and 9 (11.8%) patients who meet the M4 criteria.

Serous adenocarcinoma (43.8%), papillary carcinoma (8.3%), mucinous adenocarcinoma (8.3%), and serous cystadenoma (8.3%) were the most frequent final diagnoses in the current study.

According to **Sujata *et al.*** [14] and in agreement with our analysis, serous cystadenocarcinoma accounted for roughly 46.1% of the malignant cases, followed by mucinous cystadenocarcinoma at 23%. Serous cystadenoma made up 30.1% of the benign cases, followed by endometriotic cyst and mature teratoma (23.8 and 17.4%, respectively). Two of the marginal instances (15.3%) had mucinous characteristics. **Patel-Lippmann *et al.*** [12] demonstrated that cystadenomas or cystadenofibromas made up the majority of the benign

neoplasms (76/93). Mature dermoid cysts (16/93) and a cystic fibrothecoma (1/93) were the other benign tumors.

We showed that nine of the 23 benign cases in the histology report were also benign. In identifying benign instances, IOTA displayed sensitivity (100%), specificity (64.1%), PPV (39.13%), NPV (100%) and accuracy (70.83%). We demonstrated that 10 of the 10 cancer patients identified by IOTA were also identified by histology as malignant. In detecting malignant cases, IOTA demonstrated sensitivity (26.3%), specificity (100%) and accuracy (41.6%).

In agreement with our work, **Patel-Lippmann *et al.*** [12] demonstrated that the AUC for the diagnosis of cancer using the IOTA basic criteria was 0.98 in ROC analysis. With the IOTA simple guidelines, significantly fewer benign lesions were diagnosed as malignant and undetermined; according to IOTA, 35 of 764 (4.6%) benign lesions were categorized as malignant and 65 of 764 (8.5%) as uncertain. This method proved extremely sensitive to cancer.

Patel-Lippmann *et al.* [12] revealed that 12 of the 20 malignant cystic tumors were categorized as malignant based on imaging results, 7 of the 20 were classed as uncertain, and 1 of the 20 were classified as benign. The cystic lesion was ultimately excised in the one instance of a malignant cystic tumor that was initially misclassified as benign at imaging using the IOTA basic guidelines because follow-up imaging revealed that it had grown in size. They demonstrated that when a cystic lesion was identified as malignant based on ultrasound features, the IOTA simple guidelines for diagnosis had a sensitivity of 90%, a specificity of 96.5%, a positive predictive value (PPV) of 29%, a negative predictive value (NPV) of 99.8%, and an accuracy of 96.4%.

Solanki *et al.* [10] found that IOTA's simple rules had a sensitivity of 96.67% (95% confidence interval 82.78-99.92), specificity of 92.36% (95% confidence interval 86.74-96.1), PPV of 72.5%, and NPV of 99.25%, according to the examination of the data. By designating cancerous cases in IOTA as uncertain, this information was obtained. Furthermore, because borderline tumors in women who have given birth to children are surgically treated similarly to malignant tumors, they were categorized as malignant on the basis of histology.

In 2013, **Guerriero *et al.*** [15]; IOTA basic guidelines for diagnosing either benign or malignant adnexal tumors were examined for reproducibility using saved photos and examiners with varying degrees of experience. All observers' intraobserver repeatability (Kappa index: 0.59–0.74) was moderate to good. They came to the conclusion that IOTA's straightforward rules were simple to utilize and to learn. **Nunes *et al.*** [16] discovered in their study that ovarian cancer may be accurately diagnosed in 76%–89% of tumors using IOTA's straightforward guidelines. **Dodge *et al.*** [17] undertook a meta-analysis evaluating several systems for classifying and rating adnexal masses in order to diagnose them prior to surgery, and came to the same conclusions in favor of IOTA's straightforward guidelines.

Timmerman *et al.* [11] wrote in their conclusion "Simple risk estimates can be derived from 10 USG features". They are guidelines that could serve as the foundation of a clinical management system. In a prospective investigation, **Sayasneh *et al.*** [18] discovered that the IOTA model works well even for sonographers with different levels of expertise [18-20].

Yadav *et al.* [21], similar to our work, in a prospective investigation on 50 patients discovered that IOTA basic guidelines are 90% sensitive in properly detecting ovarian tumors. For the best possible care, sonography and other radiological investigation must be used in conjunction with the clinical diagnosis to properly anticipate the malignancy of adnexal tumors.

Naturally, histological confirmation of a cancer diagnosis is the gold standard. In a meta-analysis comparing the performance of 19 methods to distinguish between benign and malignant adnexal masses before surgery, the Simple Rules had a sensitivity of 93% and a specificity of 81% when ambiguous tumors were all believed to be malignant [22].

Different ultrasonography training, experience, and ultrasound equipment quality may be the cause of the variations in IOTA's sensitivity and specificity in different studies when separating benign from malignant tumors.

We demonstrated that CA 125 exhibited sensitivity of 83%, specificity of 77%, and AUC of 0.91 in predicting malignancy at a cut off of 35.

In agreement with our study, **Sehouli *et al.*** [23] indicated that Ca-125 could distinguish between benign and malignant tumors with a sensitivity of 61%-90%, specificity of 71%-93%, positive predictive value of 35%-91%, and negative predictive value of 67%-90%. We demonstrated that combining malignant IOTA criteria with CA125 >35 can accurately diagnose 31 out of 38 cases with a sensitivity of 81.5%, a specificity of 80%, with a sensitivity of 81.5%, a specificity of 80%, and an accuracy of 81.25%, combining benign IOTA criteria with CA125 >35 can correctly diagnose 8 out of 10 cases.

Fischerova *et al.* [24] found that when an ovarian mass is present, ultrasonography seems to be the best modality to identify benign from malignant tumors and to detect the existence of early ovarian cancer. Serum markers are also employed. Actually, the application of a variety of diagnostic techniques, of which ultrasonography is a vital component, is the reason why the numbers listed above have improved [25].

The recommendation to refer a patient with a malignant mass to a specialized facility or an oncology surgeon, because therapeutic outcomes have been shown

to be superior to treatment by an obstetrician/gynecologist specialist (previously known as generalist), is the primary motivation for trying to distinguish benign from malignant tumors [26]. Based on ultrasound results, numerous grading systems for determining the likelihood that an ovarian tumor will be malignant have been developed [22]. Using ultrasound Easy Guidelines [11] and the assessment of several neoplasias in the adnexa (ADNEX) model [27] to determine the risk that an ovarian tumor would be malignant are too simple but effective methods from the International Ovarian Tumor Analysis (IOTA) group. The ADNEX model assesses whether a tumor is likely benign or malignant (in percent), as well as whether it is likely to proceed through several stages (borderline tumor, stage I, stage II-IV, or metastatic) if it is malignant. The Simple Rules can categorize a tumor as benign, malignant, or indeterminate. The relative sensitivity and specificity of Simple Rules and the ADNEX model, respectively, are 92% and 96.5% and 96% and 71.3% for a cut-off of 10% to predict malignancy [28]. Despite not being tools for ovarian cancer screening, the Simple Rules and the ADNEX model are the most effective predictive tests for the preoperative categorization of adnexal tumors.

CONCLUSION

The diagnostic accuracy of the IOTA basic rules plus C 125 was superior to that of the IOTA simple rules alone in order to distinguish benign and malignant adnexal tumors. Due to the IOTA principles' high efficacy, simplicity, and lack of need on professional sonographers, general gynecologists should implement them into their daily practices. Having stated that, when the results are ambiguous, expert opinion is needed.

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